ANNEX VIII/XXI „DEPLOYMENT STRATEGIES FOR HYBRID, ELECTRIC AND ALTERNATIVE FUEL VEHICLES“

DEPLOYMENT STRATEGIES FOR HYBRID, ELECTRIC AND ALTERNATIVE FUEL VEHICLES

A REPORT OF THE IEA PROJECT „DEPLOYMENT STRATEGIES FOR HYBRID, ELECTRIC AND ALTERNATIVE FUEL VEHICLES“

Task force leaders:
Sigrid Kleindienst Muntwyler, Engineering Office Muntwyler
Martijn van Walwijk, INNAS

Task force members:
Antonio Mattucci, Ente per le Nuove Tecnologie ENEA
Stephan Rieder, INTERFACE Politikstudien
Tommy Månsson, EnEN Miljökonsult AB
Michaela Kargl, Austrian Mobility Research FGM-AMOR

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Introduction

This report provides recommendations on government programmes to introduce clean vehicle technologies and clean fuels in the market. Information has been collected on 95 programmes in 18 countries. From this wide range of government programmes, case studies have been selected which can be regarded as "typical" strategies of government administrations and stakeholders. The analysis of these programmes and measures has shown that some approaches are successful but they also identified weaknesses which are often repeated. This points out to a low level of learning, either from the successes or from the failures. This report can be used as a tool to complete a general picture of „clean vehicle" market introduction strategies. It aims to help government officials responsible for administering fleets, incentives and regulations with assessing the most promising strategy for their country for the market introduction of hybrid, electric and alternatively fuelled vehicles.

Background

At the present time, fossil fuels, such as gasoline, diesel oil, LPG and natural gas, overwhelmingly predominate the transportation energy market. Liquid fuels cover the greatest market share, because they are characterised by high energy density, easy handling and relatively low costs. Looking at 1999, oil products covered about 95% of the fuels used in the transport sector in the entire world, and 97% in the OECD countries[1]. There is obviously a large margin that would allow substitution by alternative fuels, provided that effective technical and marketing solutions are found. In fact, the conventional propulsion systems, based on internal combustion engines (ICE), have gained a big advantage, as they have benefited from a long period of manufacturing experience that has enabled continuous improvements, making ICE vehicles an essential component of road transport. However, in recent years, the harmful effects and the greenhouse gases resulting from the use of conventional vehicles and their ICE have created many concerns about continuing in the same direction. This has increased chances for the new technologies to succeed.

Hybrid or electric vehicles and alternative fuels like natural gas, ethanol or hydrogen are considered as a less polluting alternative to the conventional gasoline or diesel car, and in many countries they are considered an essential element in reducing urban pollution and greenhouse gases. At the beginning of the 1990ies many governments started to support research and developments of the above mentioned technologies. Governments know that only a wide dissemination of „clean vehicles" can have noticeable effects on the environment, and they have increasingly implemented measures to promote the market introduction of these new vehicle technologies – with different approaches and various effects.

There is still a lot to be done. Information still is the most important and most neglected issue in the efforts to introduce „clean vehicles" on the market. Improving the exchange of experience can also result in alliances in which several countries follow similar support and regulation strategies. This will provide certainty for the vehicle producers both on technologies and market segments, and also on the infrastructure demands. In addition, the needs of consumers can be defined more clearly, at the moment they can only be evaluated in demonstration programmes.

Equally important are the learning processes that happen with the organisers, the users, the political decision makers and other stakeholders when promotion measures for „clean vehicles" are implemented. Enabling „learning across projects" not only from „success stories", but also from failures, is the main objective of this report.

[1] see Key World Energy Statistics 2001 of the International Energy Agency, http://www.iea.org/statist/keyworld/keytsts.htm

Methodology

A task force of international experts from Austria, Finland, Italy, Japan, The Netherlands, Sweden, Switzerland and the USA prepared this report between 2000 and 2002. They were working under the auspices of two International Energy Working Groups, known as Implementing Agreements, the „Hybrid&Electric Vehicles" and „Advanced Motor Fuels" Agreements respectively. The task force is known as an „Annex" in IEA terms, and its official title was „Deployment Strategies for Hybrid, Electric and Alternative Fuel Vehicles". The Annex has worked on the identification of the most successful strategies to introduce „clean" vehicles into the market, and has divided the work into four main „sub-tasks". This report is the result of that work, and it is structured along the lines of these four sub-tasks.

The first step was to identify government measures and programmes for which infomation should be collected for the assessment of their effects on the market introduction of „clean vehicles". The main criteria were a good coverage of vehicle and fuel technologies, the consensus of all participating countries and the availability of information.

Report Structure

The market introduction of clean vehicle technologies needs strategies that include the identification of steps, target groups and stakeholders. One general way of defining the stages is:

- Fleet tests are a first testing of the reliability and application of advanced vehicle technologies. It is essential to get an accurate estimation of the real performances of the technologies, their reliability and possible side effects.
- Demonstration programmes are the first step of the market introduction of hybrid, electric and alternative fuel vehicles in niches. The vehicles used in the programmes are already tried and tested. The programmes address acceptance issues, behavioural changes, and ways of motivating users to shift to the adoption of clean vehicle technologies.
- Government support and regulations targeted at the framework conditions of the vehicle market prepare the mass market for hybrid, electric and alternative fuel vehicles.
- Widespread efforts that address as many stakeholders as possible to both increase the acceptance of new technologies and prepare a favouring framework for a successful market introduction.

Consequently, this report is divided into four parts:

- Part 1 „Fleet Tests of Hybrid, Electric and Alternative Fuel Vehicles"
  describes fleet tests (case studies) and gives recommendations for fleet tests addressed to government officials responsible for administering fleet test programmes of hybrid, electric and alternative fuel vehicles, operators of test fleets, automobile manufacturers and manufacturers of infrastructure (chargers, etc.) and vehicle components.
- Part 2 „Government Support and Regulations"
  defines the role of the government and government promotion activities, evaluates the effectiveness of incentives and gives recommendations for government support and regulations. It is addressed to government policy advisors responsible for transportation energy issues and government policy advisors responsible for urban air pollution and greenhouse gas issues.
- Part 3 „Stakeholders, Local and City Administrators"
  defines the role of fuel/energy providers and other stakeholders (utilities, gas companies, EV associations, coalitions, etc.) and the role of city administrations, and elaborates recommendations for stakeholders.
- Part 4 „Market Introduction"
  describes the results of market introduction programmes in various countries and analyses the information on these programmes. The emphasis is on the identification of successful market introduction strategies and promising market niches for hybrid, electric and alternative fuel vehicles and recommendations for market introduction strategies.

The responses of programme managers to our questionnaires served as the starting point of the study. Analyses of publications and requests for comments from programme managers on interim conclusions completed the picture. To a certain extent the task force was dependent on the feedback of the national experts and the information provided by the questionnaire. This explains why not all known experiments are included and not all countries are represented in all the sub-tasks. As an example, many Japanese promotion measures could be evaluated, but fleet test data were not available to our task force.

The questionnaire was developed by the task-force to suit to its information needs. It raised questions on objectives, schedules, stakeholders, funds and funding sources, the geographical context, framework conditions (policy instruments, infrastructure, links with other national or international programmes) and vehicle types, their technologies and application. To support the analysis, answers were solicited on programme milestones and main results, methods used to assess the effects, side effects and follow up programmes. Both numerical fields and fields whith comments enabled a structured but detailed analysis. The list of the measures favouring the market introduction of clean vehicles that were analysed can be found in the Appendix (page 103).

In addition, workshops were held to discuss questions that arose in the course of the work, and to invite experts from outside the Annex to examine the work against the background of their experiences and knowledge.

Main Findings

Governments are not the only stakeholders, but they play the key role not only by actively implementing promotion measures but also by being responsible for the framework in which a market for alternatively fuelled vehicles must succeed. During the task-force work, our thoughts and discussions considered the role of governments as stakeholders in the „transport market".

First of all it became clear that it is less important whether government authorities act on the national or local level. It is more important to know and assess the powers, authority, and responsibilities of a government at a given level (which differ from country to country) and to make full use of these powers. We found good examples (ZEV-mandate in California at the state level) and less good examples of making the most of the legal powers (for example, many national governments favour voluntary agreements with stakeholders like the car industry which often do not show the results striven for). Secondly, according to the stages leading to the market introduction of alternatively fuelled vehicles, from research to marketable „products", the role of the government as a stakeholder differs and also is perceived differently by the governments themselves. In addition, governments find themselves among a whole lot of other interest groups. Figure 1 gives an impression of stakeholders, their interactivities and their interdependencies. Research organizations, for example, do not naturally work on fields prefered by the governments. Government support for research therefore acts as a certain and necessary steering mechanism. Pilot-projects are a typical government action to assess the chances and possibilities of the research product (prototype). In the case of demonstration projects governments already tend to look for co-operation and networks as now the product has to prove its usability for everyday use. The government support of deployment has the objective to bridge the period of market introduction in which the purchase prices of the products are too high to compete with the products already on the market. These activities known as „support" or „promotion" efforts are supplemented but not necessarily connected with the implementation of technical standards and regulations. Nevertheless the legal framework can provide a favouring framework, or, on the contrary, be one of the barriers for a successful market deployment.

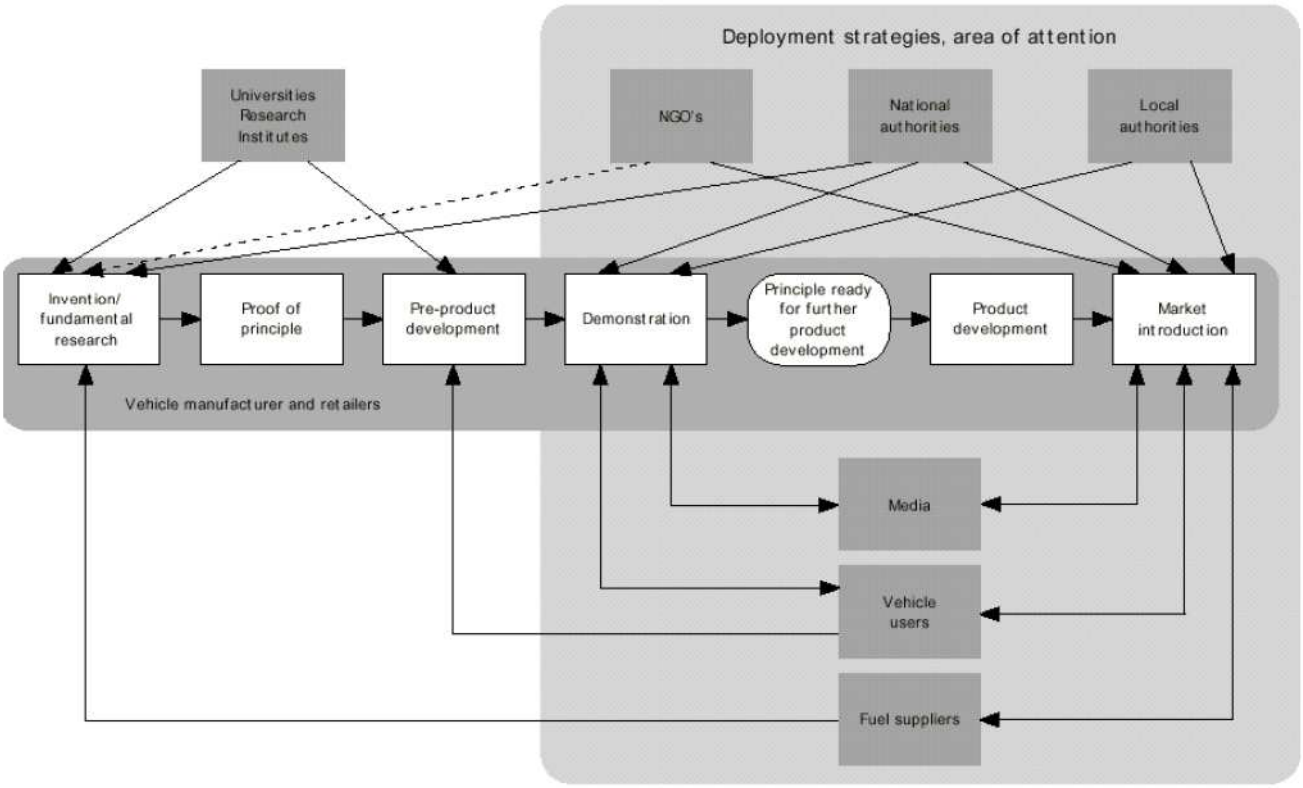

Figure 1- Interdependencies of the stakeholder networking. The field „deployment strategies, area of intention" has been the object of this evaluation

Another finding of this study is that governments are not always aware of their own roles in the transportation market. A transformation to sustainable transport needs a high steering capacity and high financial and technical resources. This calls for a „steering state"; but in most of the cases governments cannot provide the large amount of resources needed to realise the appropriate steps. A government market deployment strategy therefore should start with the identification of the political will, the financial and technical resources and the amount of time needed from research to marketable consumer products. Otherwise the effect may be that policy instruments are not sufficient, that goals have to be modified or that the results do not meet the targets. Sometimes an ex-post tuning of goals towards actual results can even be observed. For these reasons, our work had to deal with indistinct delimitations and poorly defined terminologies, and this made an analysis more challenging. As a recommendation, this study proposes that governments should take the role of a facilitator, network manager or moderator in cases where the necessary pre-conditions for a more interventionist steering model are not present.

In this report the term „clean vehicle" is used for electric, hybrid and alternatively fuelled vehicles. „Clean" above all means that the two major problems of the current transport situation are addressed: the air pollution by exhaust emissions and the greenhouse gases. Avoiding air pollutants is cheaper and fits more easily into the strategies of vehicle producers and local authorities (who have to deal with urban pollution problems) than reducing greenhouse gas emissions like CO_2. The technology is closer to that of the predominant internal combustion engine vehicles, and alternatively fuelled ICE vehicles are therefore more „marketable". For the public, air pollution is more irritating and more obvious, and therefore measures to reduce pollutants are more accepted.

What Does „Marketable Product“ Mean?

Markets demand „marketable“ products. In the field of clean vehicles, „marketable“ often is reduced to the satisfactory functioning of the technology. In the highly competitive vehicle market „marketable“ includes

- licensing, compliance with national technical standards
- a purchasing process with reasonable conditions for the customers (including the purchase price)
- the reliability and safety of the technology
- easy access to fuels or other forms of required energy (in an area in line with the range of the vehicles)
- service facilities within a in reasonable distance
- trained staff at the service facilities
- availability of driving lessons available (if necessary)
- access to information on performance, operation, best application of the vehicles

A reduction of greenhouse gases is mandated by the Kyoto Protocol (which is, by the way, a voluntary agreement, with the effect that governments put pressure on themselves) and therefore national governments are especially interested in promoting „zero emission“ vehicles. But the reduction of CO_2 caused by transport can only be achieved by unpopular measures, by a complete paradigm shift and by the mass introduction of technologies which are still expensive or not yet ripe for the market (battery electric vehicles, fuel cell technologies). Governments have well understood that the barriers for these technologies are higher and that promotion must intervene here. The efforts are still made, but now governments are faced with the fact that the acceptance of electric vehicles is still too low, and that in the late 90ies the strategies of the vehicle industry clearly shifted to alternative motorfuels and the fuel cell technologies. Governments seem to adapt their current strategies to that of the car industry, including or even favouring alternative motor fuels and fuel cell technologies. Some other governments have shifted to establishing a regulatory framework fixing the wanted effects (e.g. emission standards), leaving the choice of the product to the market.

In the coming years additional experiences will become available that will add to the knowledge on deployment strategies. It seems wise to monitor and assess these developments centrally, and to make information publicly available for all groups interested in and involved with the market deployment of clean vehicles.

What About Prescriptions?

Working in markets always means dealing with such a great variety of framework conditions and market forces that prescriptions can only give general guidelines. This report gives a lot of considerations and observations which also result in recommendations in line with the relevant field (e.g. fleet tests, government support etc.). You can find them at the end of each part. What should be observed for every promotion activity for clean vehicles can be summarized as follows:

- be flexible: Markets are complex and changing. Measures promoting market introduction must take this into consideration. It is better to focus on groups of technologies, not only one.
- evaluate: The complexity of the market forces makes effects of deployment measures unpredictable. Only continuous evaluation ensures that the necessary adaptions can be made.
- learn by doing: Market studies however perfect they seem mirror theoretical approaches. Only practice reveals weaknesses in technology and real effects of the market forces.
- learn from others: Much experience has been gained by worldwide market introduction programmes. It is a waste of money to repeat failures that occurred elsewhere.
- inform: Learning processes only can happen if the informations on successes and failures are available.
- think markets: The smartest technology will fail if it is not accepted by the customers. Learning from marketing specialists may be more helpful in some stages of market deployment than to polish the technology.

I Fleet Tests

Antonio Mattucci

I.1 Objective

At the present time, fossil fuels, such as gasoline, diesel oil, LPG and natural gas overwhelmingly dominate the transportation energy market. The liquid fuels cover the greatest market share, because they are characterised by high energy density, easy handling and relatively low costs.

In table I.1, the fuel consumption, related to the overall world and the OECD countries, is shown for the year 1999. The data are expressed in Mtoe (Million tons of oil equivalent) units.

Transport Sector Fuel Consumption	Coal	Crude Oil	Oil Products	Gas	Combustible Renewables & Waste[2]	Other[3]	TOTAL
World	6.25	0.01	1663.45	58.36	8.77	18.66	1755.50
OECD countries	0.1	-	1168.87	23.47	1.91	9.20	1203.45

Table I.1 - Year 1999 Transport Energy Balance (Mtoe)[4]

From the table can be easily seen that the oil products cover about the 95% and 97% of the fuels used in the transport sector for the entire world and for OECD countries respectively. It is also important to note that OECD countries are responsible for almost two thirds of the transport sector energy consumption. There is obviously a large margin that would allow substitution by alternative fuels, provided that effective technical and marketing solutions are found. In fact, the conventional propulsion systems, based on Internal Combustion Engines (ICE), have gained a big advantage, as they have benefited from a long period of manufacturing experience that has enabled continuous improvements, making ICE vehicles an essential component of road transport. Therefore the alternative technologies have to work hard to challenge ICE vehicles and to carve out a significant market share.

However, in recent years, the harmful effects resulting from the use of conventional vehicles and the greenhouse gases resulting from their ICEs have created many concerns on continuing in the same direction, giving more chances for the new technologies to succeed. Of course many problems, related to road transport, are of general type such as traffic congestion, accidents, the always growing need of parking space, etc. They are induced by the increased number of vehicles and the larger size of vehicles, and therefore they are quite independent of the drive train technology. New drivetrain technologies will not provide solutions to these general problems. Instead, for impacts such as emission of noxious pollutants, production of greenhouse gases, increase of noise pollution, consumption of non-renewable natural resources, etc., the new vehicles and fuels can be effective means to avoid an unacceptable degradation of the ecosystem and of the quality of life, especially in the urban areas. Of course the success of innovative vehicles depends on the present level of development of any specific technology, its peculiar benefits, its cost, its attractiveness to consumers, etc., and the market penetration will be strongly related to all these aspects.

[2] Combustible Renewables & Waste final consumption has been estimated based on Transformation Process Energy Statistics.
[3] Other includes geothermal, solar, electricity and heat, wind, etc.
[4] See Key World Energy Statisrics 2001 IEA Web Site http://www.iea.org/statist/keystats.htm

One of the issues that normally characterise any new technology is that additional field experience is needed after the successful testing of the prototypes. This can be achieved by fleet tests whose aim is to use a few innovative vehicles under real operating conditions, in order to determine the behaviour of the technologies and to acquire valuable information on their potential benefits and weak points. Although such fleet tests are normally expensive and characterised by a quite high chance of failure, it is worthwile to undertake such initiatives in order to try out new technologies and prove that they work under real life conditions.

The aim of the sub-task was to determine the most important features of new vehicle and fuel technologies, that lead to successful market deployment and reduce the risk of failure. A successful fleet test creates an understanding of the steps and precautions required to make innovative technologies increasingly competitive and to allow an easier market penetration. To achieve this aim, the sub-task analysed the field results of specific fleet tests. It paid attention not only to technical features of vehicles and fuels, but also to how they should be presented to buyers.

Fleet tests are generally carried out with a limited number of vehicles, since the focus is normally on vehicles and fuels that have just passed the prototype phase. Depending on the technology under examination, the number of vehicles (including the case where the test addresses mainly a new fuel) covers a range varying from few units up to hundreds. There is obviously an upper ceiling on the number of vehicles, as there is the need to avoid very heavy investment costs on technologies. In fact, although some innovative technologies are very promising, nobody can assure their future success, as by definition no field evidence on their effectiveness has been acquired. On the other hand, if the fleet under consideration is too small, it is difficult to have convincing findings on some topics, such as the need for infrastructures, consumer acceptance, specific actions to promote the technology, etc. Summarising, the scope of Sub-task I was to analyse specific fleet tests to deepen understanding of the following issues, i.e.

- future new experiments, related to new vehicle and fuel technologies, in order to increase their chance of success and to get really useful information for the following steps related to the technology deployment on the market;
- the structuring of the information, resulting from experiments, in a way that helps the interested stakeholders to take proper decisions and effective action.

To meet the above targets, fleet tests are required to obtain information about the performance of new technologies under real operating conditions, together with information about their reliability and possible side effects related to large scale deployment and use. In short, the results of the fleet tests are typically technical, although some relevant information related to social, economic, and regulatory aspects can also be acquired. Such information is crucial to approach the market deployment issues of the new technologies, especially if a high level of systematisation has been created to carry out new specific fleet tests. Of course it is important to keep in mind that only a few aspects of the vehicle and fuel market introduction strategy can be addressed during fleet tests, as they are the first step for new technology deployment.

Summarising, the activities of Sub-task I were:

- description of the specific fleet tests (case studies)
- collection of information, both at official and non official level, on practical/technical problems for hybrid, electric and alternative fuel vehicles
- analysis of the fleet tests results and their dissemination to the potential users (typically fleet operators, fuel suppliers, users, etc.);
- definition of guidelines for fleet tests, in order to assess the vehicle performances and to make possible comparisons among different technologies;
- formulation of recommendations for new fleet tests for:

- government officials, responsible for administering fleet test programmes of hybrid, electric and alternative fuel vehicles
- fleet operators
- vehicle and fuel industries
- manufacturers of infrastructures (i.e. fuel stations, electric rechargers, etc.) and special vehicle components

I.2 Description of Sub-task I

The main issue that motivates the study of alternative vehicle and fuel technologies are the harmful effects produced by conventional vehicles, both at local and global level. This makes the development and market introduction of new environmentally benign technologies increasingly urgent. To this end, some of the solutions being considered are:

- improved conventional vehicles using conventional oil fuels (gasoline and diesel)
- conventional vehicles using new oil fuels
- conventional vehicles using non oil fuels
- non-conventional vehicles using oil and non oil fuels

The first choice is only a natural evolution of the traditional technology and is not within the scope of the sub-task. This does not mean that improvements of conventional vehicles and fuels are not taken into account. In fact, as the new technologies have to show performances at least similar to those of conventional vehicles, this becomes an implicit target they have to meet, if they really want to acquire a share of a market segment presently held by conventional technologies.

Under the item "non-conventional vehicles using oil and non oil fuels" all the new vehicle technologies are included (i.e. electric, hybrid, fuel cell vehicles), independently from the type of fuel they are using. This reduces the number of classes and avoids the big issue of defining the primary energy origin of the fuels (e.g. it is not easy to identify the primary energy source for electric and fuel cell vehicles).

It is clear that, in order to get comprehensive results, the number of test cases to be evaluated becomes potentially very large, if all the promising technologies should be analysed together with all their possible options. To clarify this aspect, it is easy to understand that, in order to get a complete overview, a technology should be tested taking into account:

- its intended application (i.e. private or public transport, freight transport)
- the application domain (general use, urban domain, etc.)
- special boundary conditions (i.e. existence of special technical standards, level of motorization of the country, presence of infrastructures, etc.)

Many other considerations could be added to the above list and this would inevitably lead to an unaffordable number of fleet tests to be investigated. Such an approach would not have been feasible, in the light of the general constraints of the Annex. In fact, for all the tasks the driving idea was that the information had to be obtained only from existing experience, with no possibility of doing new experiments or programmes. Therefore some additional considerations have been taken into account for the selection of the test cases to be analysed under Sub-task I. In particular, the choice was based on the quality of the available experiences, the resources made available to the projects, the uniqueness of specific information for some technologies, the lack of interest due to poor market prospects of some technologies, etc. These considerations have excluded promising technologies from the analysis, such as methanol for fuel cells, as there are neither any fleet test available, nor reliable information on specific prototypes. This does not reduce the main aim of the sub-task, that is to provide guidelines to create effective fleet tests for market deployment.

The natural consequence of this approach was that in the sub-task the focus was put more on the possibility to build an effective tool to define and carry out new fleet tests with higher chance tosucceed than to provide a wide coverage of the alternative fuel and vehicle technologies. Therefore, on the basis of the above trade-off, the following technologies were considered:

Technologies of interest for fleet tests

Conventional vehicles using other oil fuels
- Liquefied Petrol Gas (LPG)[5]
- Diesel/water Emulsion

Conventional vehicles using non oil fuels
- Compressed Natural Gas (CNG)
- Biodiesel
- Biogas
- Ethanol
- Methanol
- Hydrogen

Non-conventional vehicles using oil and non oil fuels
- Electric vehicles
- Hybrid electric vehicles
- Fuel cell vehicles

The above technologies can provide considerable improvements to the negative externalities of road transport , especially for:
- emission of polluting substances
- consumption of non renewable resources
- emission of greenhouse gases
- noise

In Table I.2 a short summary of the possible benefits is provided. Of course there are possible combinations among the items in the table, such as hydrogen and fuel cells, hybrid vehicles and different fuels, etc.; such combinations are not shown to avoid making the table too complicated, as its meaning is only qualitative. It is evident that significant effects can be detected only in domains where a consistent replacement of the conventional technologies is made. It is also to be underlined that the indications in Table I.2 are independent of time considerations; therefore different technologies can provide their positive effects at different times, depending on the maturity level of the technology, the reference conditions, the application domain, etc. It is also to be underlined that the correlations between the characteristics of any fuel and the related emissions are complex, because the emissions are strongly dependent on the physical and/or compositional properties of the fuel that can be variable even though in a known range. These aspects have been particularly studied for the conventional fuels, but a qualitatively similar behaviour can also be detected for the alternative ones. The present trend is to reduce the variability of the fuel characteristics and to achieve an optimal chemical composition for the specific engine. Such a task is not easy, as any modification of physical or compositional fuel properties:
- can produce variation in many of the other characteristics of the fuel
- can favour, at the same time, the increase of one polluting substance as a consequence of the decrease of the emission level of another,
- should take into account the compatibility between the fuel and the engine technology, in order to increase the performances of the engine/vehicle system.

[5] LPG can also be obtained as by-product of natural gas production

Technology	Effects			
	Emission of polluting substances	Consumption of non renewable resources	Emission of greenhouse gases	Noise
LPG	●●		●	
Diesel fuel emulsions	●			
CNG	●●		●	
Biodiesel	●	●●●	●●●	
Biogas	●●	●●●	●●●	
Ethanol	●●	●●●	●●●	
Methanol	●●	●●●	●●●	
Hydrogen	●●●[6]	[7]	[7]	
Electric vehicles	●●●[6]	[7]	[7]	●●●
Hybrid electric vehicles	●●	●●	●●	●●[8]
Fuel cell vehicles	●●	[7]	[7]	●●●

Table I.2 – Positive effects of alternative fuel & vehicle technologies (in the table the symbol ● indicates a perceivable improvement; the presence of two or three symbols reinforces such indication)

Therefore, as the indications given in Table I.2 are to be considered qualitative, specific fleet tests could show considerable deviations from such indications. In particular, looking at the pollutant emissions, it is also to be underlined that the alternative fuels have to face a very hard challenge with the conventional ones. In fact, the oil companies have been forced to produce high quality gasoline and diesel fuels in the past years, in order to cut road traffic noxious emissions. In particular, at the European level, the AUTOOIL programmes[9] have confirmed that more stringent fuel specifications can have a positive impact on the polluting emission level. The addition of oxygenated compounds (such as ethyl butyl ether and methyl butyl ether) to the gasoline, to keep the fuel octane characteristics unchanged, produce a significant reduction of the CO and hydrocarbon emissions and, in particular, of the benzene emissions. Starting in 2005, more severe restrictions are planned for the road transport fuel specifications, particularly for the sulphur content and the aromatic and polyaromatic hydrocarbons for gasoline and diesel fuels.

I.2.1 Criteria for Fleet Test Selection

The first step of the sub-task was to find a set of relevant experiments where the new technologies had been applied. The criteria for the choice of fleet tests were mainly based on the technical aspects, rather than on the strategic ones. In fact a significant market for the innovative vehicle and fuel technologies can only have a chance if the alternative technologies have demonstrated that no deficiency exists and tangible advantages can be gained from their use. This also implies that fleet tests are normally looking to short-medium time intervals, while other promotion measures also refer to larger time intervals (medium-long time periods).

With this in mind, the selection of specific case studies for Sub-task I was made on the basis of the following criteria:

[6] At the point of use emissions are zero; it is also easier to reduce or eliminate the pollutant emissions by adopting proper techniques at the places where the energy source is produced.

[7] As the energy source is not available in nature, the specific effect depends on the primary source used to produce it. In any case, especially for hydrogen a global effect of CO_2 reduction can be achieved by gas sequestration.

[8] The score depends on the technical solution selected for the hybrid vehicle, but some noise reduction can be anticipated.

[9] For more information look at the web site http:// europa.eu.int/comm/environent/autooil/index.htm

- good coverage of vehicle and fuel technologies
- good coverage of personal, collective and freight transport
- relevance of the project in terms of allocated resources and technical results
- up-to-date characteristics of experience
- adequate coverage of all the participating countries

The selection was made in a two step process with the final choice of 15 projects, of which a short description can be found in the Appendix p. 99. A summary can be found in Table I.3.

Project	Country	Acronym	Fuel Propulsion	Vehicle type	Start	End	Total budget (M$)	Vehicle number[10]
ATAF Florence	Italy	I-ATAF	Electricity, CNG, emulsion	Bus	1996	2001+	5.2	26+50+96
FLEETS + Terni	Italy	I-FLEET	HEV, Biodiesel	Bus	1996	2000	3	24 + 2
Breitentest	Austria	A-Breit	Electricity	Car, van	1992	1993	0.1	135
Large scale lightweight EV	Switzerland	CH-MENDRISIO	Electricity	Car, minibus, 2-3 wheels, LDVs	1995	2001	7.2	396
E-Mobile Rügen	Germany	D-RUEG	Electricity	Car, bus	1992	1996	26	60
BMW H vehicle	Germany	D-Hydrogen	Hydrogen	Car, Van	1997	2001+	15	1 + 5
Regional ethanol buses	Netherlands	NL-Bio-E	Ethanol	Bus	1992	1995		3
Field operations program	USA	USA-FO	EV, HEV	Car, Van, Bus	1976	2001+	50	500+500
Diesel emulsion	Italy	I-GECAM	Diesel emulsion	Bus, truck	1999	2001+		4000
2-wheel LPG	Italy	I-2wheel LPG	LPG	2-wheel	2000	2001+	0.5	20
EVs in Göteborg	Sweden	S-Göteborg	Electricity	Car, LDVs	1992	1999	3.5	64
EVs in Skane	Sweden	S-Skane	Electricity	Car, LDVs, trucks	1994	1995	3.5	120
ZEUS Sweden	Sweden	S-ZEUS	HEV, biogas, ethanol	Car, van, LDVs	1997	2000	55	6+2+250+400[11]
Fuel Cell buses in Vancouver	Canada	C-FCBuses	Hydrogen	Bus	1998	2000	5.3	3
Zeus bus conversion	Finland	FIN-ZEUS	LPG	Bus	1996	2000	0.5	5

Table I.3 - Projects considered in Sub-task I "Fleet Tests"[12]

Some of the projects have also been used for other sub-tasks, as they were addressing targets exceeding those belonging to fleet tests. In fact, if it is already hard to design new projects to respect specific classification boundaries, this becomes impossible whenever already completed projects are to be considered, such as in this Annex. Of course all the selected projects have only been considered and analysed in the light of the aspects important for fleet tests. In addition, it is to be underlined that the selected fleet tests cover only a few of the possible technologies as for some of them (i.e. methanol) no available project fitting the sub-task criteria was found.

In order to verify that the selected fleet tests satisfy the aim of providing a comprehensive coverage of the application fields, the matrix in Table I.4 provides a rapid check. For the sake of simplicity in the table the vehicle technologies (such as fuel cells, hybrids, etc), are not shown, as they refer in any case to fuels as primary energy sources. Table I.4 provides an indication of the specific technologies addressed by the selected fleet tests.

[10] Where more than one figure is provided, each number is referring, in the same order, to vehicles using the fuels indicated in the fuel/propulsion column.
[11] 6 hybrid-electric buses, 2 biogas garbage vehicles, 250 ethanol hybrid buses, 400 biogas and ethanol vehicles
[12] The complete set of questionnaires can be provided by the author

		Fuels							
		LPG	CNG	Electricity	Diesel blends	Ethanol	Biodiesel	Biogas	Hydrogen
Vehicles	**Car**			A-Breit(EV); D-RUEG(EV); CH-MENDRISIO (EV); USA-FO(EV, HV); S-GÖTE-BORG; S-SKANE (EV)		S-ZEUS; USA-FO		S-ZEUS	D-H2
	Bus	FIN-ZEUS	I-ATAF, USA-FO	I-FLEETS(HV); I-TAF(EV); D-RUEG(EV); USA-FO (EV;HV)	I-GECAM; I-ATAF	NL-Bio-E; S-ZEUS (HEV)	I-FLEET		C-FC Buses
	2-wheel	2wheel LPG		CH-MENDRISIO(EV)					
	Light Duty			USA-FO(EV;HV); S-ZEUS; S-GÖTEBORG				S-ZEUS	D-H2
	Heavy Duty			S-SKANE(EV)				S-ZEUS	

Market existing Currently no market chance Market segments evaluated in this study

Table I.4 – Coverage matrix for fuel and vehicle technologies

Although some of the interesting cells of the table are empty, the level of technology coverage is adequate to get a sufficient idea of what is going on. In fact at least one fleet test is available for each alternative energy source and the most promising application fields are considered. This first analysis should be updated periodically as new technologies appear, so that over time a database is created and kept up-to-date of fleet testing experience.

I.2.2 The Main Results Derived from an Analysis of Responses to the Questionnaire

The Sub-task I projects are spread over a time interval that covers about 10 years (1992-2001) and are characterised by a wide variety of technologies and budgets; in particular this holds for electric vehicles, with significant changes in the type of battery used during the study period. Of course the latest projects have been selected taking into account the state of the art of the most promising technologies, but also those completed several years. They provide some "historical" information that is very useful to better understand the trends. Some of the selected projects were still going on at the time when the Annex was started and the questionnaire was completed.

The budgets of the projects range from tens of thousands to tens of millions of American dollars, depending not only on the number of vehicles, but also on the type of vehicles and fuels and whether the technology is fully developed. Of course it is clear that the results of the selected fleet tests are normally strongly dependent on the boundary conditions of each project. In any case the questionnaires have been structured in a way that makes the analysis of the information and any related additional processing easier.

The first item to be checked are the fleet test objectives, with the results shown in Table 1.5, where the dots indicate the presence of specific objectives under each of the selected projects.

Projects	*Presence of specific objectives*				
	technical improvement	behavioral change	environment. quality	organisational improvement	other
I-ATAF		●	●	●	
I- FLEETS		●	●	●	●
A-Breit	●	●			
CH-Mendrisio	●	●	●	●	●
D-RUEG	●		●		
D-H2	●	●	●	●	●
NL-Bio-E			●		●
USA-FO	●	●	●	●	
I-GECAM			●		
I-2-wheel LPG	●		●		
S-Goteborg		●	●		
S-Skane	●	●	●	●	●
S-ZEUS	●	●	●		●
C-FCBus	●		●		
FIN-ZEUS	●		●	●	
Count	**10**	**9**	**14**	**7**	**6**

Table I.5 – Objectives of the selected fleet tests

Of course the indications are provided on the basis of the answers provided by the experts. It is a little bit surprising that the environmental target is the most frequently indicated one, while the technical improvement, which should be the most important for fleet tests, is well behind the first one, with only 10 positive answers on 15 questionnaires. A confirmation of this can be found in the bar chart of Fig. I.1, that gives the percentage of positive answers to each target, averaged on the total number of projects. The maximum score belongs to the environmental target with 93%, while the technical improvement gets only 67%.

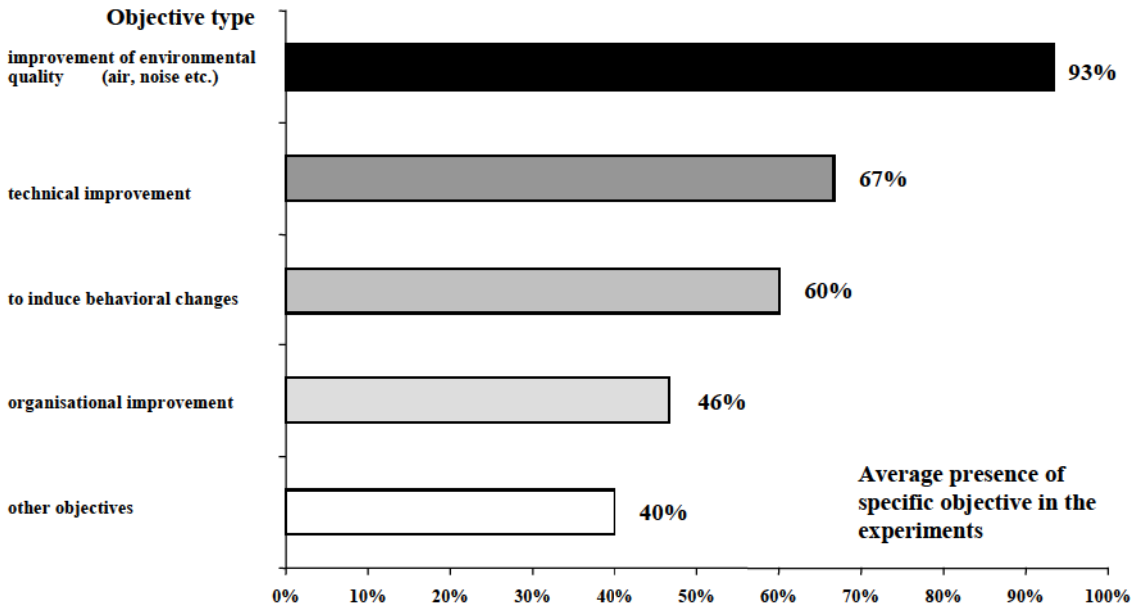

Figure I.1 – Average importance of the objectives of the selected fleet tests

There is an easy justification for these results, as normally the environmental issue is the mainspring that pushes for the introduction of the new technologies (although it is evident that the environmental effect of the fleet tests cannot have significant impacts at global level, as the number of vehicles/fuels is small). Therefore there is often a mismatch between which should be the real targets of such experiments and which are the long term targets under test. On the other side it is much easier to get the resources needed to carry out a new test if special emphasis is laid on the environmental aspects in the project proposal.

This aspect is particularly true for the environmental target that is a pure extrapolation of what could happen in the future in case the technology were successful and a wide market share could be gained. In this sense the experts' answers are misleading, but the approach was to avoid changing the information found in the questionnaires. It is also interesting to look at the level of the target achievement for the selected fleet tests; to this end each expert had the possibility to give a score, ranging from 1 to 4 for each target. The results are shown in table 1.6, where only the score for the targets indicated as relevant for the specific projects have been indicated. Therefore some filtering of the questionnaires was done, as many experts also provided answers to the targets they classified as unimportant just before; this to increase the reliability of the classification. On the other hand, it was quite interesting to verify that in a few cases the experts were unable to provide an answer for relevant targets (or data were not available); this happened with all the cases where the the symbol ❍ is shown. This situation was quite frequent and was detected not only with the heterogeneous items summarised under "other", but also with the well specified targets. There was even one specific project for which all the targets received no score. The lack of experts' answers implicitly confirms that sometimes fleet tests have been carried out without a clear and complete definition of the goals and without methods to check whether the targets are reached or not. Paying attention to this issue would be very beneficial, as this could result in a better "design" of the projects consequently in increased chances of success. This should be done at the very beginning of each project.

Projects	***Achievement of the objectives***				
	technical improvement	**behavioral change**	**environment quality**	**organisational improvement**	**other**
I-ATAF		●●●	●●●●	●●●	
I- FLEETS		●	●●●●	●●●	❍
A-Breit	❍	❍			
CH-Mendrisio	●●	●●	●	●●●	❍
D-RUEG	●●●		●●●		
D-H2	●●●	❍	●	●●	❍
NL-Bio-E			●●●		❍
USA-FO	●●●●	●●●●	●●●●	●●●●	
I-GECAM			●●●●		
I-2-wheel LPG	●●●●		●●●●		
S-Goteborg		●	●		
S-Skane	●●	●●	●	●●	●●●
S-ZEUS	●●●	●●●	●●●●		❍
C-FCBus	●●●		●●●●		
FIN-ZEUS	●●●		●●●●	●●●	

Table I.6 – Achievement of the objectives of the selected fleet tests

● to ●●●● indicate the level of achievement; ❍ indicates that the experts were unable to provide any score although the objective was considered relevant

In order to have a global view, the results have been averaged over the different projects and are shown in Fig. I.2. Two sets are provided, one showing the projects with the objectives indicated as important by the experts, the other one indicating all projects. The first set is generally characterised by higher scores, although there are situations where there are opposite indications. This is dependent on the fact that some experts also provided scores for objectives declared unimportant by them (with high scores for the specific targets) and thereby creating such strange results. In any case it is to be underlined again that the most reliable indications are those belonging to the first set. Looking at the specific objectives, the highest scores can be found for the "technical improvement", "environmental quality" and "organisational improvement" targets. Specific attention is to be paid to the organisational issue, where fleet tests can have a special importance to address many of the framework conditions necessary to create a market for the technologies, both reducing the investments and avoiding many of the deployment pitfalls.

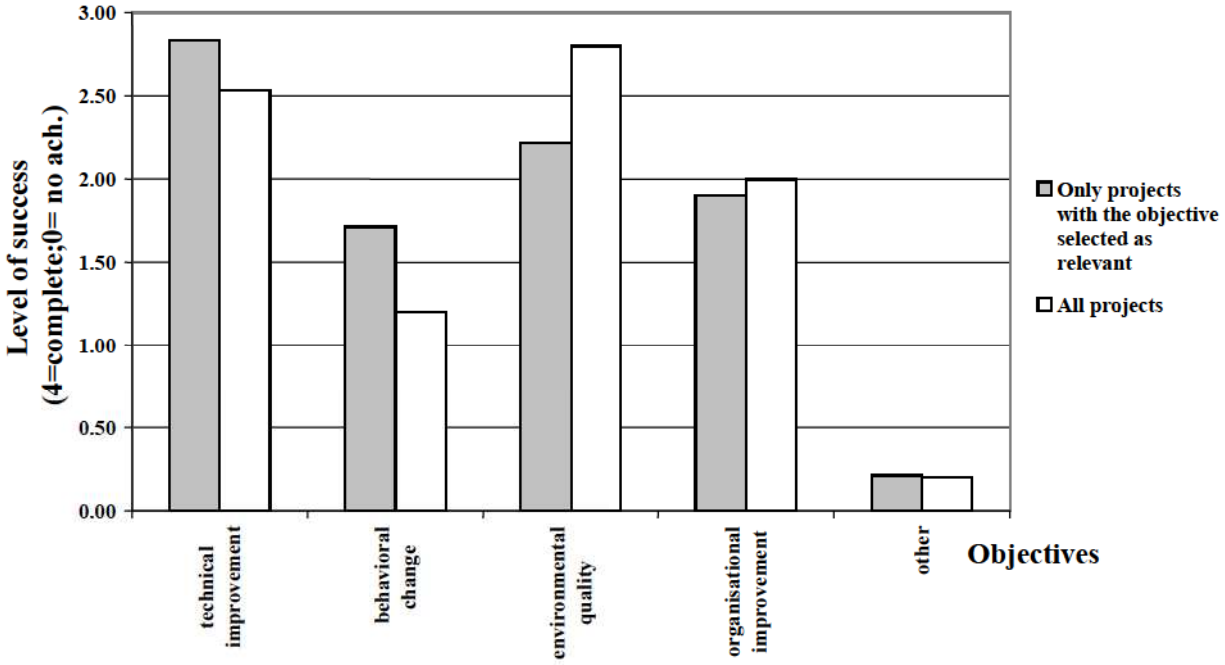

Figure I.2 – Average score for fleet test targets

Other important aspects to be analysed are the barriers that can prevent or slow down the diffusion of the innovative technologies. This is shown in Fig. I.3, where the percentages indicate the ratio between the number of projects for which an affirmative answer has been provided, and the total number of projects. All the experts gave useful responses to this question, as barriers are always present and constitute the real problem to be overcome for a diffusion of the technologies. It is confirmed by the bar chart that the main reasons for a poor presence of the innovative technologies on the market are attributable to their high cost and low reliability, while also the lack of infrastructures, standards and political support are deemed important. In particular, the high percentage of positive answers on "technology not mature" confirms that fleet tests are very important to provide valuable technical information on the field application of the innovative technologies.

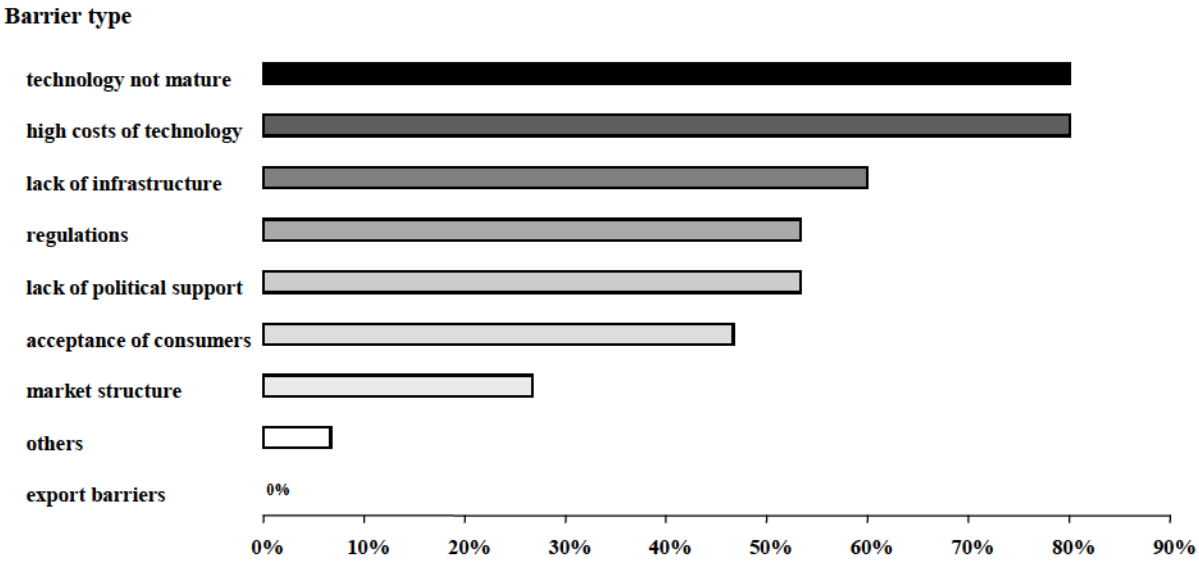

Figure I.3 – Average impact of barriers on selected fleet tests

At this stage the early acquisition of information on drawbacks and even on failures helps to identify the weak points of the technology and to increase the vehicle reliability. On the contrary, the experts' indication about the "acceptance of the consumers" is very promising, as it is considered a barrier in less than 50% of the experiments. This shows that potentially there is no consumer's prejudice to change the technology, provided that the new vehicles and fuels are competitive. Of course the transformation of the consumer's neutrality into acceptance remains a long process, but there is the chance to succeed if good solutions are proposed.

Going to analyse the importance of measures favouring the diffusion of new technologies, the experts have indicated that the main means are related to have pilot projects and the availability of subsidies and infrastructures; high attention has also been paid to the creation of the right channels for a widespread diffusion of information. This can be seen in Fig. I.4.

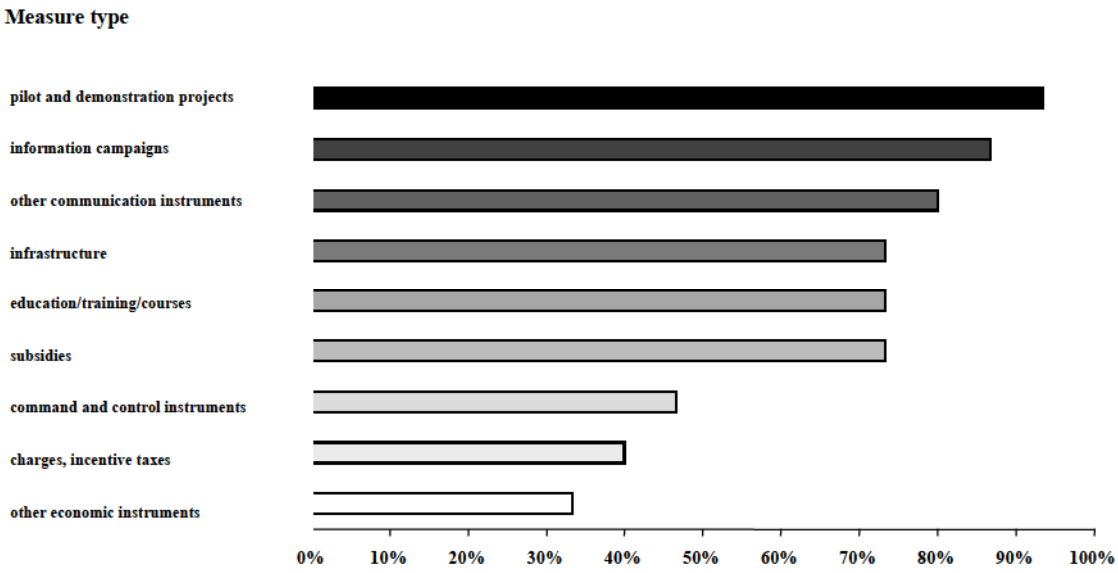

Figure I.4 – Average importance of specific measures in selected fleet tests

For fleet tests the application of particular measures such as taxes, special laws, etc. is deemed less critical, as such measures have more importance whenever the market is developing. Other provisions have a higher priority, especially as fleet tests are considered to be the first step of a deployment strategy. Therefore action on other fronts, such as information and communication provisions, is very important and has to be initiated at an early stage to increase the likelihood of success of the innovative technologies. Of course the presence of subsidies and economic incentives is generally a prerequisite condition to carry out a fleet test and therefore it is quite obvious to find high scores for such measures.

The last general observation found in the questionnaires is related to side effects tied to fleet tests. The experts have guessed that the new technologies can provide additional benefits, such as improvement of other vehicle technologies and job creation. In particular, the use of specific components and ideas belonging to the innovative vehicles and fuels can be applied to other fields, not necessarily belonging to the transport area. Of course, also for the above benefits, it is clear that all these results can be only reached if the technologies achieve real success on the market; this indirectly shows that the general feeling the experts have on their fleet tests is positive. The indications on side effects are shown in Fig I.5.

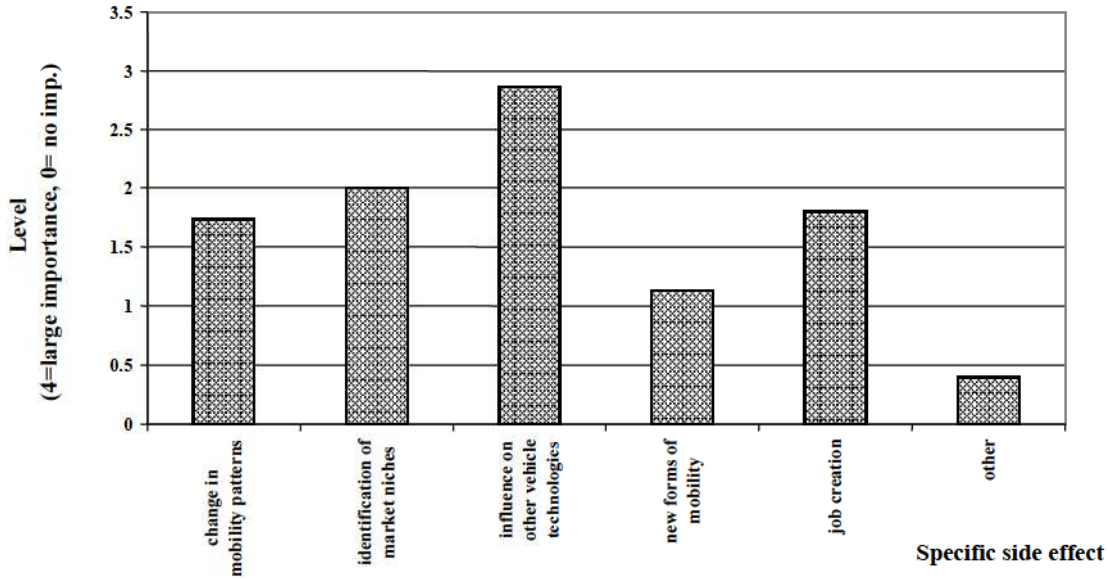

Figure I.5 – Average importance of side effects on selected fleet tests

I.3 Conclusions and Recommendations

The analysis of the questionnaires of the selected fleet tests provides a basis that gives room for defining general criteria and provisions for planning new initiatives for innovative road transport technologies. They constitute a planning framework that can significantly increase the probability of success for such initiatives, improve the usability of their results and provide information on the results in the most suitable way for the interested stakeholders. Three phases can be identified, where it is particularly important to make improvements: the design of the project, the assessment of the results, and the follow-up after the conclusion of the test.

Design of the Experiment

It is necessary to pay maximum attention to:

1. a quantitative definition of the main objectives that can be provided by the
   - acquisition of information provided by similar projects, both to avoid testing features for which the results are already available and to have the possibility of increasing the significance of the test findings
   - identification of the main targets of the fleet tests
   - identification of adequate resources to meet the project requirements (i.e. careful selection of the targets to be reached with respect to the project funding)
   - identification of indicators and methods to assess the target achievement

2. the identification of an easily controllable operating context (i.e. where the likelihood of achieving the findings expected for the project can increase) and characterised by:
   - limited geographic dimensions;
   - availability of information on features that can impact the test results (in particular those aspects that can give more generality to the findings or specialise them for typical applications, identifying specific criteria and requirements for their management);
   - adequate availability of necessary infrastructures;
   - adequate availability of maintenance services;
   - adequate assistance from the manufacturers and suppliers;
   - involvement and motivation of all the stakeholders (without exceeding in the opposite sense, in order to avoid hiding significant drawbacks);
   - reduced criticality of the applications where the technologies are used, in order to avoid that malfunctions and/or delays produce negative feelings of the stakeholders and the final users;
   - deployment of adequate human and economic resources, and availability of sufficient time, assuring in particular the right dimensioning of the project evaluation phase (often the purchase phase of the technologies is favoured too much);
   - possibility to allow an easy involvement of the community, with the aims of both keeping people informed on the project evolution in a timely manner and, where possible, of making them active partners.

Fleet test evaluation phase

It is necessary to assure that the following points are covered:

1. determination of the level of success for every objective and, where deviations are found, to identify the reasons that have hampered their attainment;
2. identification of important side effects;
3. identification of the technical and/or organisational improvements needed to favour the creation of a market for the technologies (i.e. conditions for the technology to be self-sustaining on the market);
4. estimation of the impact of a wider scale technology application, i.e.:
   - environmental benefits.
   - user's behavioural changes.
   - weak aspects of the technologies with indication of possible solutions.
5. identification of the most adequate measures and contexts for the creation of market niches, in particular
   - economic (subsidies, incentives, reduction of taxes, facilitation of a second-hand vehicle market, etc.);
   - legislative (national and local standards, constraints to use traditional technologies, etc.);
   - logistics (availability of infrastructures and services, spare parts, etc.);
   - formative and informative (courses, seminaries, specialised magazines, demos, etc.).

Follow-up phase

It is necessary to guarantee that

1. the stakeholders (i.e. governments, local administrations, manufacturers, component industries, suppliers, fleet managers and citizens), interested in the development of the technologies, are fully informed of the results in a transparent and complete way. This will allow them to become aware, without excessive effort, of the main features of the technologies, and to enable them to proceed with follow-up initiatives for market growth. Obviously an additional effort will be required for the team involved in the fleet test, in order to supply each stakeholder with the information of interest.
2. the activity is continued for a significant period after the technical conclusion of the project, and that proper resources are planned and allocated for this task. As an adequate budget is required for the follow-up phase, this normally creates considerable problems for the entire project.
3. whenever fleet tests have to face budget constraints and activities have to be cut, the phases of data evaluation and dissemination should not suffer from the main reductions. Cutting back evaluations should always be avoided and, where the resources were deemed insufficient for the project, a reduction of the original targets should be decided. Consequently a new project evaluation should be carried out to verify if the effectiveness remains adequate, i.e. enough benefits are gained.

A final remark concerns the type of transport application where fleet tests have a better chance to succeed. To this end it is very important to identify transport domains that can be easily controlled. In particular, public transport and captive fleets (i.e. vehicles are used for companies or special use) are applications where generally very good boundary conditions can be met (i.e. availability of fuel supply, maintenance personnel, etc.) and this could be a big advantage.

I.4 Open Questions

During the work some very important issues have not been adequately addressed as they require resources and expertise well beyond those available for the sub-task. It would be very useful if these issues could be analysed in depth in the future as this could be a big step in the direction of increasing the effectiveness of future fleet tests. Among these issues the following ones are deemed particularly important:

- definition of a well consolidated methodology for the evaluation of experiments;
- creation of a proper environment in order to keep the information updated;
- building of future scenarios not only as evolutionary trends of the present situation, but keeping in mind that some revolutionary changes can happen to society.

In order to evaluate the results of fleet tests in the proper way, it would be very important to define a set of indicators that should be provided by the fleet tests. Such indicators could be both monitored or calculated, but what is required is that they are widely applied, and that also the methods for their determination are generally accepted. This is a formidable task and some international organisations (i.e. OECD, IEA etc.) are putting a lot of effort in this direction, although a lot of work still needs to be carried out. If these initiatives are successful, it will create a framework to collect the information, to compare the different technologies in quantitative way, to have the possibility of using already available results in different contexts and ultimately to avoid mistakes and to save a lot of resources, as only the technologies with significant chances of success would be investigated.

Another important issue is to avoid that the technical information becomes outdated; therefore it would be worthwhile to guarantee that periodically some activity is carried out on fleet tests, adding new information on advanced vehicles and fuels, and thereby creating a database, where the latest information on the available innovative technologies can be found. This could create a very useful tool for the stakeholders helping them to select the most effective innovative solutions fitting their needs.

It is quite obvious that all these recommendations try to increase the chance to get comprehensive answers to the issues related to new vehicle and fuel field applications, but cannot turn such answers to be positive if the technologies are inadequate. Therefore in each of the fleet tests the risk of failure is not negligible, but, if the provisions indicated in the previous paragraphs are taken into account, the risk that the overall project is compromised by lack of attention to important planning aspects is considerably reduced. In any case, even in the case of technology failure, it is important that the project is designed to avoid that the entire budget is lost. Therefore attention should be paid by the fleet test manager to have information on negative results as early as possible, in order to allow him to make the appropriate modifications.

The last consideration is that transport issues are to be addressed not only by looking at vehicles and fuels, but also at other important aspects, not necessarily belonging to technology improvement. In particular the future scenarios concerning the deployment of advanced technologies should not only be considered as a pure extrapolation of the present situation as this could create significant drawbacks. In fact, it has to be taken into account that modern society is changing fast and that some new elements could gain a lot of importance; for instance the introduction of the Internet and the expansion of communication networks could considerably modify the present way of life. This can influence the present road transport configuration both modifying the need for trips (acting on the mobility demand, reducing it in some cases), and creating the conditions to make new transport modes more effective (acting on the transport supply). In particular, communication technologies could also favour information dissemination, whenever new tests are carried out, and make such a process timely and cheap, even during the fleet test execution. Of course a management of such a process will always be required, in order to create an information channel where the final users can get reliable information, learn what is going on and can provide their feedbacks. The additional budget that should be allocated for this task could have many positive effects in speeding up the innovation process for vehicle and fuel technologies and in favouring their market growth.

II Government Support and Regulations

Stefan Rieder

II.1 Objective: Define the Role of Government

Sub-task 2 "Government Support and Regulations" is concerned with measures preparing the mass market for hybrid, electric and alternative fuel vehicles (inclusive support for trucks, buses and infrastructure). The objective of this analysis on the role of government is to:

- identify government objectives, measures, regulations and incentives and their results in different countries
- evaluate the effectiveness of these measures and incentives
- elaborate recommendations for government support and regulations

Programme	command + control	financial incentives	communication	networking	infrastructure	remarks
A-Breit		●			❍	
A-Tourism	❍	●	●	❍	●	infrastructure designed to the needs of pedestrians and bicycles, preferential treatment EV, zones with restricted access for conventional vehicles
CH-CityCar		❍	●	❍	●	networking of transport service suppliers and government; no formal involvement of vehicle suppliers
CH-MENDRISIO		●	●	❍	❍/●	in some of the sub-programmes implemented in other localities than Mendrisio, the project was part of a general planning policy favouring clean vehicles, bicycles and pedestrians
D-PROKOM		●	❍		❍	battery leasing, advice for application of EVs
FIN-MOBIL				❍		research programme; in corporation with industry (fuel and vehicle suppliers)
F-PRAXI		❍	❍	❍	●	
I-LEG		●				also information of target group (public transport suppliers/fleet owners)
J-TAX		●				
J-LOAN		●			❍	
J-SUB		●				
J-CARShar		●	●		●	
J-EVShar		●	●			
NL-DEMO		●	●		❍	
NL-RATIO		●	❍			research funds, tax reductions
NL-SSZ		●				mainly research funds (RD&D), tax reductions,
S-ETOUR		❍	❍		❍	small scale (37 two-wheelers)
S-ZEUS		●	●		●	
UK-PowerShift		●	❍			
USA-CleanCities		❍	❍	●	❍	
USA-ENVVEST	●	●	●	❍	●	
USA-FleetEV		❍	●			

Table II.1 – Programmes and instruments evaluated for this section (●=dominating, ❍=partly)

Within this Sub-task 22 programmes have been analysed (see table II.1). The instruments used by the programme managers are split in five groups:

- Command and control instruments: All kinds of regulations to support clean vehicles and fuels (rules, standards, approvals, traffic regulations etc.)
- Financial instruments (loans, subsidies, taxes etc.)
- Communication (information, training, education, public relations etc.)
- Networking (establishing communication platforms, support of certain actors, setting up of contacts etc.)
- Infrastructure (building of filling stations, modification of roads, parking spaces, information systems etc.)

The main sources of information were the questionnaires which were filled out by programme-managers or national experts. For most of the programmes, some additional empirical work was also done: Comments on the programmes were sent to the programme-managers with additional questions. On the basis of these reactions the evaluation of one or the other programme was modified. In addition, publications available in English for all the programmes were analysed.

II.2 Detailed Description of Results

This chapter gives the results of the inquiries (questionnaires and additional analyses of documents).

Programme		91	92	93	94	95	96	97	98	99	00	01	02	03	04
A-Breit			■	■											
A-Tourism									■	■	■	■	■	■	
CH-CityCar										■	■	■			
CH-MENDRISIO						■	■	■	■	■	■	■			
D-PROKOM		■	■	■	■	■	■	■	■	■	■	■	>>?		
FIN-MOBIL				■	■	■	■	■	■						
F-PRAXI									■	■	■	■			
I-LEG										■	■	■	>>		
J-TAX										■	■	■	>>		
J-LOAN										■	■	■	>>		
J-SUB									■	■	■	■	>>		
J-CARShar											■	■	>>		
J-EVShar										■	■	■	■	■	
NL-DEMO									■	■	■	■	■	■	
NL-RATIO	83	<	■	■	■	■	■	■	■						
NL-SSZ				■	■	■	■	■	■	■	■	■	??		
S-ETOUR											■	■	■	■	
S-ZEUS								■	■	■	■				
UK-PowerShift						■	■	■	■	■	■	■	>>		
USA-CleanCities			■	■	■	■	■	■	■	■	■	■	>>		
USA-ENVVEST										■	■	■	>>		
USA-FleetEV									■	■	■	■	>>		

Table II.2 – Duration of programmes

Before discussing the results, a remark on the selection of the case studies should be made. The starting point was a list of programmes in the area of clean vehicles identified by the operating agents, the sub-task-leaders and national experts. Jointly with the operating agents, programmes were then identified which should be analysed within Sub-task II. Due to the scarcity of deployment measures aimed at the market preparation and medium or large scale market introduction, some larger scale pilot- and demonstration (P+D)-programmes were also included in this analysis. We admit that our selection is not abundant. However we think that it gives a fairly good picture of the kind of activities undertaken to further the deployment of clean vehicles.

II.2.1 Programme Budget and Duration

Regarding the duration, the programmes under study show some variety. Most of the completed programmes extended over a period of four years or more. This can be interpreted as a sign of the continuity of the efforts to further clean vehicles (see table II.2). It has to be said, however, that several programmes were started in the last few years and are not yet completed. In these cases a post-facto evaluation is hardly possible.

The programmes differ strongly with respect to the allotted budgets (see figure II.1). The largest budget totalled 150 million US$, whereas the smaller projects are limited to budgets below 1 million US$.

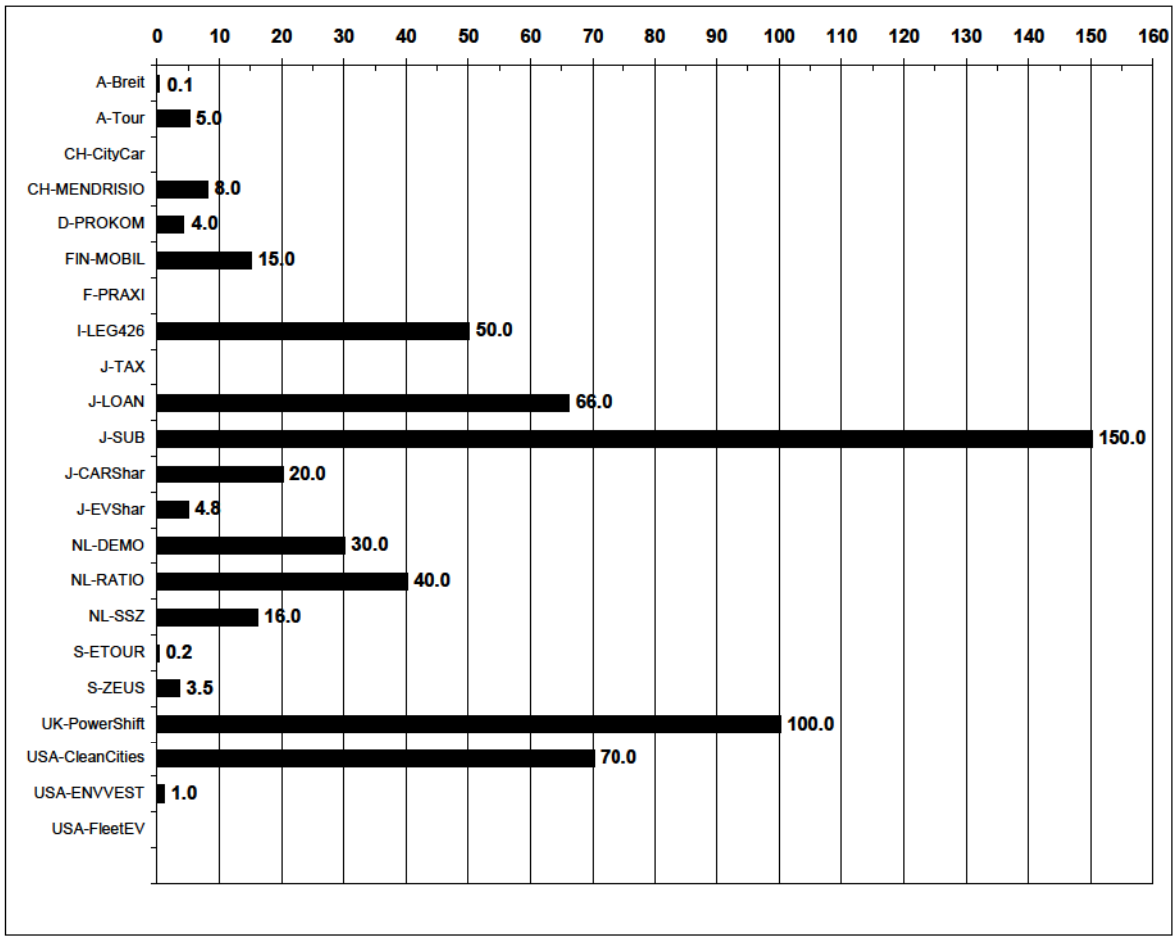

Figure II.1 - Project budgets in million US-$ (only public funds without investments by privates)

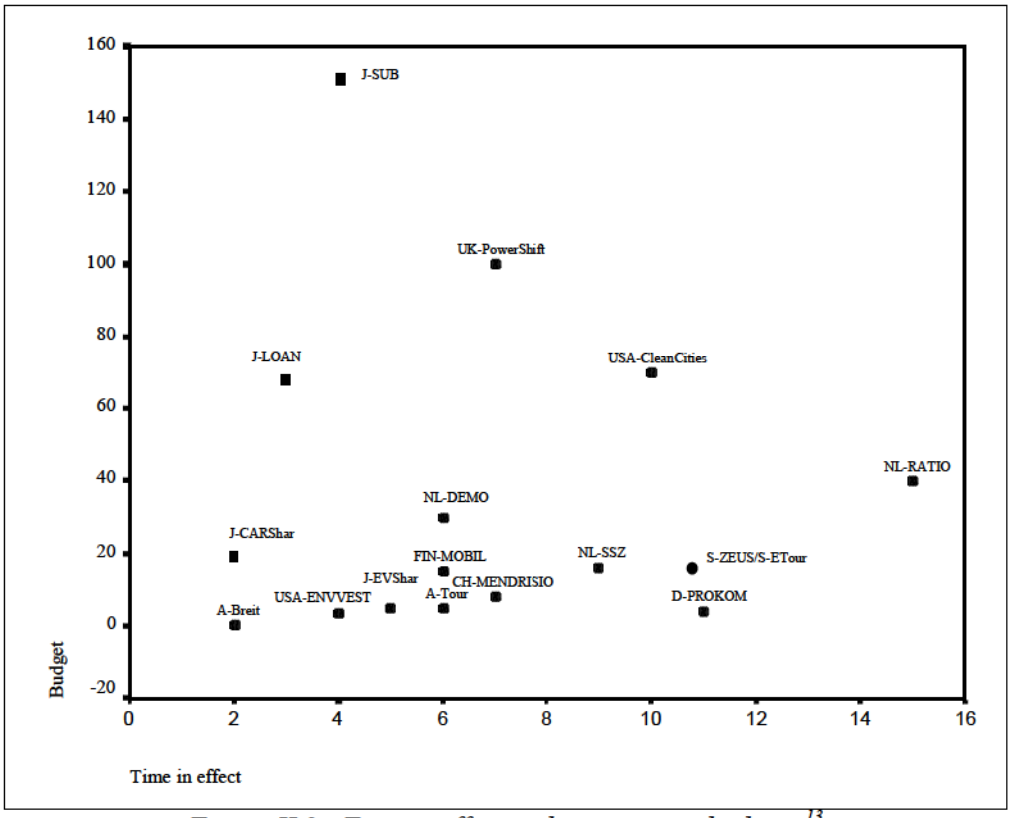

Figure II.2 - Time in effect and programme budgets [13]

Figure II.2 relates the time span of the programme to the available budget. From a theoretical point of view, a programme with a long execution time needs a high programme budget and vice versa. Although projects with a longer running time show a slight tendency to large budgets, this is only a very partial explanation for these large budget differences. A better explanation can be found in the different scopes and policy approaches of the projects.

II.2.2 Scope of Programmes and Barriers

The scope of a programme is determined by the technological and the geographical scope.

- The technological scope of a programme can be focused very much on the promotion of a single technology and/or fuel type (e.g. EV). Other programmes have a wider scope, aiming at the deployment of several types of clean vehicles or respective fuels. We shall classify programmes promoting at least three different fuels or three different propulsion technologies as wide in scope.
- The geographical scope also can vary considerably. There are programmes of a purely local scope (one or few cities/localities within a state). Other programmes are operating on a national level and including the whole area of a state or at least all localities in the state fulfilling given conditions (e.g. high level of air pollution). This means that programmes launched by national governments are classified as national in scope, even if they only cover a specific type of area (e.g. all cities with more than 50‘000 inhabitants). For local level programmes see Part III.

Applying these two criteria to the programmes under study, the following table II. 3 results:

[13] Due to lacking or unclear information regarding time in effect and/or budget, five programmes (CH-City-Car, F-PRAXI, I-LEG, J-TAX, US-FleetEV) are not present in the graph. The S-ETOUR and the S-ZEUS programme are part of a long term policy of the local authorities of Stockholm. Therefore they are merged in the table.

Programme	local-focused	local-broad	national-focused	national-broad	comments
A-Breit			●		
A-Tourism	●				
CH-CityCar	●				
CH-MENDRISIO	●				
D-PROKOM	(●)		●		covers supply area of RWE
FIN-MOBIL	●				mainly research, some small scale demonstration projects (LPG- and CNG-Buses, EV), deployment projects only locally
F-PRAXI	●				self service EV-rental system
I-LEG				●	public fleet owners in cities >25'000 inhabitants
J-TAX				●	
J-LOAN				●	
J-SUB				●	
J-CARShar		●			
J-EVShar	●				
NL-DEMO				●	
NL-RATIO				●	
NL-SSZ				●	focus on urban areas
S-ETOUR	●				integrated in S-LEV Stockholm; part of EU-Project
S-ZEUS		●			integrated in S-LEV Stockholm; part of EU-Project
UK-PowerShift				●	
USA-CleanCities				●	
USA-ENVVEST	●				Pilot programme within the area of Vandenberg Air Force Base
USA-FleetEV	●				Georgia-Power Fleet (EV in industry application)
Count	**9**	**2**	**2**	**9**	

Table II.3 - Scope of programmes

The table shows a dominance of technologically focused programmes on the local level and technologically broad programmes on the national level. Given the common policy recommendation that successful programmes have to be very clearly focused, the lack of technologically focused programmes on a national level is noticeable. This may be due to the fact that national policies are more interested in the effects of clean vehicles (namely less pollution) than in the promotion of a specific technology. National governments favour programmes reducing harmful emissions (e.g. emissions standards) without favouring a specific technology to reach this goal.

When we look at this fact from a theoretical point of view, it is clear that programmes on a national level with a broad technological approach are the most ambitious ones. As a consequence, these programmes need a high budget and a broad set of political measures. In practice, these two preconditions are not always fulfilled.

II.2.3 Intended Change: Fit and Stretch in Technology and Use Context

Regarding the strategies of projects to influence transport, Elzen[14] distinguishes two dimensions of intended change in technology and use context: Programmes can aim at "fit" or "stretch" strategies in both dimensions.

[14] Elzen, Boelie: Optimising learning from experiments with transport innovations. A crucial step towards sustainable mobility, Paper for the IEA Workshop „Market Deployment Strategies for Clean Vehicles", Kyoto, Japan, June 2001. The paper is included in the Appendix p. 117ff.

Concerning the technology dimension, "fit" means that the project manager tries to make the new technology appear like an existing one to the user (more or less trying to hide that there is something different under the hood). "Stretch" implies an emphasis on the novelty of the technology to the extent that adaptive behaviour is expected from the users, for example to drive an electric vehicle with lower range and performance.

		Technology	
		Fit	Stretch
Use-context dimension	Fit	**Type I** e.g. CNG-trucks	**Type II** e.g. fuel cell-cars
	Stretch	**Type IV** e.g. car-sharing*	**Type III** EV in Mendrisio /A-Tourism (subsidies, privileged access to certain areas, special parking-lots)

*Table II.4 - Strategies for clean vehicles; *this type of programmes was not included in this study*

Concerning the use-context dimension, the distinctive feature of the strategy is whether users will not have to change their existing travelling habits (fit) or whether the objective is that users have to do so (stretch). Thus, attempts to achieve a modal shift are stretch strategies – in practice use context stretch often means to favour public transport and/or clean vehicles at the expense of private transport and conventional vehicles (e.g. restricted access to city centres, clean vehicle-lanes etc.) [15]. Table II.4 illustrates this.

Programme	**Type I**	**Type II**	**Type IV**	**Type III**	**Comment**
A-Breit		●			
A-Tourism				●	
CH-CityCar				●	
CH-MENDRISIO				●	
D-PROKOM		●			
FIN-MOBIL	●	(●)			
F-PRAXI				●	
I-LEG	●	●			
J-TAX	●				
J-LOAN	●				
J-SUB		●			
J-CARShar				●	
J-EVShar				●	
NL-DEMO		●			
NL-RATIO	●	●		(●)	
NL-SSZ	●		((●))		some research for better freight transport logistics
S-ZEUS				●	
S-ETOUR		●		●	
UK-PowerShift		●			
USA-CleanCities		●	(●)	(●)	open approach, kind of project depending on individual city
USA-ENVVEST		●			
USA-FleetEV		●			
Count	**6**	**12**	**0**	**8**	

Table II.5 - Strategies regarding technology and use-context change (fit vs. stretch)

[15] One could see a problem of this classification due to technology changes over time. However, this problem should not be overestimated. Given a fixed concept of the programme, technology changes take a really long time. It is not probable that within the time a programme is in effect a technology makes such a big change. If the concept of a programme is changed, or enlarged to a broader scope, it is a new programme. In sum, we don't think that technologies and context dimensions change in the short- or medium term.

Elzen points out that most programmes are focusing on technology changes (technology stretch). If we apply Elzen's criteria to our sample of programmes we come to the same conclusion: Strategies aiming at changes in the use-context are relatively rare. Most programmes are trying to induce technology stretches (table II.5)[16].

When we put all the projects into a matrix as shown in table II.4, we have the following overview: 6 Programmes fit Type I, 12 Type II and 8 Type III. Each type of measure may be ranked from ambitious (fit-fit-strategies need no new technology and no change in use-context), rather ambitious (a technological change is needed) and highly ambitious (technological change and change in use context is needed).

		Technology	
		Fit	Stretch
Use-context dimension	Fit	**Type I:** less ambitious 6 programmes	**Type II:** rather ambitious 12 programmes
	Stretch	-	Type III: **highly ambitious** 8 programmes

Table II.6 - Numbers of programmes for each type of programme

We can see that a lot of programmes are rather ambitious (12) or have even very high ambitions (8). That means, these programmes need a lot of resources, and the probability of failure is much higher than for strategies with a fit-fit profile.

II.2.4 The Role of Government: Network Strategy Versus "Strong State" Approach

In the political sciences the roles of governments are discussed in the field of governance theories. Braun (2000)[17] sums up these discussions and distinguishes four basic models which define the role of government. For the purpose of this discussion, mainly two models seem to be relevant[18]:

- the steering state: This model assumes a relatively strong state which has the resources (know-how, money, legal authority) to steer the actions of (in our case: vehicle industry, users, car-seller etc.).
- the network state: Acknowledging its lack of resources (expertise, money), the state takes the role of a facilitator, network manager or moderator. Many political scientists of different theoretical traditions (systems theory, rational choice) advocate this model as a more realistic approach to policy making[19].

In the following table, we applied these considerations to our programme sample:

[16] A possible explanation for the fact that programmes aiming at changing the use-context are relatively rare could be that most people involved in alternative fuel vehicle projects and in the promotion of clean vehicles have quite a technical background.

[17] Braun, Dietmar: Steuerungstheorien. In: Wörterbuch der Politik, 2000. For a similar argument s. also CERT/WP/IA Deployment Project: Lessons Learnend and Best Practices in Technolgy Deployment Policies, Paris 2001

[18] We neglect the minimal state and the planning state for our disussion. The minimal state refrains from intervention in the market, its only role in our case would be to further basic (not applied) research.

[19] The paradigm of a network state is influencing more and more policy areas. According to the advocates of this model, the network state cannot guarantee any success. The steering state however is (according to the advocates of the network state) almost sure to fail with ambitious programmes. Its reaction to failure will be more of the same, resulting in an even worse performance.

Programme	direct steering	networking/facilitating	comments
A-Breit	●		
A-Tourism	●	❍	
CH-CityCar	●	❍	
CH-MENDRISIO	●	❍	
D-PROKOM	(●)		RWE is a private enterprise
FIN-MOBIL	●	❍	research was driven by universities in co-operation with industry
F-PRAXI	-	-	EdF main funding source
I-LEG	●		
J-TAX	●		
J-LOAN	●		
J-SUB	●		
J-CARShar	●		
J-EVShar	●		
NL-DEMO	●	❍	
NL-RATIO	●		main focus on RD&D
NL-SSZ	●		
S-ETOUR	●	❍	
S-ZEUS	●	❍	
UK-PowerShift	●		
USA-CleanCities		●	
USA-ENVVEST	●	❍	
USA-FleetEV	●		

Table II.7 - Programmes and governance model: ● dominating model, ❍ model partly applied

The following criteria to divide the programmes into the two categories have been used:

- steering state: direct intervention in the market with financial incentives (taxes, loans, subsidies, e.g. *J-Tax, UK-PowerShift*), services completely provided by the government (e.g. *J-CarShar*)
- network state: primary use of persuasive instruments like negotiations, information, voluntary agreements; strong co-operation with market actors (car manufacturers, garage owners, communities, associations), the state is not the only actor who is responsible for the success of the programme.

The result is quite clear-cut: The paradigm change has not taken place in the area - only the Clean Cities Program in the USA corresponds to a network model, all the other programmes follow the steering state model. However, in some programmes a tendency to include networking as a complementary aspect of policy making (not as a core issue) can be observed.

This analysis shows that most of the programmes start with the assumption of a strong steering state. Accordingly, we observe a dominance of models relying on a strong government, having financial and technical resources as well as the know-how to actively steer this development. This view seems to be deeply anchored with programme managers and proponents of clean vehicles. The scope of policy instruments accordingly is rather traditional: direct state regulations and financial incentives are dominant. Networking and persuasion are mostly if at all seen as a complementary measure.

From our point of view it is obvious, that this precondition is not given in most of the cases. Transport is a policy field, where the opposition against policy measures is very high (especially if the free choice of transport-facilities or the prices of fuels are concerned). The resource "public acceptance" of many measures is not very high. Therefore there is a need of programmes with a "networking approach". The aim of such an approach is not to influence the target groups directly.

The goal is to support market actors, to arbitrate among market players, to strengthen the communication between opponents, to arbitrate in conflicts. This set of instruments should change the behaviour of market actors in the direction of the government goals. A precondition of such an approach is the insight that the government is not able to attain its goal alone or even against market players.

To be clear, the argument is not that the strong state concept does not work, is it is assumed that the necessary resources are available (money, strong authority of the government). The introduction of ethanol as fuel in Brazil shows that, in case the government has the power and the competence, the strong state concepts does work. The government of Brazil implemented a law forcing manufacturers to provide motors for ethanol, fuel companies to provide the ethanol and filling stations, to limit the choice of fuels. The precondition for such a policy is the power of a government to overcome all opposition against it. In most of the industrialized countries, the introduction of such a law would be impossible, not only because the natural preconditions are not given (no sugar cane industry) but primarily because in democratic systems the power is divided, and the opposition against a strong market intervention has enough instruments to prevent such a law. Generally speaking, in democratic countries a strong state strategy in policy areas with a high potential of social conflicts (and private transport is such an area) has low prospects of success.

II.2.5 Coherence of Resources with Scope and Strategy

In this section a synopsis is presented of the dimensions used to characterise the case study programmes.

The basic hypothesis of this chapter is that the ambitions of a programme (which can be described by scope and the intensity of stretch in the strategy) should be coherent with the given resources (namely time and financial budget). Given the considerations of section II.2.4, we would hypothesise that for the most ambitious programmes the state will be dependent on additional resources of other stakeholders.

Table II.8 combines the two dimensions defining the ambition of a programme:

- intensity of stretch: the intensity of the intended technological and contextual stretch and
- intensity of scope: the technological and geographical scope.

The higher the intended stretch and the scope of a programme the more ambitious is it. In other words: The ambition of the programme is growing from the lower left to the upper right cells of the table.

Geographical and technological scope	intensity of stretch		
	Type I (fit-fit)	Typ II (stretch-fit)	Type III (stretch-stretch)
nation-wide	I-LEG, J-TAX,, J-LOAN, NL-RATIO, NL-SSZ	J-SUB, NL-DEMO, UK-PowerShif, US-CleanCities	
national-focused		(D-Prokom), (A-Breit)	
local-wide			J-Carshare, S-ZEUS
local focused		USA-ENVVEST, USA-FleetEV. (FIN-Mobil)	A-Tourism, F-PRAXI, CH-CityCar, CH-Mendrisio, J-EV-Share, S-ETOUR

Table II.8 - Scope and stretch-intensity of programmes

To simplify interpretation, we only consider the difference between national and local scope. This results in 6 types with ascending ambition from type A to F.

As Table II.7 shows, we do not have the most ambitious (Type F = technological stretch, and nation wide) and the least ambitious (Type A = fit-fit strategy and locally focused) type of programme in our sample. Striking is the high proportion of locally focused programmes with intense stretch (type E).

Now we need a criterion to evaluate whether the concepts of the programmes are coherent with the resources (time and money). It is quite obvious that the higher programme ambitions are, the more important are the resources needed in term of time and money. Figure II.3 illustrates this concept and can be interpreted as a model for the coherence of scope, strategy (intensity of stretch) and resources (time and finance). Each circle shows the optimal combination of time and finances for each type of programme.

There is also the assumption behind this graph that the growing intensity of stretch needs time above all (for example type C programmes) – whereas a wide scope is especially demanding concerning financial resources (for example D programmes). In other words, figure II.3 is the yardstick for a conceptual evaluation of programmes.

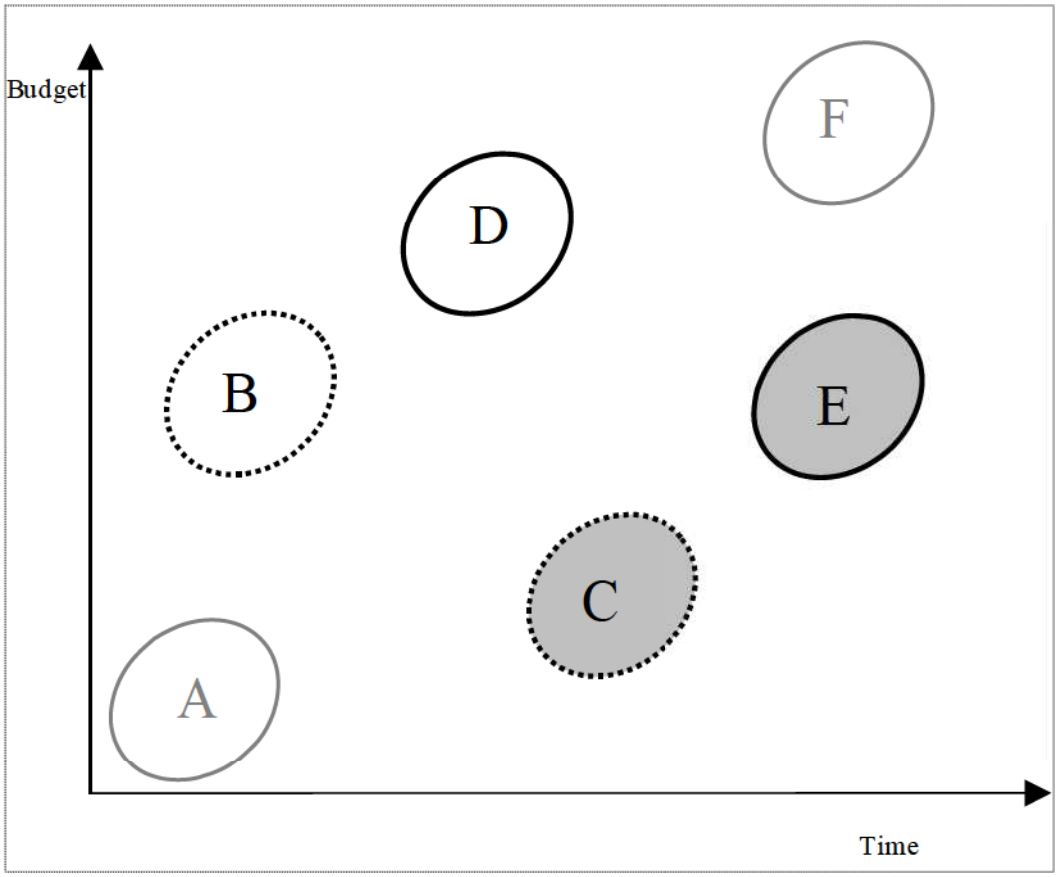

Figure II.3 - Model for coherence of programme strategy, scope and resources

Figure II.4 superimposes the model of figure II.3 with the empirical reality of the programmes under study (given in Table II.2). The resulting picture is certainly distorted[20], but still instructive as a starting point for discussion. The absolute positions in the time scale are not based on an exact scientific method. At this point of the discussion however, the absolute position is less important

[20] For instance. the differences in budget are not weighted regarding the different size of vehicle markets on the national level.

than the relative position of different types. The main statement is that a stretch-stretch-programme needs a long execution time – whether exactly 14 years is arbitrary. We had the execution time of some programmes in mind and took this into the picture[21]. On the whole, the result shows a huge gap between model and real world.

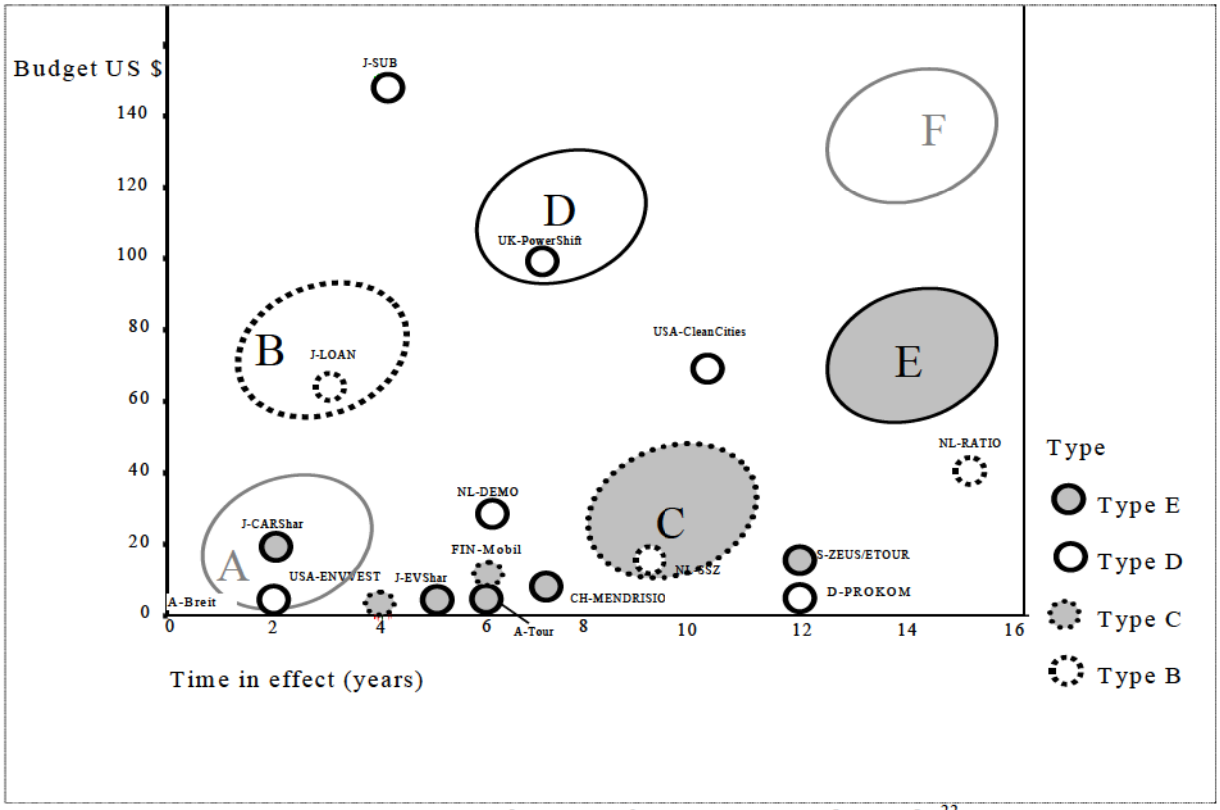

Figure II.4 - Coherence of programmes under study [22]

The main results from Figure II.4 are the following four points:

- *Type E programmes*: This type shows the most striking deviation. Given their ambitious stretch-stretch strategy, finances and especially time seem to be too scarce for success.
- *Regarding Type D*, the UK-Powershift and the US-CleanCities Programme are in the area of the ideal model position. The Japanese *J-SUB* programme however is too shortly timed[23] and in tendency over-financed, whereas the Dutch DEMO Programme is rather under-financed given the rather ambitious goals.
- The *US-ENVVEST*-Programme, the only *C-Type programme* with available budget information, seems to be too shortly timed.
- With the exception of the Japanese *J-Loan* Programme, type B programmes (*NL-Ratio*, *NL-SSZ*) seem to be over-timed.

This purely conceptual evaluation of programmes has to be confirmed by actual data. In the next sections we will present some results regarding programme effects and their evaluation. In spite of the lack of consistent and comprehensive data (e.g. *I-Leg*, *D-Prokom*, *J-SUB*) for most of the

[21] There are of course several arguments for a longer time needed for effective stretch-stretch programmes. If we assume a longer time needed for effective stretch-stretch-programmes, the result of the evaluation would be even worse.

[22] Due to lacking or unclear information regarding time in effect and/or budget, five programmes (CH-City-Car, F-PRAXI, I-LEG, J-TAX, US-FleetEV) are not present in the graph. The S-ETOUR and the S-ZEUS programme are part of a long term policy of the local authorities of Stockholm. Therefore their are merged in the table.

[23] It is possible however, that this programme will be prolonged

programmes we will see that the conceptual evaluation corresponds to the results of the evaluation of effects.

II.2.6 Goal Attainment: Self-evaluation by Programme Managers

In this section the effectiveness of the programmes under study is evaluated, according to the answers in the questionnaires. In some cases only an approximative evaluation of programme results could be made by an analysis of the official programme documents.

programme	technology improvement	behavioural change	environmental quality	other
A-Breit	-	-	-	-
A-Tourism	-	●●●	●●●	intermediate results: positive effects on tourism (image, EVs as attraction)
CH-CityCar	●●●	●●	●	extension of the model planned, but with conventional vehicle technology!
CH-MENDRISIO	●●	●●	●	
D-PROKOM	-	-	-	
FIN-MOBIL	●●●●	-	●●	
F-PRAXI	-	-	-	
I-LEG	-	-	●	
J-TAX	-	●	●●	
J-LOAN	-	-	-	
J-SUB	-	●	●	probably high windfall-effects
J-CARShar	●●●	●	-	
J-EVShar	●●●	●	-	
NL-DEMO	-	●●	●●	approximative evaluation by Interface
NL-RATIO	●●●	●●●	●●●	better evaluation of research projects than for deployment measures (e.g. low effect of tax reductions)
NL-SSZ	●●●	-	●●●	
S-ETOUR	-	-	-	
S-ZEUS	●●●	●●●	●●●●	
UK-PowerShift	●●●	●●●●	●●●●	success with LPG and hybrid, limited with natural gas and EV
USA-CleanCities	-	-	-	substantial objectives were set only in 2000
USA-ENVVEST		●●●●	●●●●	approximative evaluation by Interface
USA-FleetEV	-	●●●	-	

Table II.9 - Goal attainment self evaluation (rows in grey are approximative evaluations by Interface, ● low attainment ●● rather low attainment ●●● rather high attainment ●●●● high attainment)

The answers concerned the results (in terms of goal attainment) regarding technology improvement (e.g. demonstration of technological reliability), behavioural change (use of clean vehicles instead of ICE-vehicles by target groups), environmental quality (e.g. better air quality due to ICE-replacement by clean vehicles). As Table II.9 shows, the overall level of goal attainment is reported to be rather high. This is not a surprise, because in a self evaluation there is always a positive bias. In the present study, this problem seems to be accentuated by the following points:

- Several programmes lack clear objectives which could serve as criteria for evaluations. This means that experts evaluating the goal attainment have to refer to goals that are set in the course or even after the completion of a programme. They will refer to what could be called "reasonable or feasible goals", not always corresponding to the ambitious general and vague goals formulated at the programme start. We cannot exclude some ex-post window-dressing in this context.

- There are only few evaluations in the sense of proper policy evaluations. Evaluations are often designed in a very technical way, evaluating the technical function and reliability of clean vehicles and in some cases also user acceptance. There is a lack of integration and interpretations of the existing experiences in the light of a large scale market introduction of clean vehicles. When some of these evaluations were done, they were hardly based on reliable/empirically proven figures and they had a strong taste of wishful thinking.
- The questionnaire asked for goal attainment, where "goal" is defined as some higher societal objective that depends on many other factors in addition to the programme outcome. It should be borne in mind that the contribution of programmes to goal attainment is hard to assess (and according to our impression from programme documents and corresponding evaluations is rarely done). Given the lack of reliable objective data, there is a considerable margin for subjective interpretation.

Given these problems, we present an additional approach to evaluation in the next section.

II.2.7 Goal Attainment: Evaluation Based on Actual Output and Impact-Data

In addition to the self-evaluation, the programmes have been compared according to their quantitative effect. For this evaluation, the goals and the number of cars in the project were compared. The aim was not to rank the programmes. What is important is the comparison within the programmes between the goals and the number of vehicles. From a programme with high goals in the environmental area high impacts are expected and vice-versa. It is obvious that such a comparison is not to be taken too literally, and it may imply considerable distortions. Even taking such distortions into account, the following table highlights the core problem of most of the programmes under study: their lack of significant effects regarding clean vehicle and fuels-deployment.

programme	goals	vehicle
A-Breit	investigation of reasons to buy EV, satisfaction, usage, mobility patterns	112
A-Tourism	ecological tourism by substituting ICE travelling	65 (including 10 bicycles)
CH-MENDRISIO	demonstrate potential of everyday EV-use, test measures for large scale introduction of EVs	396 (including bicycles and scooters)
D-PROKOM	to test EVs in everyday use	55
FIN-MOBIL	to investigate how goods and people can be transported in Finnish conditions with the lowest possible consumption of energy and low emissions	10 (LPG Buses)
J-TAX	Promotion of the use of "low emission vehicles", substitution of older cars, reduction of emissions	not available
J-SUB	among other: promote mass introduction of "low emission vehicles"	24'345
J-CARShar	testing car-sharing system, overcome traffic jam and parking lots	35
J-EVShar	testing of free EV-Share system 200'000 EV and 1'800'000 HEV in 2010	143
NL-DEMO	set up demonstration projects overcome market barriers for introduction of clean vehicles	2000
NL-RATIO	reducing noise, energy consumption and emissions of vehicles in urban areas	not available
S-ZEUS	to demonstrate that cities can play a role in overcoming market obstacles for a wide introduction of clean vehicles	650
UK-PowerShift	to develop a sustainable market for cleaner fuel vehicles in the UK	> 10000
USA-CleanCities	to reduce emissions, improve air quality an to create economic opportunities through the voluntary use of alternative fuel vehicles	170'000
USA-ENVVEST	reduction of emissions, increase number of alternative fuel vehicles within fleet of Air Force Base	25

Table II.10 - Stated goals in comparison to effects in terms of the number of clean vehicles that were introduced

(For seven programmes (CH-CityCar, I-LEG, F-Praxi, J-LOAN, S-ETOUR, USA-FleetEV, NL-SSZ), we have no output- and impact-data, therefore, the programmes are not displayed in the table)

Table II.10 shows that the self-evaluation presented in Table II.9 is rather optimistic (or based on rather low quantitative goals). This confirms our impression during the data-collection. In those cases where additional and specific questions were posed, the evaluation of the programme managers was much more critical than in the overall assessment of the questionnaire.

If we take the results from Table II.10 into account we come to the following conclusions.

- The effects measured in numbers of cars are of a minor scale in most of the projects. In some cases they are in a sharp contrast to the very ambitious goals as stated in the que-stionnaires and/or official documents.
- Even the few programmes with considerable effects in absolute numbers cannot yet make the claim that clean vehicles have captured a significant share in the general vehicle market. The number of 170'000 clean vehicles introduced on the market over several years by the CleanCities Program in the United States may seem impressive at first glance. However, it seems marginal when compared to the 380'000 new cars that are sold in little Switzerland every year!
- As already mentioned, many programmes have a strong P+D-character. In our understanding the rationale of a P+D-programme is to **D**emonstrate the benefits of new technologies to the public and to trigger a demand for such vehicles in the market. The accent of the P+D-programmes analysed however is rather on the **P** (Pilot) or even research and development of new technologies, still far from marketability for the mass market. One could ask whether the label P+D is used to ease the search for public funds to finance research programmes[24].
- To put it bluntly: None of the programmes under study can claim to serve as a model case for large-scale clean vehicle deployment or market introduction. At best they are preparatory steps in this direction[25].

II.2.8 Goal Attainment: Results in a Broad Context of Environmental and Transport Policy

In general, we have a big gap between self-evaluation and quantitative effects. When we look at the big picture of energy and environmental policy, we see that the programmes for clean vehicles tackle only a small area which is quantitatively not relevant for the transport field. This means that the programmes for clean vehicles do not contribute much to solve the CO_2-problem. From this point of view there is no success of the public policy. Sometimes it is argued that most of the programmes are P+D oriented and the goal is not to reach quantitative targets. This may be true. But what we observed on the levels of the goals is that most of the programmes are legitimated by their (potential) contribution to the reduction of harmful emissions.

Generally speaking, despite proclaimed policy goals and a substantial number of corresponding programmes in the last two decades, the deployment of clean vehicles is somewhat disappointing. As a recent statement made in a report from the ZEUS-Project of the European Union on

[24] In this point we see a strong resemblance to earlier P+D-programmes of the Swiss Government to promote the use (not the technology development for the use) of alternative energy (see Zimmermann, W.: Evaluation der Förderung von Pilot- und Demonstrationsanlagen im Energiebereich, Bundesamt für Energiewirtschaft, Bern, 1995.)

[25] The standard argument against this view (programmes have failed) is that the most important effects will come in the future. This may be the case. But we have some programmes in the sample with a starting point at the beginning of the 90ies. And these programmes also show small effects. From other evaluations we know that high effects after termination of programmes were very rare. In other words, if a programme has little success during its lifetime, you need very good arguments to assume that the main effect will follow in the future. We know from the energy field that the effects will decrease in most of the cases after programmes have been finished. In the programmes under study we found no clear evidence for a (potential) increase of beneficiary programme effects in the future.

"National Incentives and Barriers to Clean Mobility" (2000) puts it: "Overall, the use of alternative fuels (with the exception of LPG in a few countries) is still in its infancy".

Special attention should be paid to the fact that many activities of the state which are not intended to influence transport and traffic behaviour are crucial for the (non-)deployment of clean vehicles (i.e. activities that are not programmes or projects in the sense of this study and are labelled as framework conditions). There seems to be a lot of unintended but effective steering in the area of fuel taxation (e.g. introduction of higher taxes for fiscal reasons with positive effects on clean vehicles) and also in measures indirectly influencing the use context (e.g. regional planning, which is influencing the demand for mobility).

Very telling in this respect are the LPG-experiences. Italy and the Netherlands[26] provide the only examples for an extensive commercially viable introduction of alternative fuels. The major point or lesson of this success story is the absence of any active policy to promote this technology (no awareness or advertising campaigns, no special support through public subsidy or pilot project!)[27].

II.3 Conclusions and Recommendations

The synthesis is structured in the order of the policy cycle, beginning with the programme concepts, followed by the implementation process, the identified impacts and the role of evaluation. Recommendations for a network approach are added that in our opinion could serve to re-focus existing government strategies to prepare and further the market introduction of clean vehicles and make them more effective and viable.

II.3.1 Conclusions

Programme Concept: State centred governance model

Regarding the design of programmes to promote the introduction of clean vehicles and fuels on the mass market, we observe a dominance of models relying on a strong government, having financial and technical resources as well as the know-how to actively steer this development (steering-state-model). This view seems to be deeply anchored with programme managers and proponents of clean vehicles. The scope of policy instruments is accordingly rather traditional: Direct state regulations and financial incentives are dominant. Networking and persuasion are mostly if at all seen as a complementary measure.

Programme Concept: Lack of focus on market-introduction

In many programmes very ambitious goals were formulated: The programmes should provide an important contribution to reduce the CO_2-emissions. Contrary to this goal, only comparatively few examples of programmes aim at the (preparation of the) market introduction of clean vehicles.

[26] After reaching a substantial proportion of the total number of operating vehicles, the number and proportion of LPG-vehicles in the Netherlands was declining steadily after a change in the tax regime (which was not intended to harm AFV). However, these changes were small and 'creeped in' during the years, meaning that the financial incentives for LPG cars became smaller and smaller. One other reason was that because of increasingly stringent emission *legislation*, the LPG fuel systems became technically more complicated and therefore they became more expensive. Because the governmental incentives for LPG cars did not increase at the same pace, the annual mileage for which it was financially attractive to use LPG steadily increased.

[27] Fuel costs, however, are approximately 50% lower than for petrol due to lower taxation. The interest of the industry to supply LPG for a mass market was a key success factor for the introduction of LPG. Presently in Italy some incentives have been provided to convert old vehicles to LPG, as from the beginning of 2002 no more leaded gasoline is available.

Fleet tests and P+D-projects are far more widespread than projects that give priority to the market introduction.

In our understanding the rationale of a P+D-programme is to test technologically marketable and reliable **P**ilot applications and to **D**emonstrate the benefits of new technologies to the public and to trigger a demand for such vehicles in the market. The main focus of the P+D-programmes analysed however is rather R+D (research and development) of new technologies, still far from marketability for the mass market. Many of the programmes under study give the impression, that research was declared as P+D to get acceptance and money from the authorities.

Existing programmes do not always seem to be focused on adequate technologies – i.e. technologies that have proven to be marketable (with respect to the technology). This probably is only the case for "fit-fit"-technologies like LPG that need only minor changes in both, behavioural adaptation to the technology and to the use context (see footnote 2).

Self-evaluation by programme-managers

With the help of a questionnaire, the programme managers were asked for an estimation of goal-attainment in the three dimensions technology improvement, behavioural change and environmental quality.

From the point of view of the programme managers, the goal attainment in the dimension of technical improvement is very high. In the two other dimensions the positive and negative appraisals are more or less equal. The self evaluation is problematic and in general too optimistic because of several reasons:

- Several programmes lack clear objectives which could serve as criteria for evaluations. Therefore, some ex-post window-dressing can not be excluded by the method of self-evaluation.
- There are only few evaluations in the sense of proper policy evaluations. Evaluations are often designed in a very technical way, evaluating the technical function and reliability of vehicles. Changes in behaviour are often not evaluated.
- The questionnaire asked for goal attainment. It should be borne in mind that the contribution of programmes to goal attainment is hard to assess. Given the lack of reliable objective data, there is a considerable margin for subjective interpretation.

Given these problems, an additional approach, based on the number of vehicles, can be taken:

Evaluation based on actual output and impact-data

The most striking fact is the widespread failure of government measures to promote the market introduction of clean vehicles and fuels. There is hardly an example, where the mass market has been tackled successfully and clean vehicles represent a significant proportion of all vehicles. Even Demonstration Projects on the local level with very substantial subsidies per vehicle did not result in the anticipated degree of (local) market penetration (e.g. the Mendrisio project in Switzerland, and in Japan even free-of-charge car-sharing projects failed). The results indicate that in many cases the technology is not marketable for the mass market or demands behavioural changes that are not accepted by potential users.

Impact: Disappointing impact of financial incentives

The impacts of financial incentives (general subsidies and/or tax exemptions for vehicles and/or fuels) in many cases seem somewhat disappointing and rarely reach the level anticipated before the programme implementation. In some cases the incentives are far too weak (e.g. tax exemptions that come to a few $ a year are not significant compared with persisting differences in fuel, maintenance and vehicle costs of clean vehicles). In other cases, even with substantial subsidies (tax exemptions on fuel, subsidies to lower clean vehicle prices to the level of conventional vehicles) impacts are below expectations. The case of LPG even shows the limits of this instrument: The financial incentive (higher tax exemption) for the use of LPG-vehicles is substantially higher in Germany than in Italy – LPG-vehicles are far more widespread in Italy however. The cases under study show clearly that financial incentives are (1) very expensive and (2) not a stand-alone instrument to promote the market introduction of clean vehicles. In other words, financial incentives are sometimes a necessary precondition for success but not a guarantee.

On the basis of these results, subsidies should only be recommended to support the market introduction of a marketable technology with a potentially high acceptance on the market (for example "natural gas" which corresponds to the fit-fit-strategy). The goal of such a subsidy is to trigger the breakthrough of an already existing technology with proven acceptance by significant user groups (e.g. in market research or P+D-projects) and not to improve the technology or to evoke a non existing acceptance. General subsidies in the P+D–stage for cars with low acceptance is too an expensive instrument and has low effects. This does not mean that financial support for P+D does not make sense at all. It depends on the goals behind it. It is reasonable for the government to give financial support to improve the technology or to test the acceptance of a technology in a well focused P+D-project. But it makes no sense to support P+D-projects with general subsidies to stimulate a market pull and a market introduction, when the technology is not marketable or not accepted. Exactly this was the case in some projects.

Subsidies, in addition, have to take the running costs of vehicles into account. In many cases, only the price of the vehicle was lowered. But the consumer takes the whole cost into account and also the availability of services and filling-stations. Only if the running costs of a new technology are acceptable for the consumer, do we recommend subsidies to support the market introduction of clean vehicles.

Subsidies on the fuel are very costly. This is underestimated in many programmes because the subsidies have the form of a lower tax on the fuels. If subsidies are part of a programme, there is a need for a plan to reduce them over time and to cancel the subsidies after a certain period. Consequently, subsidies are an appropriate instrument if there is a chance that the supported technology becomes self–sufficient in the future.

Evaluation: Lack of clear goals, independent third party evaluation and deployment policy orientation

Given the considerable amounts invested in programmes to foster the market introduction of clean vehicles and fuels the lack of independent policy-oriented evaluations open to the public is striking. This lack of programme evaluation contrasts sharply with the very sophisticated technical evaluations (function/reliability of clean vehicles) in some projects. In some cases, the available evaluations or projects reports tend to present rather poor results as a big success. This may be encouraged by the lack of clear objectives, which could serve as criteria for evaluations. There is a danger of ex-post window-dressing in this context (ex-post tuning of goals towards actual results). We can not exclude that some existing evaluations have escaped our attention – but the fact that even the national experts of the Annex were not able to identify programme evaluations or to

report their results, is very telling regarding the status and utilisation of evaluations. We feel that more systematic, policy oriented programme evaluations would contribute significantly to a better design of future policies and programmes (and vice versa).

Evaluation in a broad context of environmental and transport policy

In general, we noticed a gap between self-evaluation and quantitative effects. When we look at the big picture of energy and environmental policy, we see that the programmes for clean vehicles tackle only a small area that is quantitatively not significant for the transport field. In other words, the programmes for clean vehicles do not provide a remarkable contribution to solve environmental problems (e.g. the CO_2-problem). From this point of view, there is no public policy success. Sometimes it is argued that most of the programmes are P+D oriented and are not aimed at reaching quantitative goals. This may be true. However we observed that, on the levels of the goals, most of the programmes are legitimated by their (potential) contribution to the reduction of harmful emissions.

Generally speaking, despite the proclaimed policy goals and a substantial number of corresponding programmes in the last two decades, the deployment of clean vehicles is somewhat disappointing. As a recent statement made in a report from the ZEUS-Project of the European Union on "National Incentives and Barriers to Clean Mobility" (2000) puts it: "Overall, the use of alternative fuels (with the exception of LPG in a few countries) is still in its infancy".

Special attention should be paid to the fact that many state activities which are not intended to influence transport and traffic behaviour are crucial for the (non-)deployment of clean vehicles (i.e. activities that are not programmes or projects in the sense of this study and are labelled as framework conditions). There seems to be a lot of unintended but effective steering in the area of fuel taxation and also in measures indirectly influencing the use context (e.g. regional planning which is influencing the demand for mobility).

As a general conclusion, none of the programmes under study can claim to serve as a model for large-scale clean vehicle deployment or market-introduction. At best they are pre-preparatory steps in this direction. Perhaps some of the programmes have a symbolic character: The government shows that it is aware of the problem. A symbolic policy is not generally good or bad. It depends on the framework. Sometimes, a symbol is the only instrument of the government when other instruments are not available. But it is necessary that symbols are followed by concrete programmes or measures. If not, the positive effects of symbols turn into the opposite: The public policy loses credibility.

II.3.2 Recommendation: Priority to Network Management

We doubt that models relying on a high steering capacity of the state (and a given "steerability" of other actors involved) are adequate in a vehicle market dominated by a few big players (vehicle manufacturers, fuel suppliers). The size of the transport-market may illustrate this: In Switzerland, in 1995 10 Billion Dollars were spent for private transport (running costs and purchase prices for vehicles)[28]. This is 40 % of the government spending (central government) in the same year. It is obvious that the government is not able to steer this market with its financial instruments. There is no money available for enough subsidies nor is it possible to introduce adequate prices for transport (lack of political acceptance). We do not advocate, however, the (normative) postulate of a "minimal state" leaving the development to the free interplay of market forces. Most probably the field under study is a typical case where the model of a moderating or co-operative state is the most adequate approach given the highly interdependent and complex nature of the problem.

[28] See Maibach et.al., 2000: Faire und effiziente Preise im Verkehr, Ansätze für eine verursachergerechte Verkehrspolitik in der Schweiz, National Research Programme Transport and Environment, Report D3, BBL/EDMZ Bern

Therefore, and based on the experiences gained to date, we come to the conclusion that governments should follow an approach based on the following considerations:

Recommendations

1. Give priority to network management as an instrument to prepare the market introduction of clean vehicles

i.e. inclusion of manufacturers, local dealers and fuel suppliers in a network to come to a common and economically viable strategy that favours the introduction of clean vehicles into the mass market. This strategy may seem to be too time-consuming and modest regarding the goals. We still prefer it to expensive approaches with ambitious short-term goals that (as the experience of the projects analysed in this paper shows very clearly) will most probably fail to accelerate the market introduction of clean vehicles to a substantial degree. To put it very bluntly: Massive programmes without significant effects are more of a waste of time than the comparatively cheap network approaches with the potential of large-scale effects.

2. To support the network-management, an appropriate framework is needed.

The national environmental policy is such a framework for deployment strategies for clean vehicles and fuels. An important element in this context are emission standards for vehicles with traditional fuels (diesel, gasoline). This is a signal for the different groups of actors of the car industry and gives an impulse to enter a discussion with the government to introduce alternative vehicles and fuels. Standards have the main advantage that they are independent of a certain technology. The government does not to have to decide which technology is the best. This is the decision of the market players. To give additional support to the market introduction of clean vehicles the government may fix limits on the total of emissions for certain vehicle categories. This strategy is practised in California.

3. Financial incentives can play an important but only complementary role to standards and network management.

Financial support for P+D-projects is useful to adapt technology and/or test market acceptance. General subsidies for a vehicle or a kind of fuel (tax reductions) are only useful if

- used in combination with network management and standards,
- the technology is marketable and has a high potential of market acceptance,
- subsidies are limited to a certain period and/or are bound to a certain degree of market penetration of corresponding clean vehicle types. Flexible bonus-malus-models seem to be an adequate instrument in this respect.

4. Focus deployment strategies, especially direct market intervention, to marketable technologies that need no or little change in user behaviour (fit-fit-technologies like LPG). Perhaps electric two-wheelers are such a technology.

5. Programmes should be evaluated, at least at the end. An ongoing evaluation of the programmes that provides elements to improve follow-up programmes is even better.

It is the lack of reliable data which made it very difficult to compare the programmes under study. Especially the substitution-effects of new technologies were of high importance. In the framework of an environmental policy only technologies with a substitution-effect for vehicles run on fossil fuel make sense.

II.4 Open Questions

International co-operation in the field of measures for clean vehicles is an urgent necessity. Especially in Europe different national standards (emissions, security etc.), taxes and programmes change the framework conditions from country to country. This makes it difficult for new technologies, because the costs of market introduction are high. The EU has established a common standard for the emissions of traditional cars. But this is only a small step to improve the international framework for clean vehicles and fuels.

A second question is the transnational exchange of experiences regarding deployment strategies for clean vehicles. Although general information on programmes is well diffused among programme-managers, details especially on failures and mistakes of programme-implementation are rarely communicated. But in many cases the analysis of failures is the best preparation for the creation of new and better programmes. Such a platform for the exchange of know-how among programme-managers is desirable.

III Stakeholders and City Administrators

Tommy Månsson

III.1 Objectives and Methods

III.1.1 Objectives

The objectives for this Sub-task III "Stakeholders and City Administrators" is to

- define the role of fuel/energy providers and interested stakeholders
- define the role of city administrators
- elaborate recommendations for stakeholders

III.1.2 Selection of Case Studies

The report is based on an analysis of a number of selected case studies. The case studies have been selected in order to meet the following criteria:

- good coverage of a large variety of local measures to support introduction of hybrid, electric and alternative fuel vehicles.
- good coverage of projects involving as many kinds of stakeholders as possible.
- coverage of most kinds of fuels and vehicles.
- coverage of all participating member countries.

The selection of the case studies was made in a two-step procedure with a final choice of 23 projects (see table III.1).

PROGRAMME	LEADING STAKEHOLDER (Project owner)	OTHER STAKEHOLDERS INVOLVED
A-LPGBus	City of Vienna, Public Bus company	Fuel provider Passengers Drivers Bus manufacturer
A-EVVienna	City of Vienna	EV owners EV manufacturers Electric utility
FIN-EVDPost	Finland Post	City of Turku and Kajaani EV owners service company (PT-Automotive Services Ltd) Electric company (Fortum Power and Heat) EV car manufacturer (Elcat)
FIN-ZEUS	Helsinki City Transport	Fuel provider Passengers Drivers Bus manufacturer
F-PRAXI	Public transport company	EDF (electric company) CGFTE Car manufacturers (Renault) Vehicle supporting industry(Dassult Electricity) Users/Passengers
I-ProMOT	The City of Rome	EV car owners EV car manufacturers Electric utility
S-ZEUS	City of Stockholm	Public Transport Company (SL) Electric company (Birka Energi) Water utility (Stockholm Water) Waste Management Company Passengers/Drivers/ Owners Vehicle manufacturers Fuel companies
S-SLBus	Public Transport Company (SL)	Bus manufacturer (Scania) Fuel provider (Sekab) Hybrid technology (Thorab) Passengers/Drivers

PROGRAMME	LEADING STAKEHOLDER (Project owner)	OTHER STAKEHOLDERS INVOLVED
S-SKÅNE	City of Malmö	Electric company (Sydkraft) Other cities in the county Car manufacturers Car owners and users
S-FFVProcurement	Swedish FFV Buyers Consortium	City of Stockholm and 5 other Swedish cities Farmers Association (LRF) Counties Insurance company (Länsförsäkringar)
S-FFVLeasing	Swedish Bioalcohol Fuel Foundation (BAFF)	Car manufacturer (Local Ford dealer) Fuel company (OK) Car users
S-PROC	The Swedish Electric/Hybrid Car Consortium (SEHCC)	City of Stockholm (MFO) and 20 other Swedish cities A number of counties, authorities and private companies Car users Electric utilities
CH-EasyMove	Swiss Rail	Municipality of Mendrisio and 4 other municipalities Car manufacturers Car owners and users Electric company
CH-MENDRISIO	Swiss Federal Office of Energy	Municipality of Mendrisio Car manufacturers Car owners and users Electric company
CH-CityCar	Swiss Post	Municipality of Martigny Car manufacturers Car owners and users Electric company Federal Office Forum de l´Air Valais (NGO)
USA-SCE	Southern California Edison (electric utility)	Car manufacturers (about 10 companies) Car owners and users Battery industry (Advanced Lead Acid Battery Consortium) Environmental Authorities (California Air Resources Board, CARB, and Southern California Air Quality Management District) Municipalities
USA-EVLoan	Potomac Electric Power Company, PEPCO (electric utility)	Car manufacturer (Ford) Car owners and users Federal governments
USA-CleanCities	Department of Energy (DOE)	About 80 cities Car manufacturers Fuel providers Car owners and users National Clean Cities Inc. (NGO)
D-ProKom	RWE Energie (electric utility)	Municipalities Car manufacturers Car owners and users
NL-Bio-E	GADO Bus company and OBL – Agriculture industry	Bus manufacturer (Mercedes Benz) Fuel producer (Nedalco – sugarbeets) Farmers Drivers and passengers
J-Kyoto	Japan Electric Vehicle Association	City of Kyoto Research Institute for SATEKIKA Car manufacturers Car users NEDO
NL-LPG	BK-Gas (gas provider)	Car owners (driving schools, taxis, police) Car manufacturers Drivers
A-Tourism	Ministry of Agriculture,Forestry and Water Management Ministry of Transport, Innovation and Technology Ministry of Economics&Labour	Province of Salzburg Municipality of Bad Hofgastein Municipality of Werfenweng European Union (Car manufacturers) Car owners and users Tourism industry

Table III.1 – Participation of stakeholders in the case studies

III.1.3 Methods Used for the Analysis

General information about the case studies was provided through the questionnaires collected in common for all sub-tasks. However, as the questionnaires did not answer all the questions raised in this sub-task, additional information had to be collected as well. This additional information are mainly written project reports, programme evaluations (where sometimes the case studies are just one among many other projects in the relevant country), and to some limited extent direct contacts with involved people.

III.2 Defining the Roles of Major Stakeholders

As illustrated in Figure III.1 and Table III.1, there are many different stakeholders involved in the process of getting new vehicles and fuels into the market. All of them play different roles, and depending on a number of factors as historical background, market situation, environmental awareness, consumer demands etc., they will act differently, some being active and some passive or even counteractive. Based on an analysis of the case studies, a presentation of the roles and position taken by various stakeholders is given.

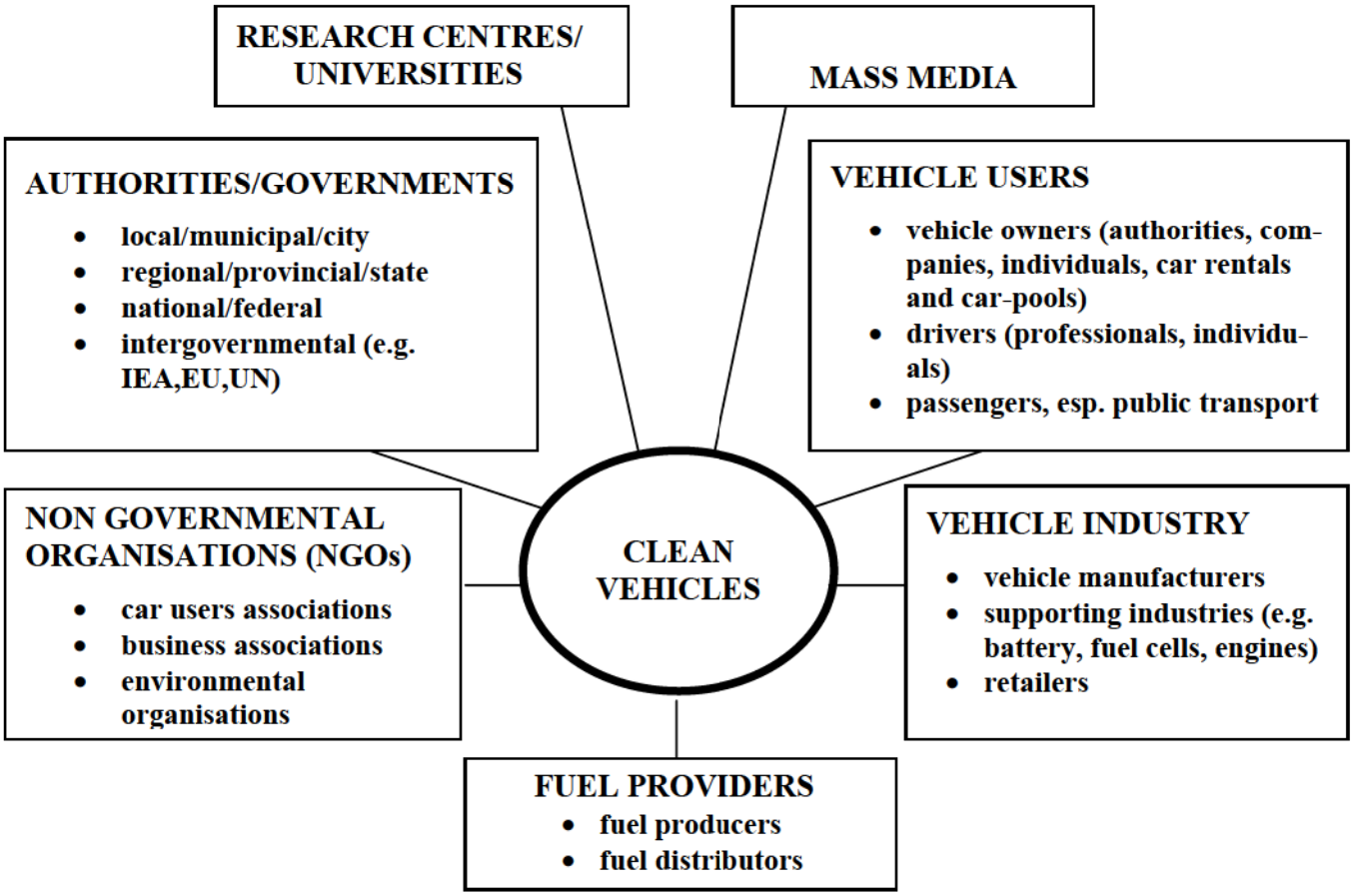

Figure III.1 - The major stakeholders who influence the promotion of clean vehicles

III.2.1 Government Authorities

Naturally, a central role is played by the national government that is responsible for most of the legislation and taxation, and also for funding R&D. For example, in most of the analysed case

studies the central government has provided funding of the programmes. However, as the government support and regulations are studied in detail in Part II, the role of the government will not be elaborated in detail in this sub-task. Due to the lack of enough information about the case studies, it has also not been possible in all cases to fully separate funding and other measures and between different authority levels (central-regional/ county-local).

The various countries participating in this evaluation study also show big differences in roles and responsibilities on the various governmental levels. While the Scandinavian countries are the most decentralised ones with very strong reliance on the municipalities, Japan and also the USA are more dependent on initiatives and support from central government. Therefore you may not see many initiatives in e.g. Sweden where a regional body has been active, while you may find such examples in other European countries.

Stakeholder	***What is at stake which***	
	supports cleaner fuels and vehicles	***combats cleaner fuels and vehicles***
Central government	Environmental concern (esp. global warming) International oil crises/price increase New markets for domestic fuel and vehicle industry	Economic/fiscal concern (e.g. taxes) Concern for traditional national industries International agreements (e.g EU, WTO)
Local government	Environmental concern (esp. local air pollution) New markets and new jobs for locally produced fuels	Economic concern Concern for local traditional business
Fuel providers	Falling prices for crops (which have a potential to be used as fuel) New markets and new jobs for locally produced fuels Environmental image (prestige)	High investments/Economic risks International trade rules
Vehicle industry	Front runners may be winners in the long run Environmental image (prestige)	Investments already made in old technology Economic risks
Vehicle users	Environmental concern	Private economy, trends, access to service

Table III.2 - Examples of factors supporting versus combating the major stakeholders willingness to influence the promotion of clean vehicles

Local authorities (cities, municipalities), in their roles as large fleet owners, legislators and facilitators for creating a good local environment, have unique possibilities to be front runners for promoting clean vehicles. Among the analysed case studies there are many good examples where local authorities around the globe of different size (e.g. cities like *Helsinki, Kyoto, Mendrisio, Springfield*[29]*, Stockholm, Vienna*) have taken a leading role by demonstrating and addressing new fuels and vehicles not only in their own fleets but also by giving opportunities for various local stakeholders to test these new kinds of vehicles. In order to be successful, the local authorities have complemented the technical demonstrations by introducing a number of various local supporting measures (e.g. free parking, access to bus lanes, environ-mental zoning, local transport advisors). This will be further analysed in chapter III.3.

[29] Springfield is one of the 80 cities participating in the US Clean City Programme

III.2.2 Fuel Providers

Traditionally, fuel providing companies for gasoline and diesel control the whole chain from well to wheel. However, for new fuels like ethanol, RME and biogas and also sometimes for LPG and CNG, the pattern is more complicated as more actors are involved as fuel producers and fuel distributors. For example, in the Swedish and Dutch case studies involving the use of ethanol, the raw materials are sugar beets (*NL-Bio-E*), grapes/wine (*S-SLBus*), wheat and cellulose (*S-FFVLeasing/Procurement*) which are produced by farmers, the processing is done by a special fuel processing company, and the fuel is then finally distributed and sold to other companies, which in the Swedish case also involve traditional oil companies.

Fuel providers like gas companies or ethanol producers who want to introduce a new fuel into a market, usually have to take an active role in promoting their fuels as this is connected with large investments in infrastructure. An interesting example comes from the Netherlands (*NL-LPG*) where already in 1954 the brothers *Veeneman* saw a business opportunity and started to introduce LPG for vehicle propulsion. The Veenemans started by leasing or loaning the vehicle fuel conversion kits to vehicle owners in order to overcome the barrier of investing in the fuel system. Often, fuels like LPG, CNG and ethanol have also, in an initial step, been introduced in cooperation with a large fleet owner such as a public bus company (e.g. *A-LPGBus, S-SLBus, FIN-ZEUS*).

However, it is not only depending on the fuel provider to introduce the new fuel. As the fuel market matures, they might face competition problems, e.g. tax will be raised on their fuels. A warning example is from an attempt to introduce LPG in Sweden where the market collapsed after the withdrawal of favourable taxation. However, in the Netherlands continued support for LPG led to mature the LPG market. This teaches us that creating a new vehicle fuel is one thing, but maintaining it also may require large efforts.

The electric utilities should be regarded as fuel providers for electric vehicles and in this function they have an interest in selling electricity. Many big utilities like *Southern California Edison* (*SCE*), *RWE-Germany (D-PROKOM)* and *Electricité de France (EDF*) have also been very active in promoting an increased use of electric vehicles, together with many other minor utilities. In many of the case studies, utilities have provided charging facilities and have sub-sidised the electricity. There are examples (e.g. *USA-EVLoan*) where utilities have actively invested in vehicles which have been leased (with strong subsidies) to potential users. The utilities have also been active in information and education campaigns in order to increase the interest for the use of electricity as a "fuel".

III.2.3 Vehicle Industry

So far, the vehicle industry has not played any dominant role in promoting new fuels and vehicles. In many of the case studies, the local authorities which have taken a lead in demonstrating new vehicles have had difficulties to get enough vehicle industries interested to procure vehicles as they do not find the market prepared or too marginal. For example: For introducing Flexible Fuel Vehicles in Sweden, only *Ford* was willing to offer such models *(S-FFVProcurement*). An exemption though is *Toyota*, who has actively started to introduce the *Prius* hybrid on the global market.

For heavy vehicles like buses, the market functions differently as this market segment is traditionally characterised by close contacts between vehicle industry and the fleet owners. Consequently, there are examples (e.g. *S-SLBus*) where a bus-maker, *Scania,* has developed new

bus generations (ethanol-, battery-, hybrid-, fuel-cell buses) during a long time period in close co-operation with a buyer, and then gradually introduced them into a larger global market.

A different industry strategy has been chosen by parts of the supplier industry, e.g. producers of batteries, fuel cells, charging stations, and by some smaller niche market companies developing and producing battery cars (e.g. the Swiss company *Cree AG*). However, their strategy is obvious as their future is depending on an increased use of their products. As shown by the Norwegian company *TH!NK* now owned by Ford, the long-term future for this industry is very much in hands of the global vehicle industry.

When running demonstration projects, the negotiations between the buyers and the vehicle producers are generally made with the head office of a large automaker, but it is the local retailer who is given the responsibility for ongoing services and maintenance support. Buyers have complained that local service support is inadequate, and retailers complain that they are forced to support vehicles they do not profit from selling. The examined projects reflect both positive and negative experience in this aspect depending on the grade of involvement of the local retailer at the start of the project. For example, the *S-FFV-Procurement* programme had a much greater involvement of the local retailer (who probably also had an economic benefit in the procurement) while retailers in the *S-Skåne* project were less motivated and hence less supportive. For the FFV-project, the local retailer started by own interest to sell the FFV car as a standard car immediately after the first cars commissioned to the buyers consortium were delivered, and made an aggressive marketing for the new car.

III.2.4 Vehicle Users

Big fleet owners like public bus companies are one group of vehicle users which have taken initiatives for demonstrating new fuels and vehicles like LPG, CNG and ethanol-fuelled city buses (e.g. *A-LPGBus, FIN-ZEUS, S-SLBus*). The new situation due to deregulation of bus operators in some European countries, has led to a fragmentation of roles and responsi-bilities which in future might make it more difficult to manage these kinds of demonstration projects. This trend can also be seen in some of the cities being active in the European ZEUS-project. However, the example of the City of Stockholm shows that the outsourcing of the publicly owned department responsible for all city vehicles (including hundreds of biogas, ethanol and electric vehicles) to a private leasing company, so far has not affected its ambition to continue to promote a further greening of its vehicle fleet.

Other kinds of large vehicle users are the national post agencies which have been active in testing new kinds of vehicles (*FIN-EVDPost, CH-CityCar*). An interesting user segment emerges when a group of industries in the same sector, e.g. tourism, co-operates with local stakeholders (*A-Tourism*). Another group of users are electric utilities who, as part of their other efforts to promote electric vehicles, start to use them in their own fleets. Also leasing firms are an important users group. The Swiss project *EasyMove* is innovative in not only providing electric vehicles for leasing, but also linking this leasing offer to long distance travelling by train and by that looking at mobility as a whole. Similar approaches also involving the transport of goods are started in other countries (e.g. *F-PRAXI*).

In many of the analysed projects, ambitious work has been done in order to involve more user groups in the demonstration projects. Also surveys among users have been made. However, the conclusion in most cases is that it has resulted in transforming enthusiastic idealists into consumers with realistic expectations. Other studies about the behaviour of vehicle buyers indicate that consumers react positively to the opportunity to gain information from a variety of sources.

Providing information from e.g. a web page could be more cost effective than launching massive test drive or loaner programmes. However, in "the real world" newspaper articles and discussion with owners of e.g. electric vehicles can only be generated if these vehicles are running on the streets. If anything, this supports the notion that most buyers, when faced with new technology, will first seek to learn how others have experienced it before buying themselves. In Brazil, for example, this was one reason why an early effort to introduce ethanol was made in the taxi fleet, as taxi riders usually listen to the advice from taxi drivers.

Subtask-leader Tommy Månsson with his new Ford Focus FFV which most of the time is running on ethanol. The car deal was made possible through an initiative of the City of Stockholm (S-FFVProcurement) to introduce FFVs into the Swedish market. As the procurement included an option of buying 4'000 vehicles (split on various owners, private as well as public) the price was 500$ lower than that for a standard Ford Focus. After the consortium had made the deal with Ford, all contacts between the final car owners and Ford have been following those of a normal car deal with direct contacts with the local car dealer. The only car company responding positively on the procurement was Ford, probably due to the company's positive experiences in the USA where similar cars are already on the market due to the US-Clean Cities-Program.

III.2.5 Non Governmental Organisations (NGO)

A good example of how a Non Governmental Organisation (NGO) can actively promote the introduction of clean vehicles comes from Japan, where the *Japan Electric Vehicle Association* (*JEVA*) works together with other stakeholders in various local projects (e.g. *J-EV Sharing*). Another example is from Sweden where a stakeholder based NGO, *Bio-Alcohol Fuel Foundation (BAFF*) is actively initiating and supporting various local projects for intro-ducing ethanol. One example is its successful implementation of flexible-fuel vehicles (*S-FFVLease/ Procure*) which has encouraged Ford to introduce the first flexible-fuel vehicles on the Swedish market, and the oil companies to invest in new ethanol filling stations in a number of cities country-wide. E.g. in an

early stage, one oil company gave a promise that whenever there were at least 10 FFVs in a city, they would set up a filling station for E85[30].

There is also an example from the USA, where a large governmental demonstration programme unintentionally has resulted in starting a new NGO. This new NGO with an objective to support the introduction of clean vehicles, operates independently from the national project, has managed to involve many new stakeholders and hence supported the various cities in their efforts.

Other kinds of NGOs like *The Green Drivers* in Sweden and the *The American Council for an Energy-Efficient Economy* in USA also play important roles as they regularly compare and publish data about all new car models (including hybrid, electric and alternative fuel vehicles). The NGOs are also actively operating as lobby groups, in the same way as the vehicle industry has its lobby groups, pushing on various levels in order to give more favourable conditions (e.g. tax reductions) for the kinds of fuels and vehicles which are regarded as environmentally friendly.

III.2.6 Others

In most of the case studies, researchers from institutes and universities are involved. Their roles are varying from those being the driving forces to get e.g. a local municipality interested in investing in a big fleet demonstration, to those acting as independent advisors or those assessing the progress. A close cooperation between science and practical demonstrations are of course fruitful and a way of improving the quality of the projects, even though it is not always the case that a scientific report is a proof of a well done project.

The media play an important role as their messages usually have a strong impact on peoples' behaviour. In many of the projects, also the media contacts have been stimulated and in general given good press. However, as media is generally acting, there is a risk of over-focusing on problems rather than on possibilities. There is no short-cut to overcome this but to have an open and transparent information on the demonstration projects.

III.3 Local Measures to Support Clean Vehicles

The environmental problems caused by vehicles are concentrated and intensified in cities. At the same time, the majority of fleet vehicles are found in cities. Thus, it is natural that city authorities are actively involved in the development and market introduction of new vehicles, as well as in a number of other measures aiming at improving the local environment.

Local authorities can influence the efficiency of energy use for transport in a number of ways. In their capacities as vehicle owners, fleet operators, city planners, purchaser of transport services, employers, trainers and providers of information, local authorities and their employees are in a position to influence future energy and transport patterns. It is also important for a local authority to take the lead and, through its own concrete measures, to provide a model and set a good example in its environmental work[31]. This is a fundamental element in all the Local Agenda 21 work started in a lot of local authorities in the world since the United Nation Conference in Rio de Janeiro in 1992[32].

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[30] ethanol blended in a mix with 85% ethanol and 15% gasoline

[31] Reference: "Going Green. How to adapt Local Transport into an Environmentally-friendly and Energy-efficient direction" Report EB 2:2000 from Swedish National Energy Administration, Swedish Environmental Protection Agency and the Swedish National Road Administration

[32] In Agenda 21, the global action programme from the United Nations Conference on Environment and Development in 1992, the local authorities are specially addressed to take a lead in achieving a sustainable development

As can be seen from Table III.2 there are a large number of measures which have been applied in the case studies with an aim to give incentives for the increased use of environmentally friendly vehicles. Incentives include access for these vehicles to sensitive areas and bus lanes, exception from restrictions applying to conventional vehicles, free/subsidised fuel, free parking, information and public awareness campaigns etc.

It has not been possible within this study to evaluate and compare the experiences from all the case studies of using various sets of local measures. However, even though there are useful lessons to be drawn from some of the case studies, it is difficult to generalise these as the documentation is very limited. Some of few examples of acceptable reports in this respect are from the European ZEUS project which was evaluated and presented in a comprehensive final report in year 2000[33]. This report covers the experiences from a broad programme in eight cities *(Athens, Bremen, Copenhagen, Helsinki, London, Luxembourg, Palermo, and Stockholm)*. Table III.4 summarises some of the major recommendations from their work.

local measures	**case studies**
1. Municipal fleets	A-LPGBus, FIN/S-ZEUS, S-SLBus, S-SKÅNE, USACleanCities
2. Green Procurement	S-ZEUS, S-SKÅNE, S-FFVProc., S-PROC, USA-CleanCities
3. Supporting infra-structure	S-ZEUS, S-SKÅNE, CH-CityCar, CH-Mendrisio, A-EVVienna, A-LPGBus, I-ProMOT
4. Free Parking	S-ZEUS, S-SKÅNE, CH-Mendrisio, F-PRAXI
5 Access to bus lanes	S-ZEUS, S-SKÅNE
6 Environmental zones	S-ZEUS, S-SKÅNE, A-Tourism
7 Local subsidies	A-EVVienna, A-LPGBus, I-ProMOT, CH-Mendrisio, FIN-ZEUS
8 Local environmental laws (e.g. air quality)	I-ProMOT, USA-CleanCities
9. City planning	S-ZEUS
10. Mobility office	A-Tourism, J-Kyoto
11. Public awareness campaigns, promoting activities (e.g. car testing)	USA-CleanCities, A-Tourism, J-Kyoto, S-ZEUS,

Table III.3 - Examples of local measures applied for supporting clean vehicles in the case studies

It is clear from the ZEUS-report, that the type and effectiveness of the local measures highly depend on local and national transport policies, planning, funding, technology and the local traffic environment. For example, some ZEUS-cities (e.g. Athens) think that giving clean vehicles access to central city areas and bus lanes would be an effective incentive. Some cities (e.g. Palermo) are also thinking about excepting clean vehicles from access restrictions put on conventional vehicles during periods of smog alarm and heavy pollution, as all Italian Mayors must now limit traffic whenever levels of certain pollutants are exceeded.

[33] "Reducing barriers to Zero and Low Emission Mobility. A Guide for Cities". ZEUS project final report. European Commission, 2000. (Copies to be ordered from zeus@environment.stockholm.se)

1.	Reduce and manage the high marginal cost of zero and low emission vehicles by buying in bulk together with other cities and stakeholders. Take advantage of any available purchase subsidies, and factor both long and short term costs into the equation.
2.	Take an active role in facilitating refuelling and recharging accessibility. This may include financing infrastructure directly or partially, planning sites, and monitoring use, or creating partnerships with competent organisations in the public and/or private sector.
3.	When monitoring vehicles, test vehicles in "real world" situations and complement automatic systems with manual log-book systems.
4.	Use fairly mature alternative fuel technologies when using vehicles in municipal service or car sharing. When retrofitting a large fleet, rely on fairly mature alternative fuel technologies. However, you may also want to test one or two vehicles using experimental or prototype technology in cooperation with a local university or national research board.
5.	Introduce one type of fuel at a time to avoid complications and confusion in the transition to zero and low emission vehicles. Consider single-supplier contracts to further simplify service and maintenance planning.
6.	Plan for service and maintenance of alternatively fuelled vehicles. At the procurement stage, ensure that maintenance, training support, and spare parts accessibility issues are adequately dealt with. Allow for extra time during the transition period, and train all technicians, drivers, and safety personal.
7.	Increase user acceptance for new vehicle technologies by conducting market surveys, clearly signing vehicles and infrastructure with clear signage, and providing direct experience by lending vehicles or offering test drives using loaner or demonstration vehicles.

Table III.4 - Some policy recommendations based on lessons learned from the ZEUS project

Many of the ZEUS cities, as well as many of the other case studies in this study, are offering local economic incentives in the form of subsidies, free or low parking fees and free electricity. However, due to lack of transparency between local-regional-central government funding and/or unsatisfactory reports it has not been possible to analyse the funding and the subsidy situation.

Most of the ZEUS cities have also put much emphasis on information and campaigning activities, but experiences show, as stated in a report from the USA Clean Cities Programme, that the lack of understanding by the general public and decision makers may be one of the largest hurdles. For example, the US experience shows that even many owners of flexible fuel vehicles do not realise that they are driving vehicles that can operate on clean-burning E-85. However, encouraging experiences to reach out with information to the general public in order to change their mobility pattern are found in e.g. Bad Hofgastein (*A-Tourism*) due to the mobility office set up in the near-by junction Bischofshofen by the stakeholders of the car-free Tourism project (mainly the Ministry of Environment) and the Austrian Federal Rail.

Most of the cities participating in the case studies have in common that there has been a political will to accept higher costs of running clean vehicles. However, there is a conflict between budget pressures and environmental goals which is generally not presented in project reports. This may be natural, as the projects have been limited and are in a trial-and-error phase that includes changes not only in technology but also in many cases in the whole socio-technical system. However, when the scale of the projects grows there is a need to be more careful and make more economical analyses in order to get the best combination of local measures. Therefore, it is necessary to assess the cost-effectiveness of all kinds of local measures (from supporting public transport, walking and biking to investments in hybrid/electric vehicles owned by the city) and compare costs and benefits in relation to economical, environmental and social goals.

III.4 Stakeholder Actions to Overcome Market Obstacles

Any project with the aim of introducing cleaner vehicles must address market obstacles. Such obstacles are related to the lack of technology, high cost, lack of supporting infrastructure, institutional barriers and conservative attitudes and values (Figure III.2).

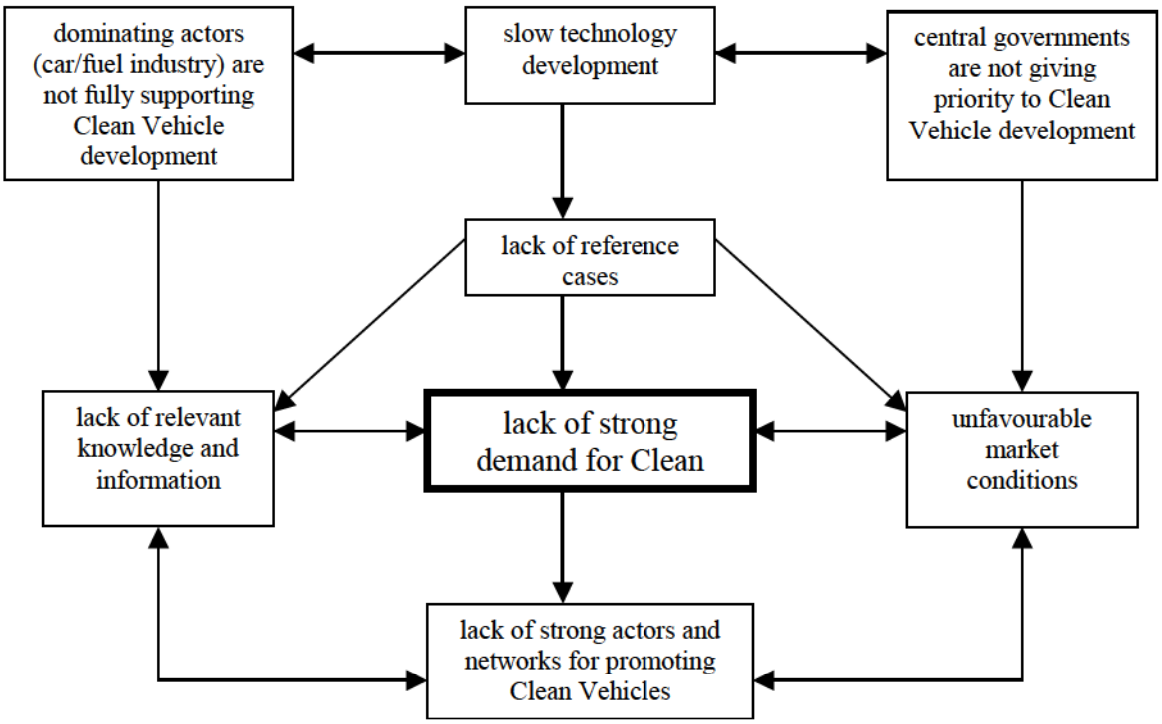

Figure III.2 - What are the main obstacles for development of Clean Vehicles – or - How to solve the chicken –and-egg dilemma?

There is a number of mechanisms that can be used to overcome some of these obstacles, but practical on-road demonstration of new vehicle types is the most effective way to start removing them. All case studies included in this report have resulted in increasing the total number of clean vehicles on the streets, hence exposing more stakeholders to these new kinds of vehicles. However, in order to get a large-scale market introduction of clean vehicles there is a range of factors to be considered including technology, infrastructure, cost and social acceptance. Solving problems that restrain the use of clean vehicles will then naturally include a large range of measures. The strongest market impacts have been achieved in the cases where the project owners have acted as a purchaser of vehicles with clear product specifications. This has enabled a more objective demonstration situation where the roles between the buyers/vehicle users and the vehicle industry are clearer compared with a situation where a vehicle user co-operates directly with a car manufacturer. Therefore, it is recommended that more of technology procurement is used by stakeholders who want to take a lead. In order to get the chance of producing series of vehicles, regional and even global procurement should be encouraged.

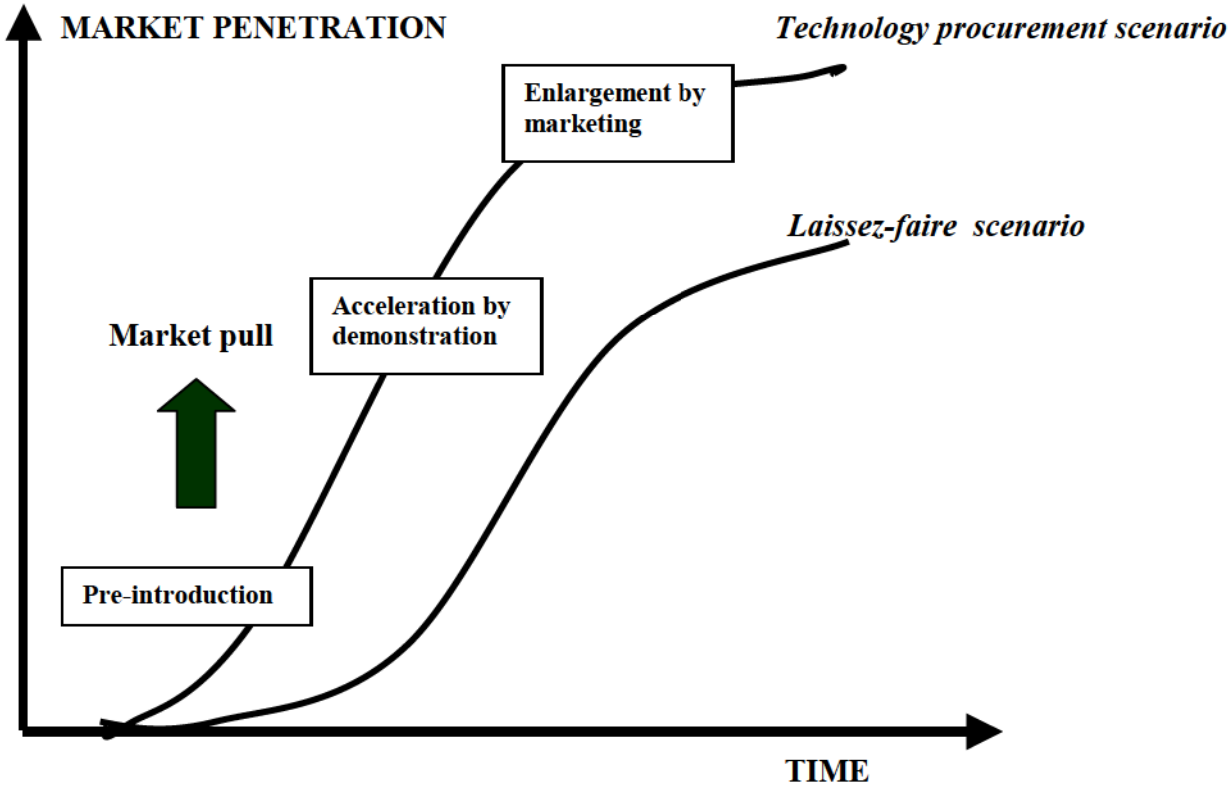

Figure III.3 - Market transformation using technology procurement versus a laissez-faire scenario. By drafting common product specifications and placing joint orders, thus creating a coherent demand, buyers groups can stimulate manufacturers to fit production to their requirements. This method is creating a market pull which can be compared with the traditional market economy which is driven by technology development on the conditions set by the producers (technology push).

Manufacturers routinely conduct market surveys to identify potential buyers – who for their part are looking for better products. Very often, however, the two groups fail to meet. Technology procurement is a method to bring the most influential purchasers of a given product category together by forming buyer groups. By drafting common product specifications and placing joint orders, thus creating a coherent demand, buyers groups can stimulate manufacturers to fit the production to their requirements (see Figure III.3). In Sweden, a number of such procurements have been carried out in order to speed up the introduction of clean vehicles (*S-FFVProcurement, S-PROC*).

III.5 Creating Partnerships

To make lasting changes on market conditions there is a need of co-operation and net-working on regional as well as on international basis. The European ZEUS and the USA Clean City networks are two good examples of such networking with positive effects. The assessment shows that the cities who have participated in these networks seem to have a more defined and well-planned range of activities than those cities who work on their own. Such kinds of networks between front liners should therefore be encouraged. Setting up a forum for frontline stakeholders could be one way of establishing early contacts which may evolve into common buyers specifications and procurement activities.

Almost no single city or vehicle manufacturer or even country can single-handedly develop advanced mass produced clean vehicles. Therefore, technology development and planning partnerships have developed among a whole range of key actors. In many of the reviewed projects such partnerships have been built through local demonstration projects. Some of these partnerships have been innovative showing the need for involving new partners, e.g. battery consortia and lobby groups. Common vehicle procurement is also an example of partnership aiming at overcoming market obstacles.

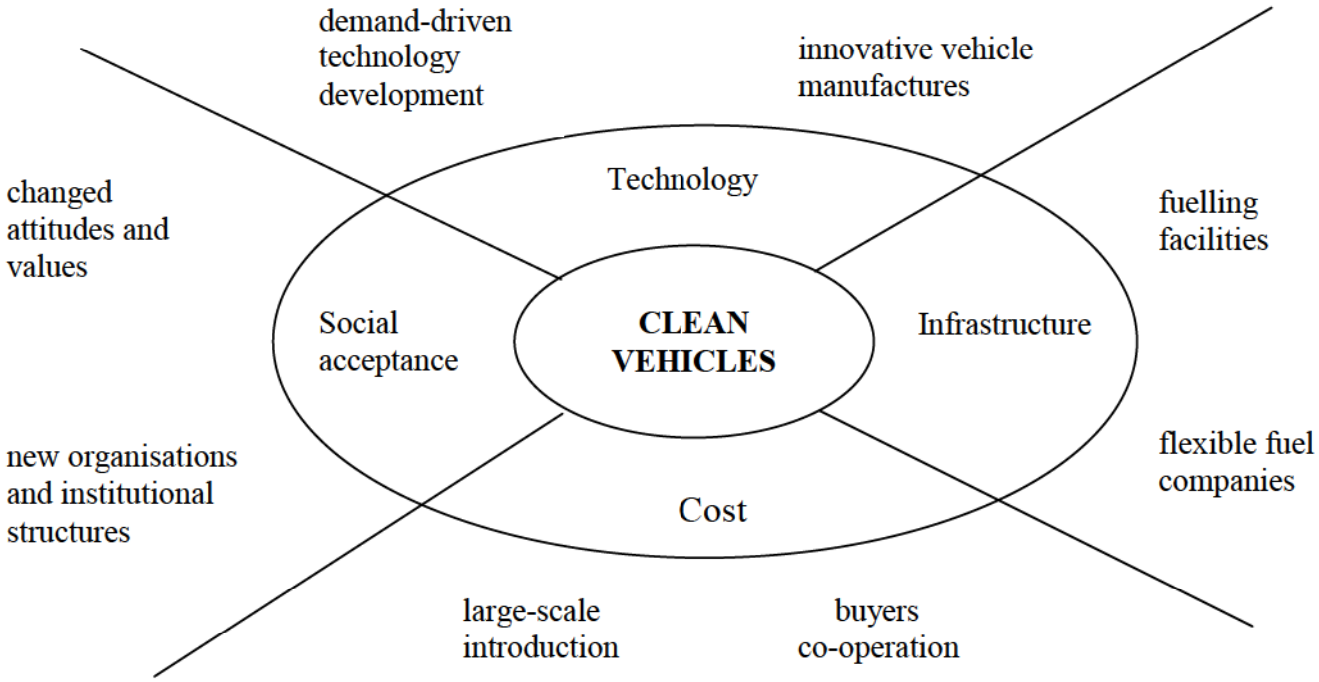

Figure III.4 - Solving problems that restrain the use of clean vehicles require partnerships between major stakeholders.

It is obvious that there is a need of global networking for various stakeholders in order to bring partners together that are ready to take the lead in developing markets for clean transport alternatives. A forum for frontline stakeholders could be an active meeting place where early contacts can be made and clear commitments for development can be taken. The Forum idea is based on a general perception that traditional workshops and conferences are not enough to maintain a steady progressive pace and even less efficient to move a subject closer to implementation even in cases with a clear evidence of economic, environmental and social benefits.

III.6 Conclusions and Recommendations

As been shown by many of the case studies, cities and local authorities can play an important role for promoting clean vehicles, not only because they can act as big fleet owners themselves, but also, being closest to the people as the authority, can promote or set barriers for the introduction of clean fuels and vehicles. In order to be successful, the local authorities have complemented the technical demonstrations by introducing a number of various local supporting means (e.g. free parking, access to bus lanes, environmental zoning, local transport advisors). However, in order to be successful, the city must have clear objectives and a transparent strategy for their activities. Based on this, decisions on various measures will be taken. Such a holistic

approach will mean that e.g. demonstrating electric vehicles is just one example of measures to foster clean air in the city.

The analysis of the case studies shows that cities who have participated in networks like the European ZEUS project or the USA Clean Cities seem to have a more defined and well-planned range of activities than those cities who work on their own. Therefore, it is strongly recommended that these kinds of networks between front liners are encouraged.

The strongest market impacts have been achieved in the cases where the project owners have acted as a purchaser of vehicles with clear product specifications. This has enabled a more objective demonstration situation where the roles between the buyers/vehicle users and the vehicle industry are clearer compared with the situation where a vehicle user co-operates directly with a car manufacturer. It is recommended that technology procurement is more frequently used by cities and other vehicle users who want to take a lead. In order to stimulate series production of clean vehicles, regional and even joint global procurement should be encouraged. A good starter for such activities could be to initiate regular forums for front line stakeholders.

III.7 Open Questions

In many of the case studies, individual cities and local municipalities have been active in promoting clean vehicles. As shown, there is also a whole range of local measures which can be used if the cities are willing to change the transport pattern in a sustainable direction. However, the experiences from individual cities indicate that many projects and local measures have neither been planned nor implemented in a systematic way. In order to get the best value of investments, all kinds of local measures need to be disseminated – not only measures focusing on energy and transport, but all measures to serve a goal as getting cleaner air. Therefore, it is recommended that the International Energy Agency IEA, together with other organisations, extends its scope of work including a closer look into non technical measures aiming at providing more guidance for local governments.

In order to get a demonstration affecting market conditions there is a need of getting a ”critical mass” of reference cases. Among the case studies the number of vehicles in one single city ranges from 5 to 1’000. The question arises whether there is a lowest limit of numbers of demonstration vehicles to get a success. From an analysis of the available project documentations it has not been possible to get a good picture of the reasons behind choosing a certain number of test vehicles in this study. As this is a crucial question which highly affects the total cost for the demonstration it is recommended that this issue is further investigated.

As the study shows that information exchange between stakeholders seems to be low, it is recommended that local authorities and other stakeholders improve their co-operation, not only within their own country, but also on a regional and global scale. However, in order to get such networking taking off, there is a need of a facilitator. It is recommended that the IEA takes that role by initiating a forum for front liners and various kinds of networks involving major stakeholders.As most of the IEA activities so far mainly involve industrialised countries, but not representatives from some of the fastest growing markets for new vehicles – the developing countries – it is time to develop a global strategy for promoting clean vehicles which consider this fact and by all means increases the efforts for global outreach.

IV. Market Introduction Programmes and Strategies

Michaela Kargl

IV.1 Scope, Objectives and Methods

IV.1.1 Objective and Scope of the Work in Sub-task IV "Market Introduction"

Programmes that aim at increasing the market share of alternative vehicles and alternative fuels can be found in a lot of countries all over the world. These programmes are initiated by different stakeholders, who had various motives to start such a programme. There are various stakeholder-groups involved and their role differs within each of the programmes. The various market introduction programmes apply a wide range of approaches and strategies to overcome the market introduction barriers, and some of them are rather successful whereas some others have failed to reach the goal of increased market introduction of alternative vehicles and alternative fuels.

The scope of the work within this Sub-task IV has been to describe the different approaches of these existing market introduction programmes, to analyse the reasons of their success or failure and to find out promising strategies for the market introduction of alternative fuels and alternative vehicles. Thus to enable initiators of new market introduction programmes for alternatively fuelled vehicles or alternative fuels to learn from others' successes and failures and to find out the most feasible way to promote clean vehicles and alternative fuels in their own countries. However, it is very important to keep in mind that a properly designed programme is very much formed by the framework conditions in the nation or region. Therefore it is evident that a successful programme can not be 'translated' into another country with just the same success - different objectives, culture, infrastructure etc. make modifications and adaptations of a successful concept absolutely necessary.

IV.1.2 Selection of Case Studies and Sources of Information

This chapter is based both on the work of the other three subtasks and on an analysis of a number of selected case studies. These case studies have been selected according to the following criteria:

- good coverage of a variety of different strategies (mandates, voluntary approaches, financial and non financial incentives, regulations, etc.)
- good coverage of a variety of programme-initiators (national and local governments, industry, NGOs etc.)
- good coverage of various (environmental, legal, economic, cultural, etc.) framework conditions

Information on the case studies has been collected from written project reports, programme evaluations, articles and papers, conference proceedings, websites and direct contacts with involved experts. A detailed list of literature and more information on the case studies referred to in this report can be found on pages 88ff.

IV.2 General Aspects Regarding the Market Introduction of Clean Vehicles and Fuels

IV.2.1 General Framework Conditions for Clean Vehicles and Fuels

At present, there is no practical or economical need for vehicle fuels other than diesel and petrol. Within the last 50 years the continuous development of conventional gasoline and diesel vehicles has resulted in a large variety of comfortable vehicles models with gradually increasing performance and decreasing fuel consumption and emissions. The refuelling infrastructure for conventional fuels is very good and corresponds with the demands of the customer, i.e. there are a lot of other services provided with refuelling (shops, car cleaning, repair stations, etc.).

However, the increasing motorisation has brought a number of problems. For some of these problems (i.e. the large contribution of transport to global warming, the serious degradation of air quality in metropolitan regions and the dependence of many countries on imported oil) large scale introduction of clean vehicles and the replacement of gasoline and diesel by alternative fuels seem to be a promising solution.

Since our perceptions of vehicles in general are constructs of a social process of interpreting the technology to be considered, over time this socio-constructive process positioned 'the car' as a powerful long distance machine. User studies indicate that vehicle users are not willing to compromise with the performance given by the conventional vehicle, even though they realize that their actual need can be met to a very large extent by an alternative vehicle. Consumers continue to evaluate performance specifications of clean vehicle against entrenched petrol and diesel alternatives and not against their actual transport needs. Neither environmental awareness nor experience using clean vehicles seem to convince house-holds to buy alternative cars, as long as these cars offer no benefit that is considered to be valuable by these individual users (e.g. economic-, safety- or image-benefits). Therefore the threshold value for all specifications of clean vehicles will be that of a petrol or diesel vehicle of the same price.

IV.2.2 Concepts Regarding the Market Introduction of New Vehicle and Fuel Technologies

As already stated, the introduction of new vehicle and fuel technologies takes place against the backdrop of the existing technological regime of gasoline and diesel based transport. The existence of this regime sets criteria for a new vehicle and fuel technology which are translated into preferences of producers, users and regulators.

The selection of a promising market segment, where the alternative vehicle or fuel technology is planned to be introduced, depends on the alternative vehicles or fuels ability to compete with conventional vehicle and fuel technologies under the given framework conditions of the targeted market segment:

widespread market introduction
Under present conditions, widespread market introduction can only be successful for vehicle and fuel technologies that either can compete with the existing conventional gasoline and diesel vehicles in terms of vehicle performance (e.g. comfort, speed, driving range etc.) and require no or only minor behavioural changes from the users' side (examples for such technologies are: LPG, CNG, biodiesel, ethanol, biogas, hybrid vehicles), or offer outstanding individual advantages to the users - in this case, users will even be willing to adapt their behaviour to new technologies.

niche market strategy

Presently, certain clean vehicle technologies (e.g. EVs) cannot compete with conventional gasoline or diesel vehicles in the general market, since they require changes in the users' behaviour and/or have disadvantages compared to the performance of conventional vehicles. In this case promoters of the technology have to look for pockets of users whose preferences are already compatible with the characteristics of the new technology. This is the market niche strategy which many actors in the field of electric vehicles are currently following.

Market niches are application domains in which a novel technology has some specific advantages over the established technology. Both producers and users recognise this. The still not marketable new technology and the user preferences need to be developed further, but it is already clear that the new technology can suit the needs of the application domain. In the case of market niches the users recognise the advantages of the new technology without more ado, and that is why companies start producing the new technology. Such market niches may be certain areas (e.g. inner cities, nature preservation areas, airports, corporate/academic campuses, tourist resorts etc.), certain transport modes (e.g. car-sharing, etc.), certain transport purposes (e.g. shopping, commuting to work, etc.), certain vehicle-fleets (e.g. post, courier services, etc.), certain types of vehicles (e.g. two-wheelers, garbage-collection trucks, etc.) or a combination of certain areas, transport-modes, vehicles and -applications.

Many regular market interactions prevail in market niches. Therefore, in principal, market introduction programmes aiming at the introduction of alternative vehicles and fuels into certain market niches face similar problems and barriers and apply the same strategies to overcome these problems and barriers as market introduction programmes that aim at introducing alternative vehicles and fuels to the general market. Also many of the same factors for success and failure are applicable.

strategic niche management approach

Technologies, where the user-specific advantages are less clear, may be developed in technological niches: In such a niche a new technology that could not survive in the economic competition of the existing regime still gets a chance to prove itself because of protection offered by a variety of actors who are willing to invest time, money and effort. Actors who support the new technology because of expected societal advantages in the future create a specific environment, a protected space, in which the new technology becomes attractive to a set of users due to the protection measures. Development of technological niches is also useful, if producers have low expectations of the users' acceptance of the technology and can only overcome their reservations to produce it because of the protection measures. Protection measures may consist of temporary resources supplied by governments or other actors, preferential treatment through regulation or fiscal measures, positive image building, and other forms of support. Within technological niches there are no regular market interactions. The prime focus in these niches is on learning rather than marketing, learning on the technological as well as on the social aspects of the alternative.

Technological niches can be seen as proto-market niches: Introduction of the new technology within such a technological niche should lead to improvements of the technology in technical and economical terms, investments in production capacity and infrastructure, and development of early markets. Both, the developments within the niche and the dynamics of the automobile regime, form the actors' expectations, the network formation and the emergent technology introduction strategies. The development and experimental introduction of the technology is costly, so that when sufficient progress is made in a technological niche, its developers and promoters will strive to launch the technology in a market niche. If this is not possible, the technological niche may be maintained but it may also dissolve. Return on investments in the market niche provides an impetus for further improvement of the technology in terms of cost, reliability, performance, etc., which will also then be of use for the development of the technology

for other applications. Introduction of new technologies can thus be described as a sequence of niche developments.

Market introduction of clean vehicles and fuels usually requires a 'mixed' approach: In most cases neither pure regular market interactions nor complete protection from the market forces will successfully bring clean vehicles and fuels on the roads. Usually their market introduction will require certain protection measures to shield the new technology (partially) from the pressure of the existing regime of conventional gasoline and diesel vehicles. The challenge is to find the right balance: protection as much as necessary, and free market as much as possible.

IV.2.3 Strategies to Manage Technological Change

Policy makers may follow three approaches to manage technological change:

- change the economic framework structure by taxing negative externalities and rewarding positive externalities.
  The problem with this approach is, that the policy measures have to be drastic to have an impact, considering the dominance of existing technologies - but the more drastic the policy measures are, the more protest and resistance they are likely to invoke.
- plan for the adoption of a new socio-technical regime, in the same manner as decision-makers have planned for large infrastructure works like railway systems.
  The problem with this approach is, that in most countries governments cannot really plan for a new technological regime in today's highly differentiated and organised society. Even for firms it is often difficult to plan for successful market introduction, since user requirements develop over time often in unpredictable ways.
- build on the on-going dynamics of socio-technical change and exert pressure so as to modulate these dynamics of change into desirable directions. The task for policy makers is to stimulate, that the co-evolution of supply and demand produces desirable outcomes, in both the short run and longer term. Rather than laying down requirements, they need to engage in process management that aims at changing the rules of the game, creating room for experimentation and variation, shaping the interactions between involved actors, learning about problems, needs and possibilities and supporting weaker actors against the interests of dominant actors.

The first and the second approach are not feasible under current framework conditions in most of the countries. The third approach - engaging in process management to modulate socio-technical change - is the most promising way for policy makers to influence technological change under current framework conditions.

IV.3 Analysis of Strategies to Overcome Market Introduction Barriers

Some of the successful large-scale introductions of alternative vehicles and alternative fuels have not been backed by any ‘introduction-strategy’, but have been supported by favourable framework conditions resulting in obvious economic advantages these vehicles and fuels have offered both to the customers and to the investors in infrastructure. Examples of such ‘market-driven’ increase of the share of clean vehicles and alternative fuels are *LPG-vehicles in Italy* and in *The Netherlands* and *CNG-cars in Argentina.*

However, most of the market introduction programmes for clean vehicles and alternative fuels follow some kind of ‘step-by-step’-strategy:

IV.3.1 Involvement of Stakeholders: Their Role

There are a lot of actors involved in the process of bringing alternative vehicles and fuels to market:

- intergovernmental authorities
- national governments
- local and regional authorities
- fuel industries (providers and distributors of alternative fuels)
- vehicle industries
  (vehicle manufacturers, vehicle conversion shops, supporting industries (producers of batteries, fuel cells, charging stations, CNG-cylinders, etc.), local retailers and providers of maintenance and service)
- non governmental organisations (NGOs)
- vehicle users (individual customers, fleet owners, vehicle-users'-associations, etc.)
- educational institutions (schools, universities, driving schools, etc.)
- the media

The roles and position of these stakeholders regarding the market introduction of clean vehicles and fuels have been defined by subtask III, based on analyses of various case studies:

National governments and intergovernmental authorities

National governments and intergovernmental authorities can support alternative vehicles and alternative fuels by various legal and regulatory measures, by setting standards, by offering fiscal and non fiscal incentives, by brokering partnerships among stakeholders and through leadership by example.

A lot of market introduction programmes for alternative vehicles and alternative fuels have been initiated by national governments. By initiating these programmes national governments seek

- to reduce the production of greenhouse gases (*e.g. promotion of alternative fuels in Japan*)
- to increase the use of indigenous or renewable resources (*e.g. U.S.-EPAct, promotion of biodiesel in Austria*)
- to increase air quality (*e.g. CNG-Egypt*)
- to support national industries and create job opportunities (*e.g. promotion of ethanol in the U.S.*).

Local and regional authorities

Local and regional authorities - in their capacity as vehicle owner, fleet operator, city planner, purchaser of transport services, employer, trainer and provider of information - have the possibility to play a key role for promoting clean vehicles and alternative fuels.

Local and regional authorities often take the role of initiators of market introduction programmes for clean vehicles and fuels (*e.g. 'Strategic Council of New Market Creation'-Tokyo, CNG-Liverpool(Australia), etc.*). For local authorities the main motivation to initiate such programmes is the miserable air quality, particularly in metropolitan areas.

Fuel industries

Providers and distributors of alternative fuels who want to introduce a new fuel to the market, usually have to take an active role in promoting their fuels, as the market introduction of alternative fuels is often connected with large investments in infrastructure. Fuel providers and distributors are the 'driving force' of several market introduction programmes for alternative fuels (*e.g. LPG in Vienna, CNG in Egypt, Japan and Switzerland*) since they want to create new markets for their products.

Vehicle industries

- Car manufacturers
  (up to now) have not played a dominant role and have not lead the way in promoting new

fuels and vehicles[34], as they do not find the market ready and large enough. However, for example Ford is starting to create partnerships with fuel suppliers to overcome the 'chicken and egg' problem.

- Manufacturers of Heavy Duty Vehicles and Buses
  traditionally have close contact to fleet owners. Consequently there are examples[35], where e.g. bus-makers, during a long period of time, have developed new bus generations (alternative vehicles) in close co-operation with a buyer, and then gradually introduced these alternative vehicles into a larger global market.
- Supporting industries
  (e.g. producers of batteries, fuel cells, charging stations, CNG-cylinders,…), whose future is depending on an increased use of their products, show more interest in the promotion of clean vehicles and alternative fuels. Whereas most of the (main) vehicle manufacturers are reluctant towards the starting of offensive market introduction programmes for clean vehicles, some large scale market-uptakes of alternative vehicles and alternative fuels have been induced by the commitment of small vehicle-conversion-shops (*e.g. LPG in Italy and in the Netherlands, CNG-cars in Argentina*).
- Local retailers and maintenance providers
  play a key-role in the market introduction of alternative fuels and alternative vehicles, since their engagement or reluctance in selling and servicing these vehicles or fuels is often crucial for the purchasers' decision.

Non Governmental Organisations[36]
work together with other stakeholders in various local projects for introducing alternative vehicles and alternative fuels. Some market introduction programmes have been initiated by NGOs (*e.g. the 'Bio-Alcohol Fuel Foundation' is actively initiating and supporting various local projects for introducing ethanol in Sweden*).

Vehicle users
Vehicle users and users' associations strongly influence the market diffusion rate of alternative fuels and alternative vehicles, since most buyers, when faced with new technologies, will first seek to learn how others have experienced it, before buying themselves.
Fleet owners (like public bus companies, taxi fleets, post, public utilities) often are the main partners for demonstrating alternative fuels and alternative vehicles.

Educational institutions
Similar to the media, also educational institutions play an important role since they influence the opinion and behaviour of the next generation of vehicle purchasers.

The media
play an important role as their messages usually have strong impact on the people's behaviour. However, as media are generally acting, there is a risk of focussing on problems rather than on possibilities.

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[34] An exception is the Japanese car manufacturer Toyota, who is actively introducing its hybrid model 'Prius' to the global market. But, regarding market introduction, this hybrid car is not a typical alternative vehicle, since there are no market introduction barriers like missing infrastructure ('Prius' is gasoline-fuelled) or much higher purchase cost than for a conventional car (the price for the 'Prius' is in the range of expensive conventional cars); and the 'Prius' can easily compete with conventional cars in terms of performance.

[35] *e.g. A-LPGbus and S-SLbus*

[36] *e.g. Japan Electric Vehicle Association, Sweden's Bio Alcohol Fuel Foundation, America's Lung Association,…*

IV.3.2 Involvement of Stakeholders: Their Motivation

The various stakeholders will only look upon the programme favourably, if the clean vehicle-/ fuel-technology can offer special benefits to each stakeholder-group (see Table IV.1).

Stakeholder group	Preconditions for the promotion of clean vehicles and fuels
national governments	• emission benefits will be achieved • renewable resources will be utilised • indigenous resources will be utilised • national industries (e.g. vehicle manufacturers, farmers,…) will be promoted • acceptable level of mobility will be maintained • new jobs will be created • prospects of economic growth will be associated (the relevance of these conditions is depending on the focus point of the national political strategy)
local governments	• reductions of local emissions and/or noise will be achieved • local industries will be promoted (and jobs will be created) • acceptable level of mobility will be maintained • municipal waste problems will (partly) be solved (e.g. production of biogas or biodiesel from waste material)
vehicle-/parts-manufacturers	• there is a favourable legal framework with foreseeable 'trends' for future years • there is a realistic chance, that there will be a market for the new technology
fuel industries and infrastructure providers	• there is a realistic chance, that there will be a market for the new fuel • there is a realistic chance of a return of investments (e.g. in infrastructure) within the foreseeable future
local retailers (for vehicles and fuel)	• economic advantages can be expected
users and users'-lobbies	• users do not expect to have important disadvantages (e.g. difficulty to sell the used vehicle, no cheap and easy maintenance, etc.) • users can expect economic advantages • users can expect 'performance' advantages (e.g. excellent safety, excellent driving performance, etc.) • users can expect other personal advantages (e.g. comfort, accessibility, 'image', etc.) Compared to conventional gasoline or diesel vehicles new technologies must offer clear advantages (e.g. economic advantages) directly to the user in order to be accepted by the user – 'general' advantages (like environmental benefits) are not sufficient!

Table IV.1 - Preconditions for the promotion of clean vehicles and fuels

IV.3.3 Involvement of Stakeholders: Initiators of Market Introduction Programmes

Under present framework conditions, in most countries the main advantages of alternatively fuelled vehicles over conventional gasoline and diesel fuelled vehicles are environmental and macro-economic benefits. Therefore in these countries the stakeholders primarily interested in bringing clean vehicles on the road are:

- national governments
- local and regional authorities
- non governmental organisations (like environmental activists, health organisations, etc.)
- the providers and distributors of alternative fuels (like farmers, gas suppliers, etc.).

Consequently most market introduction programmes are initiated by these stakeholder groups.

Additionally, in some countries certain fuels offer favourable economic conditions for the users (*e.g. LPG in the Netherlands and in Italy, CNG for cars in Argentina*). In these countries the

market introduction of the concerned fuels is supported by market forces and often initiated by small vehicle-conversion-shops.

IV.3.4 Strategies to Involve Additional Stakeholders

It is not critical for the success of a market introduction programme, who takes the initiative to start the programme - but it is essential and most important that all(!) relevant stakeholders are included.

National and local governments, industries (producing vehicles, infrastructure, fuel, vehicle parts, conversion kits, etc.), local retailers for vehicles and fuel, car-drivers' lobbies, ecological groups and citizens' action committees play a role for the success of the programme. Of course not all of them must be involved 'deeply' within the programme (the stakeholders play different roles and some of them have more possibilities to take a lead), but if the market introduction programme is opposed by one key-stakeholder-group, it is likely that it will not be successful.

Some market introduction programmes for clean vehicles and alternative fuels involve a great variety of stakeholders (*e.g. CNG-Egypt, CNG-Liverpool(Australia), US-CleanCities*) whereas some other programmes are mainly supported by the initiator of the programme and (in some cases) a very limited number of other stakeholder-groups (*e.g. CNG in Switzerland, 'National Programme for Substitution of liquid Fuels' in Argentina, etc.*). In general the possibility to reach the goal of a successful market introduction of clean vehicles and alternative fuels increases with the number of stakeholders committed to the programme. Under current framework conditions the introduction of alternative vehicles and fuels against the will of vehicle manufacturers, local vehicle dealers and fuel suppliers is an illusion - any strategy aiming at mass market introduction of clean vehicles and fuels will be dependent on the integration of all actors in the supply and maintenance chain. It is very important to get the existing car-industry-network (including manufacturers, dealers, garages, services, fuelling stations, etc.) 'into the boat'. Nevertheless, in many existing projects there is only poor integration of conventional vehicle manufacturers, local vehicle dealers and fuel suppliers. Since the government (and any other initiator of a market introduction programme) is not strong enough to change the market and has not sufficient resources to create a change in demand through subsidies, this lack of integration of key-stakeholders is often the main reason of failure in effective implementation of clean vehicles and fuels. Especially the absence of support of the programme by key-stakeholders like the vehicle- or fuel-industry (*e.g. 'National Programme for Substitution of liquid Fuels' in Argentina', etc.*), local retailers (*e.g. CH-Mendrisio, etc.*), legal and regulatory authorities (*e.g. CNG in Switzerland, etc.*) or user's-lobbies (*e.g. 'National Programme for Substitution of liquid Fuels' in Argentina, etc.)* is fatal for the success of the programme.

Existing market introduction programmes developed a variety of strategies for the involvement of additional stakeholders:

- **Persuasion:**
  The initiators of a market introduction programme try to win over those key-stakeholders to which the large scale market introduction of alternative fuels and alternative vehicles would bring obvious advantages. Thus forming a core-group of key-actors committed to the programme. This group of actors tries to modify the framework conditions (e.g. by legal and regulatory measures) in order to be able to persuade more stakeholders to support the programme.
- **Networking:**
  By forming national and international networks with like-minded groups additional stakeholders can be recruited to join the programme (*e.g. US-CleanCities, CNG-Liverpool*

(Australia), etc.). One example of very successful networking "outcomes" are procurement programmes (*e.g. S-FFVProcurement, etc.*)

- **Mandates:**
  Some governments that initiated market introduction programmes have tried to 'include' other stakeholder groups by means of mandates (*e.g. US-EPAct, California-ZEV, etc.*).
- **Voluntary agreements and Public-private-Partnerships:**
  A more modern approach to recruit additional key-stakeholders are voluntary agreements and the creation of public-private-partnerships. (*e.g. California ZEV Amendments, 'Strategic Council of New Market Creation'-Tokyo, Voluntary Agreement between the Italian government and FIAT*[37]*, etc.*)
- **Leadership by example:**
  Some initiators of market introduction programmes have tried to bring additional stakeholders 'into the boat' by starting to use the new technologies and actively demonstrating the advantages of the new technologies to other stakeholders. (*e.g. CNG-Liverpool (Australia), etc.*)

IV.3.5 Choice of Clean Vehicle or Alternative Fuel Technology

Depending on the motif of the initiators of the market introduction programme, the scope of promoted clean vehicles and/or fuels varies: Some market introduction programmes focus on a specific clean vehicle- or fuel-technology (*e.g. CNG-Egypt, E85-Minnesota*), some other programmes support a variety of clean vehicle- and fuel-technologies (*e.g. The Powershift programme (UK), the DEMO programme (NL)*).

The choice of the clean vehicle and/or fuel technology is crucial for the success of the programme: Under present framework conditions only technologies can successfully be introduced into the mass market that either offer outstanding advantages to the users or require only minor behavioural changes in adaptation to the technology and no (or only minor) changes in the travelling habits.

Some of the existing programmes, however, are not focused on the adequate technologies (i.e. technical solutions that have proven to be ripe for the mass market), or require behavioural changes that are not accepted by the users (*e.g. J-EVSharing*, especially the Koyto Public Car System).

IV.3.6 Research- and Development Activities

Research and development activities are carried out and stimulated during the whole course of a market introduction programme. These activities are necessary in order to support the continuous improvement of the vehicle- and fuel-technologies and by that to enable clean vehicles to become (and stay) competitive with conventional gasoline and diesel vehicles. In many programmes R+D activities are financially supported by the national government (e.g. the 'cleaner, quieter, more efficient vehicles'-programme in the Netherlands, etc.), in some

[37] In 1997 a voluntary agreement between the government and Fiat has been signed in Italy which has the goal to increase the use of electric, hybrid and CNG vehicles and to reduce the fuel consumption of future cars. The consumption of the new car fleet should be limited to 5.5 l/km by 2010 – a reduction of 25% compared with the 1995 values. FIAT Iveco aims at reducing the fuel consumption in the heavy duty vehicle fleet by 6% by 2005. Results of the voluntary agreement: Fiat succeeded in the creation of new vehicles based on hybrid, electric and CNG-technology, and is interested to further invest in CNG. However, one of the targets of the voluntary agreement - to commercialise a car with a consumption less than 4.5 l/km - has not been met. The Italian agreement with Fiat is backed by support for both a public-private programme of basic research and a programme of industrial research.

programmes R+D activities are (financially) supported by other key-stakeholders like fuel providers and fuel distributors (e.g. CNG-Japan). In a more advanced stage of the programme, and when success seems to be likely, often vehicle manufacturers continue R+D activities by their own without financial support by other parties (e.g. CNG-Japan).

IV.3.7 Fleet Tests and Pilot- and Demonstration Projects

Fleet tests and P+D projects often form the first step of a market introduction programme (e.g. CNG in Egypt, India, Switzerland, Japan, etc.). The rationale of a demonstration project is to demonstrate the benefits of alternative vehicle and fuel technologies to the public and to trigger a demand for these new technologies in the market. The aim of a fleet test or a pilot project is to test the performance of a new technology under 'real' framework conditions. The result of the fleet test or the pilot project confirms whether a technology is marketable to be used either in market niches or for market introduction within the given framework conditions. Fleet tests and pilot projects help to discover weak points of the technology that need to be corrected. Additionally, fleet tests and P+D projects help to find out possible barriers for the market introduction of the tested and demonstrated clean vehicle and fuel.

Recommendations for fleet tests

A large number of fleet tests has been analysed within Subtask I. In order to increase the chance of success for fleet tests, to get really useful information for the technology deployment on the market and to provide the resulting information in the most suitable way for other stakeholders, it is recommended to attach importance to the following issues:

in the design-phase of the fleet test

- pay maximum attention to a quantitative definition of the main objectives of this fleet test
  - look for information about similar projects, in order to avoid testing features for which the results are already available and to have the possibility of increasing the relevance of the test findings
  - identify targets compatible with the available resources of the project
  - identify indicators and methods to assess the performance of the technologies
  - identify criteria and requirements related to organisational aspects
- identify an operating context, where the expected objectives of the project are likely to be reached;

  such a context is characterised by
  - limited geographic dimensions
  - identified peculiarities that can impact the demonstration results
  - adequate availability of necessary infrastructures and maintenance services
  - assistance from the manufacturers and suppliers
  - involvement and motivation of all stakeholders (without exceeding in the opposite sense, in order to avoid to hide significant drawbacks)
  - reduced criticality of the applications where the new technologies are used, in order to avoid that malfunctions and /or delays create negative user-attitudes
  - in particular the collective transport and captive fleets (i.e. vehicles are used for companies or special use) are applications where generally very good boundary conditions can be met (i.e. availability of fuel supply, maintenance personnel, etc.) and this could be a big advantage.
- employ adequate human, economic and time resources, assuring the right dimensioning of all phases of the fleet test (currently, in most fleet tests the purchase-phase is too much favoured and the assessment-phase is often paid too less attention)
- keep the public continuously informed about the project and, where possible, make people affected by the project active partners.

in the phase of the assessment of the results of the fleet test

- determine the level of success for every objective and identify the reasons that have hampered the attainment of each of the objectives
- identify important side effects

- identify the technical and/or organisational improvements needed to favour the creation of a market for the technologies
- estimate the impact of a wide scale technology application (environmental benefits, behavioural changes, weak aspects of the technologies with indication of possible solutions)
- identify the most adequate measures and contexts for the creation of market niches
  - economic (subsidies, incentives, taxes, facilitation for the market of used vehicles,…)
  - legislative (national and local standards, constraints of use for the traditional technologies,…)
  - logistic (availability of infrastructures and services, spare parts,…)
  - formative and informative (courses, seminars, magazines, demos, …)

in the phase of follow-up of the fleet test

- guarantee that the stakeholders (governments, local authorities, manufacturers, component industries, suppliers, fleet managers and citizens) interested in the development of the technologies are fully informed of the results of the project in a transparent and complete way, so that they can acquire, without excessive effort, the main features of the technologies
- continue the information activity for a significant period of time after the technical conclusion of the project. Proper resources must be planned and allocated to this task.

IV.3.8 Targeting Initial User Groups

In the initial phase of a market introduction programme fleets and 'activity centres' are often targeted as 'first' user-group.

Targeting Fleets as Initial User Group

Most market introduction programmes try to target vehicles fleet as initial market for clean vehicles and fuels. On the one hand, fleet vehicles are seen as a perfect initial market for clean vehicles and fuels, because

- fleet vehicles are (on average) annually driven twice as far as household vehicles
- the fleet mileage is for the most part typically accumulated in urban areas, where emission reductions are mostly needed
- high vehicle turnover (light duty fleet vehicles stay typically only three to five years in 'fleet service') facilitates a rapid penetration of alternative vehicles into the vehicle market since most 'used' light duty fleet vehicles are sold to households
- targeting fleets is very efficient because relatively few decision makers control a dis-proportionately large number of vehicles
- many fleet vehicles have fixed daily routes and are regularly fuelled at a certain location – these operating parameters make it easier to establish a fuelling infrastructure

On the other hand, fleet operators are reluctant to purchase alternative vehicles, because

- clean vehicles have higher capital cost
  It is widely believed that fleet operators are more cognizant of the full life-cycle costs associated with owning and operating a vehicle than individual buyers, and thus would accept clean vehicles sooner than individual consumers. But studies[38] show that the 'most influential factor' in vehicle selection is 'capital cost' which is usually the largest and easiest cost difference to assess amongst the vehicles in the final choice set. Thus the higher purchase cost of a clean vehicle tends to mask any potential savings resulting from lower operational costs.
- fleet managers' vehicle choice is based on past experience with a particular vehicle and/ or manufacturer
  'past experience with a particular vehicle make and model' is a major decision criterion for the

[38] Nesbitt, K. and Sperling, D., 1998 and Moser, M. and Andrae, A., 1998

purchase of fleet vehicles – sometimes fleet operators are even being more brand-loyal than cost conscious.

- fleet managers are concerned about expenses and problems associated with vehicle 'downtime'
  especially for small fleets the costs resulting from a vehicle out of service due to scheduled and unscheduled repairs form a major barrier. - A vehicle breakdown could have a severe impact on the operation of a smaller business.
- fleet managers are concerned about uncertain future framework-conditions (e.g. technological development and resale-values of alternative vehicles)
  fleet managers calculate the 'economic' life of heavy duty vehicles and buses with more than 10 years - since the framework of future conditions is often changing and not stable (like pilot-projects running for e.g. only 3 years, or public-transport-service-contracts tendered every year, etc.), they want to have the guarantee that they either will be able to exploit their alternative vehicles for the complete 'economic' lifetime, or that they will be able to sell them for a good price.
- fleet managers will not take the risk of being the first to adopt a new technology
  fleets generally have a 'wait and see' attitude hoping someone else will assume the risk of being the first to adopt a new technology; fleets are more willing to purchase a clean vehicle, if they are aware that such a purchase has been proven to be productive for another fleet.

Therefore most market introduction programmes establish initiatives to target governmental and public-sector fleets rather than private fleets, since the above mentioned barriers are not so pronounced within governmental and public-sector fleets, and these fleets can be influenced more easily by the authorities (*e.g. in France a mandate for public fleets demands a certain share of clean vehicles in new vehicle-purchases*).

Another very popular vehicle group often targeted in the initial phase of market introduction programmes are public transport vehicles, particularly taxis and buses (*e.g. LPG-Japan, CNG-Egypt, Ethanol-Brasilia*). Especially taxis are a good choice as initial user-group, since usually taxi-passengers (i.e. potential vehicle-purchasers) pay attention to the experience of the taxi drivers, and thus the experience of the initial user-group will quickly be spread and may encourage other vehicle users to buy a clean vehicle.

Motivation of fleets to acquire alternative vehicles

In (business) fleets initial purchases of alternative vehicles are top-down decisions motivated largely by corporate image benefits. Despite the fact that nearly all efforts to sell clean vehicles to fleets take place at the fleet level, purchase decisions for clean vehicles will generally be made at a much higher level within the organisation, at least for the near term. For these upper level managers, the most important motivation for purchasing a clean vehicle are company image enhancement and public relation benefits. As soon as clean vehicles become more common, the purchase decision slides down the company hierarchy and economics and operating characteristics become the primary decision criteria.

Public policy aimed at accelerating the adoption of clean vehicles by fleets should tilt more toward flexibility, market instruments, and assuring positive experiences than applying mandates.

Targeting 'activity centres' in the initial phase of a market introduction programme

To avoid spreading too few resources across too many types of projects, some market introduction programmes (*e.g. CleanCities*) start to target 'activity centres' (e.g. airports, national parks, governmental/academic campuses, tourist resorts). The various vehicles types at service in 'activity centres' open up many interesting possible applications for alternative fuels. Since these vehicles are usually owned by a variety of different entities, the recruitment process for clean

vehicle proponents is more complicated. Therefore it is recommended, instead of approaching these entities one-by-one, to meet with decision makers and present the applications as an activity-centre-wide opportunity. If e.g. hotel-, parking-, taxi-, delivery- services etc. jointly commit to implementing alternative fuels, an investment in a fuelling infrastructure is easier to justify.

Addressing fleets and activity centres should merely be seen as initial step for the wider market introduction of clean vehicles and fuels, the 'overall'-aim of market introduction programmes should be to reach the private vehicle purchasers. However, today most market introduction programmes are just in this 'initial phase', the use of alternative fuels (with the exception of LPG and CNG in a few countries) is still in its infancy.

IV.3.9 Up-scaling of a Local Project – Looking for Other Consumers and Applications

A lot of market introduction programmes start with the implementation of (one or more) fleet tests and/or P+D projects. Already at the design stage, these fleet tests and P+D projects should be considered not just as a stand-alone project, but as the first step of a market introduction strategy. If the results of the fleet test and the P+D projects confirm the 'marketability' of the tested and demonstrated technology, the next step must be the active up-scaling of the project in terms of geographical scope, in terms of involved stakeholders, in terms of the number of introduced vehicles, in terms of targeted consumer groups, in terms of various applications, in order to push the market introduction initiative. Many (successful) local projects have never been up-scaled, since their initiators have not been interested and motivated to introduce the technology into a wider (but local) market (e.g. A-LPGbus). Some market introduction projects fail to succeed in this up-scaling process (e.g. CNG in Switzerland), but there are also some successful experiences (e.g. CNG-Liverpool(Australia)).

Key success factors for up-scaling of a local project

- The **local project** must be seen as a **first step** for a wider market introduction strategy:
  The involved stakeholders must be motivated to introduce the technology into a wider market. And they must recognise and keep in mind, from the outset of the project, that a purely local project can neither provide the environmental benefits, nor the critical mass of customer demand needed to push the initiative.
  In many cases, local projects are initiated by local authorities or local companies with just one goal: solving local problems. Since these initiators are not motivated to 'up-scale' the project and introduce the technology into a wider market, it would be helpful if they at least would be motivated to spread their experience. For instance funding of the project could be coupled with the obligation to evaluate and publish the results of the project, thus to enable other stakeholders to build upon the experiences of this local project.
- **A Project Manager** must be appointed to drive the project forward and to co-ordinate the myriad of issues that will surface as the project is progressing.
- **'External' stakeholders** must be invited to join a partnership to bring the market introduction programme to life:
  Since the initiators of the project usually neither have the financial nor human resources, technical knowledge, lobbying and marketing skills, nor the influence needed to achieve the aim of wider market introduction of alternative fuels and clean vehicles, they must try to persuade a great variety of stakeholders (local/ regional/national government, motorist advocacy organisation, environmental lobby groups, vehicle/conversion parts-industry, fuel industry, etc.) to join a 'task force' to develop strategies and links needed to bring the market introduction programme to life.

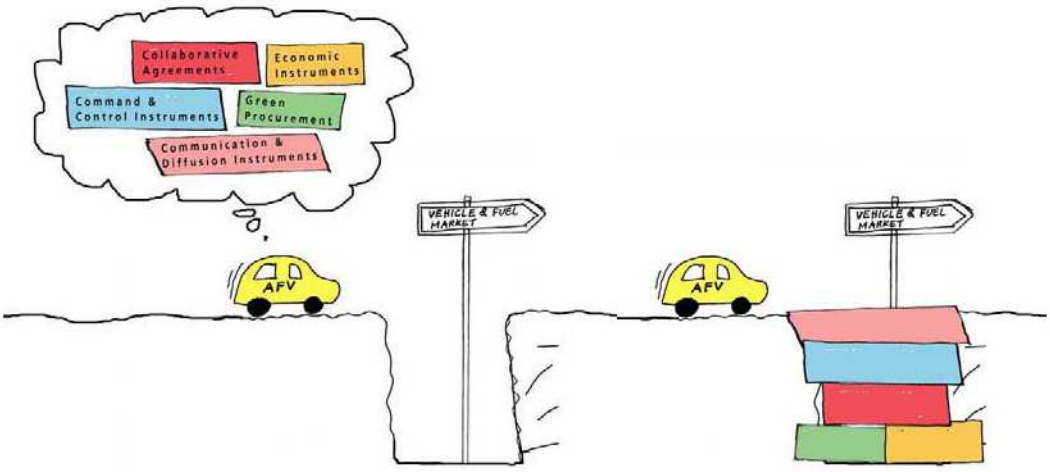
- **Creation of a network**:
  Other local governments and interested stakeholders in other municipalities must be informed about the results of the local project and the plans for the future in order to facilitate establishing similar projects in other municipalities.
- **Development of a refuelling network**:
  Progressive development of a refuelling network by encouraging other local governments to make a commitment to this alternative fuel and to provide leadership in their respective communities is necessary.
- **Lobbying activities**:
  Through lobbying by the members of the 'task force', the authorities may recognise the national (and even trans-national) significance of the project.
- **Media**:
  It is essential for the success of the up-scaling of the local project, that the project is being recognised in the (national) media as a viable option to help to reduce local and national air pollution and greenhouse gas emissions.
- **Continuous public and business education** about the benefits of this alternative fuel for private and commercial vehicles is necessary.
- **Development and distribution of training packages** for mechanics, emergency service personnel, fleet managers and operators is essential.
- **Establishing a market for used clean vehicles**:
  Especially fleet owners are concerned about the resale value of their used clean vehicles and therefore often reluctant to acquire such clean vehicles. Organised sales of used clean vehicles at public auctions may be helpful in solving this problem.
- **Clean vehicles/fuels as 'Contractor-Specification'**:
  The use of the alternative fuel may be specified as a requirement for any vehicle operated by a contractor (e.g. domestic garbage collection contract, public transport services contract, etc.)

IV.4 Measures to Overcome Barriers

In order to enter the vehicle and fuel market successfully, clean vehicle-technologies and fuels must offer advantages - or at least no disadvantages - to all relevant stakeholders. Since clean vehicles/fuels usually cannot offer advantages to all relevant stakeholders under present framework conditions, supporting measures that aim to change these framework conditions are necessary.

There is a wide variety of supporting measures – command and control instruments, economic instruments, procurement instruments, collaborative instruments, communication and diffusion instruments (see Table IV.2 *Supporting Measures*) that will be briefly described within the following paragraph.

SUPPORTING MEASURES ARE THE BRICKS THAT HELP TO BRIDGE THE PRESENT GAP ON CLEAN VEHICLES' AND FUELS' WAY TOWARDS THE MARKET.



Command and Control Instruments

- **Standards**
  Standards are necessary to promote clean vehicles in several ways:
  - standards for quality and safety of clean vehicles and fuels to reassure users
  - standards for technical design to ensure compatibility of refuelling systems and allow free movement of vehicles between different countries. Standards promote competition and innovation by allowing the connection of components made by different manufacturers.
  - reform in inappropriate existing standards and regulations which discriminate unnecessarily against cleaner vehicles
- **Emission-Regulations**
  Up to now, vehicle emission regulations that have become gradually stricter in most countries during the past decades have stimulated the development of cleaner conventional vehicles but had no big effect on the market introduction of clean vehicles.
  One approach to promote the market introduction of clean vehicles and fuels is simply to force manufacturers to develop cleaner technologies through the imposition of very tough medium or long term emission standards (e.g. the *Californian ZEV programme*).
  Progressive regulations, including air quality regulations and emission standards, can act as catalysts to spur technological development. However, regulators must be prepared to adapt the standards as new technologies become available and markets develop (or fail). When promoting (or forcing) clean vehicle technology, regulators are well advised to maintain state-of-the-art expertise in technological and environmental impact assessment issues in order to maintain strength as a negotiating actor.

Supporting measures for the market introduction of clean vehicles and fuels

Command and Control Instruments

- **Standards**
- **Emission-regulations**
- **Licensing**
  inclusion of environmental criteria in licensing procedures
- **Quality Contracts**
  inclusion of environmental criteria in contracts for procurement of public services and public vehicles, etc.
- **Mandates**
  - for procurement of clean vehicles
  - for selling of clean vehicles
- **Exemptions from certain restrictive regulations**
  - access to restricted zones, bus lanes, etc.
  - exemptions from parking and driving restrictions

Economic Instruments

- **Direct investment**
  - in research and development
  - in infrastructure
  - in demonstration-projects
- **Pricing policies**
  - road pricing
  - parking fees
  - internalisation of external cost of transport
- **Subsidies**
  - for vehicle purchase and conversion
  - for infrastructure construction and operation
- **Tax incentives**
- **Financing schemes**

Procurement Instruments

- **Green procurement**
- **Leadership by example**
- **Common procurement**

Collaborative Instruments

- **Network-management and co-ordination**
- **Certification and labels**
- **Voluntary agreements**
- **Public-private partnerships**
- **Private-private partnerships**

Communication and Diffusion Instruments

- **External information**
- **Marketing**
- **Vehicle buyers' guides and vehicle labelling**
- **Internal information**
- **Education and training measures**
- **Persuasion and lobbying activities**

Table IV.2- Supporting measures

- **Licensing**
  Environmental criteria may be included in licensing procedures (e.g. for taxis or public transport)
- **Quality contracts**
  Quality contracts allow the inclusion of environmental criteria when issuing contracts for purchasing public service vehicles (e.g. refuse trucks) or public services (such as public transport services, garbage collection services, delivery services, etc.)[39]. The use of quality contracts may require reforms of existing legislation on public procurement which often forces local authorities to accept the cheapest tender regardless of environmental quality.
- **Mandates**
  - for procurement of clean vehicles
    The mandatory approach to green procurement requires a certain number of clean vehicles to be incorporated into public sector fleets, usually by buying clean vehicles when conventional ones are taken out of service[40].
  - for the selling of clean vehicles
    (e.g. the Californian ZEV mandate)
- **Exemption of clean vehicles from certain restrictive regulations**
  In several countries advantages regarding the access to certain areas are offered for clean vehicles. Examples include:
  - 'high occupancy vehicles'-lanes[41] and bus lanes may be used by certain clean vehicles, regardless of the number of passengers
  - restricted zones (e.g. pedestrian areas, inner-city-zones, national parks[42],…) are open for clean vehicles
  - clean vehicles may be parked, where it is forbidden to park conventional cars
  - clean vehicles are exempted from restraint of driving motor-vehicles during smog-alarm-periods within metropolitan areas
  - certain clean heavy duty vehicles are allowed to drive in sensitive city-areas during night time, where operation of conventional heavy duty vehicles is not allowed for noise-limitation reasons

  However, as clean vehicles become more popular, their driving in bus lanes and pedestrian zones may not be acceptable any more - so these incentives are generally viewed as short term incentives only.

Economic Instruments

- **Direct investment**
  - R+D support
    Although now supplemented by a range of complementary market-based measures, direct support for pre-commercial R+D is still very important for overcoming the technical barriers to clean vehicles and bringing down production costs. In most projects this support is provided by national governments but sometimes also the alternative fuel industry financially supports R+D activities for clean vehicles.

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[39] e.g. Helsinki was the first public body in Finland to introduce competitive bidding for bus services. Tenders are judged on "economic advantage", using a points system that takes account of life cycle costs and environmental advantages. Environmental points are given for meeting certain NO_x and particulate emissions targets.

[40] e.g. France: public fleets of over 20 vehicles have to work towards a target of 20% alternative fuelled vehicles as old vehicles are scrapped. The Netherlands: 50% of public service vehicles must be clean fuelled by 2002.

[41] e.g. HOV lanes may be used by alternative vehicles in California

[42] e.g. four U.S. national parks using alternative vehicles: Yellowstone (bio-diesel), Grand Canyon (CNG, LNG, electric and light rail), Zion (LPG) and Mid-Atlantic (CNG, electric).

- Infrastructure
  The lack of refuelling or recharging infrastructure is a major barrier to the uptake of clean vehicles. Several initiators of market introduction programmes address this barrier by direct investment in infrastructure[43].
- Demonstration
  Support for the funding and management of demonstration projects is a popular tool in the promotion of clean vehicles. However, there are only few examples of pro-grammes aiming at the (preparation of the) market introduction of clean vehicles and fuels - 'stand alone' fleet tests and P+D projects are far more widespread than projects that give priority to market introduction.

- **Pricing policies**
  - Road pricing
    The idea behind road pricing is to link costs more strongly to the vehicle use, i.e. in-stead of paying a single high charge (e.g. for vehicle purchase tax) the user will pay according to the distance travelled or type of infrastructure used. Road pricing also presents an opportunity to encourage cleaner vehicles, by setting the price based on the vehicle emissions[44].
  - Parking charges
    Offering preferential parking charges for clean vehicles can be a contribution to com-pensating users for the added cost of such vehicles[45] .
  - Internalisation of external cost of transport
    Although there are still a number of unresolved problems related to the practical implementation of internalisation strategies, any attempt towards the internalisation of external cost of transport will be a strong incentive for investment in clean techno-logies, as the consumer will directly experience the reduced environmental burden as reduced private costs.
- **Subsidies**
  - Vehicle purchase and conversion subsidies
    Subsidies for purchasing new clean vehicles and for switching to a clean fuel (con-version of a conventional vehicle) form a major part of many support programmes for clean vehicles[46].
  - Subsidies for infrastructure construction
  - Public transport subsidies
    Governments frequently provide subsidies for public transport in order to ensure a comprehensive service on all routes, not just the most profitable ones. These subsidies can be directed at cleaner vehicles[47].
- **Taxes**
  The use of fuel taxes[48] and vehicle taxes[49] to promote clean vehicles or fuels is popular in many countries. However, increase in taxes on conventional fuels can be very unpopular[50], both with

[43] e.g.: The Italian government plans to invest in the introduction of a CNG refuelling network.
The Cities of Florence and Copenhagen, and some Swedish cities, have provided free recharging facilities for electric vehicles

[44] e.g. the German government plans to introduce a distance-based highway charge with emissions components for HDVs.

[45] Copenhagen and some Swedish cities offer free parking to electric vehicles and also provide designated spaces with free recharging facilities.
The city of Gothenberg offers free parking for any vehicle meeting the Environmentally Enhanced Vehicle (EEV) standard recently adopted by the European Commission.

[46] e.g.: Subsidies for cleaner vehicles in the EU
France: 7600 Euro for heavy-duty (or 760 € for cars) running on CNG, LPG and electric vehicle;. an additional 1500 Euro subsidy for EVs is available from EdF (the French electricity utility).
Italy: 4500 Euro for an electric vehicle, and 2300 Euro for a CNG-vehicle
Netherlands: Up to 15% of the cost of an EV or HEV as part of the DEMO programme; Subsidies for conversion of buses to LPG or CNG.
UK: Up to 75% of the incremental cost of buying a LPG, CNG or electric vehicle through the Powershift programme

[47] For example, the Netherlands' government uses a formula based on NOx, CO, VOC and particulate emissions to determine the level of subsidy to bus operators.

the general public and with the freight sector. Reductions in taxes on alternative fuels can face less opposition.
In order to promote clean vehicles and fuels, consistency of taxation is very important, since the vehicle market reacts extremely sensible on economic changes[51].

- **Financing schemes**
  Financing schemes for the purchase of clean vehicles, the conversion of conventional vehicles and the construction of an infrastructure for alternative fuel availability (e.g. fuelling stations, pipelines, service centres, etc.) are important measures to successfully overcome the barrier of high investment cost (*e.g. CNG-Japan, CNG-Egypt*)

The analysis of existing financial incentives (within the work of Sub-task II) has shown that the impacts of financial incentives often do not reach the level anticipated before the programme implementation, since either the financial incentives are too small to 'outweigh' the extra cost of clean vehicles[52], or the technology requires behavioural changes that are not accepted by potential users despite of substantial subsidies[53].

The analysis of existing market introduction projects shows clearly that financial incentives are very expensive and not a stand alone instrument to further the market introduction of alternative fuels and clean vehicles.

Procurement Instruments

- **'Green' procurement / 'greening' fleets**
  The aims of 'green' procurement (i.e. purchase of clean vehicles for fleets) are to achieve immediate air quality improvements, and to boost the market by increasing the demand for cleaner vehicles.
  There are both voluntary and mandatory[54] approaches to encourage the procurement of clean vehicles.

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[48] e.g. The Netherlands was one of the first countries to introduce an environmental tax on fossil fuels, with the tax level being calculated based on the overall environmental impact of the fuel.
In Sweden gasoline and diesel are heavily taxed, with the tax being based partly on CO_2 and partly on energy content. Biogas and ethanol are exempt. This is one of the mainsprings of the biogas bus programme.

[49] e.g. In the Netherlands purchase taxes are set in line with a new fuel economy label, which divides cars into seven bands based on the size (by that indirectly on the concumption). The purchase tax on relatively fuel-efficient cars is lowered, and the tax on relatively inefficient cars is raised, depending on how much CO_2 is emitted per kilometre relative to what is technically feasible for cars in the same size class. The measure is expected to reduce the growth in CO_2 emissions by 0.6 Mtonnes in 2010.
In Sweden an environmental sales tax was previously in place, with an exemption for electric vehicles. However this tax was unpopular and was discontinued.

[50] e.g. Fuel tax policies in the UK:
In 1993 the UK government committed itself to an annual fuel price escalator of at least 5% above inflation. In 1997 the new Labour govern-ment increased the escalator to 6%. However, in the face of protests from the freight industry and rural populations, the escalator was abandoned in 1999. Future decisions on fuel tax rates were to be "set on a budget by budget basis", and any future real increases in fuel duties would be "ring fenced" for improving public transport and improving the road network. Most recently, the escalator has been reversed by the pledge to freeze excise duty on petrol and diesel until 2002 as a concession to the fuel tax protestors.

[51] e.g. Sweden previously invested heavily in an LPG infrastructure, but then the tax on LPG was raised and all the infrastructure was dismantled.
In the Netherlands traditionally the LPG share in the car fleet is very high, because for vehicles driving high annual mileage it is cost effective to use LPG, since the tax on LPG (and consequently the price of LPG) is relatively low. With the increasingly stringent emission legislation of recent years, LPG systems have become technically much more complicated than before, resulting in a much higher price for LPG-systems. Since the tax regime has not been adjusted, the share of LPG cars in the Dutch fleet decreased significantly from previously about 10% to currently about 6%. Recently the Dutch government has changed the tax regime somewhat in favour of LPG vehicles.

[52] e.g. vehicle tax exemptions that come to a few $ a year are not relevant compared to the persisting differences in fuel-, maintenance- and vehicle-costs of alternative vehicles

[53] e.g. tax exemptions on fuels or subsidies to decrease clean vehicle prices to the level of conventional vehicles

[54] see point A) Command and Control Instruments

- **Leadership by example**
  Usually the most respected sources of information for people planning to buy a vehicle are other vehicle owners and vehicle users. An endorsement from an other vehicle user is far more meaningful than anything read or seen in magazines, newspapers, TV or trade journals. Also fleet operators are more willing to purchase a clean vehicle, if they are aware that such a purchase has proven itself productive for an other fleet. Fleets generally have a 'wait and see' attitude hoping someone else will assume the risk of being the first one to adopt a new technology. Therefore 'leadership by example', i.e. the use of clean vehicles by the initiators of the market introduction programme ('greening' their own fleets) and the spread of their experiences is an effective measure to promote clean vehicles, since in-use success-stories are the best sales tools for clean vehicle marketers.
- **Common procurement**
  When a large number of users form purchasing consortia, their negotiating power can be greatly enhanced. With larger scale procurement programmes, genuine economies of scale can be achieved, allowing manufacturers to reduce their costs and prices significantly. Transferable options can encourage new buyers, and tender specifications signal vehicle-manufacturers which types of vehicles are most attractive. However, to assure a positive impact of common procurement, it is critical that local retailers are involved early in the process, to help to build a strong local buyer/supplier relationship (examples *for common procurement: ZEUS project, ALTER project).*

Collaborative Instruments

- **Network-management and co-ordination**
  Since most of the existing market introduction programmes are designed assuming a strong 'steering state', the scope of policy instruments within most of the existing market introduction programmes is accordingly rather traditional: direct state regulations and financial incentives are dominant; networking and persuasion are mostly, if at all, seen as a complementary measure. But taking into account the given fact that the current vehicle market is dominated by a few 'big players' (vehicle manufacturers, fuel suppliers), and the 'state' (i.e. the government) usually does not have the resources (money, know-how, legal authority) to steer the action of those 'big players', the 'network state' where the government takes the role of a facilitator, network manager and moderator, would be a more realistic approach to modern policy-making.
  Initiators of market introduction programmes can play an important co-ordinating role between manufacturers, researchers, authorities and user groups.
- **Certification and labels**
- **Voluntary agreements**
  The modern trend for public authorities is to try to forge alliances with manufacturers, based on voluntary agreements backed by the prospect of regulations if the targets are not met. Support for R+D has a valuable role in such agreements – both in demonstrating government co-operation, and helping to set the technical agenda for future developments. A programme with public support can be directed to include more radical technologies as well as incremental improvements in conventional technologies which are favoured by manufacturers *(e.g. voluntary agreement between EC and ACEA[55], voluntary agreement between FIAT and the Italian government, 'Memorandum of Agreement' within the Californian ZEV-programme, etc.)*
- **Public-private -partnerships**
  - Quality partnerships[56]

[55] a voluntary agreement between EC and ACEA (representative body of the vehicle manufacturing industry) where manufacturers have agreed to reduce the average CO_2 emissions of new cars to 140 g/km by 2008 has been reached in 1998

[56] For example, within the last years this approach has been used widely in the UK, although generally it has been used to encourage the adoption of cleaner diesel buses and easier disabled access (low floor buses) rather than alternative fuelled vehicles.

Quality partnerships are voluntary agreements between local authorities and public transport operators. Operators agree to invest in higher quality services including new, cleaner vehicles and staff training, and in return local authorities agree to invest in traffic management schemes such as bus lanes and improved facilities.

- Regional Transportation Centre (RTC)[57]
  Regional transportation centres dedicated to clean vehicles and alternative fuels bring together clean vehicle availability, service, refuelling, and education/awareness.

- **Private-private partnerships**:
  Examples for partnerships among private companies that provide advantages for all partners:
  - Partnerships of fuel suppliers and fleet owners[58]:
    Suppliers may be willing to invest in refuelling infrastructure in order to open up a new market for their fuel. For depot-based systems, the supplier can recoup the investment cost through a long-term fuel supply agreement with the user. This removes the investment risk from the fleet operator. It is important to encourage the fuel supplier and fleet operator to allow third party access to the facilities, in order to support the diffusion of the fuel to other users including non-fleet applications.
  - Partnerships of fuel suppliers and vehicle-conversion-shops or vehicle manufacturers:
    In most countries, the alternative fuel supplier must rely upon market entry by other companies to provide the clean vehicles. This dependency can severely limit market development. Partnerships among vehicle conversion shops or vehicle manufacturers and fuel providers help to overcome this dilemma[59].
  - Partnerships of vehicle users and vehicle dealers:
    Vehicle users anticipate some vehicle repair needs, but they (especially fleet operators) are concerned about the length of time the vehicle is out of service. They are looking to form a 'partnership' with clean vehicle manufacturers and dealers in order to develop a strong clean vehicle support network and to minimise downtime. Emergency roadside service and free loaner vehicles during breakdowns are two examples of services fleet operators expect from dealers, manufacturers and leasing companies.

Communication and Diffusion Instruments

- **External information and awareness campaigns:**
  For the success of a market introduction programme it is absolutely necessary to attach great importance to clear objectives that are transparently communicated by continuous and intensive information measures. People must be informed about both the advantages and features of the new technologies as well as about the objectives and strategies of the market introduction programme.
  - Public educational efforts (e.g. in newspapers, schools and driving schools, etc.) about clean vehicles and fuels and the advancements made in clean vehicle technology are very important.
  - Partnerships with people and organisations who can 'help to spread the word' are essential for the success of information and awareness campaigns, since unbiased third party endorsements usually are paid more attention by the public.

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[57] e.g.: The RTC in San Diego (U.S.) includes Ford Motor Company, the U.S. Department of Housing and Urban Development, the U.S. Department of Energy and the local Clean Cities Coalition, among others.

[58] *e.g. this* approach is widely used in the UK to implement LPG- and CNG-fuelling stations

[59] e.g. Alliance between eFuels and Ford aiming at linking the marketing of CNG-vehicles to the provision of fuelling infrastructure: In three geographic areas (Vancouver, Toronto and Arizona) eFuels (a subsidiary of BC Gas Inc.) will work with Ford on a number of CNG-projects, including Ford dealer service and sales training, customer prospecting, sales calls, demonstration vehicle displays, event marketing and customer awareness campaigns. eFuels will provide CNG-infrastructure development in these target areas, while Ford will strengthen marketing efforts for CNG-vehicles there.

- It is essential to assure that local retailers are committed to the programme. Their enthusiasm or reluctance about the new technology is crucial to the success of the market introduction programme, since they are the main link to the customers.
- Satisfied users are most important, since they will spread their experience and the 'word of the mouth' weighs more than any marketing campaign

- **Marketing**
  It is important that the marketing activities for clean vehicles and alternative fuels are not 'problem-centred' (e.g. stressing the environmental and macro-economic advantages of these technologies) but position alternative fuels and clean vehicles as modern technology that has much to offer for the individual: 'fun, love and freedom' - that's what people want…
- **Vehicle buyers' guides and vehicle labelling:**
  Easy accessible information about the performance, the safety, and the advantages of clean vehicles is most important. Vehicle Buyers' Guides (*e.g. the Powershift-register in the UK, the CleanCities' Fleet Buyers' Guide*) and vehicle labelling (*within the European Union, e.g., informing the customers about the CO_2-emission and fuel consumption of the vehicle is mandatory*[60]) are examples for consumer-friendly, easy accessible information that helps customers in comparing different (conventional and clean) vehicle models and gives them the possibility to take full life-cycle costs as well as environ-mental issues into account:
  - Information of consumers about vehicle economies: In principal, alternatively fuelled vehicles tend to have lower fuel costs and/or reduced maintenance, but higher vehicle purchase costs. Thus, the use of full life-cycle cost accounting, rather than simple vehicle purchase price comparisons, would tend to favour clean vehicles. In order to make the potential economic benefits of using clean vehicles, compared to conventional vehicles, visible for the consumers, the operating costs should be explicitly stated along side the purchase price in sales brochures and showrooms.
  - Information of consumers about vehicle ecologies: Surveys show that usually environ-mental issues are not a primary criterion for the purchase-decision of a certain vehicle model. However, environmental issues may be decisive for the purchase of a certain vehicle model out of a group of several models that equally fulfil the customers expectations regarding performance and economies.
- **Internal information**:
  Just as important (but often neglected) are internal information and education activities in order to keep all people continuously informed that are directly involved in or affected by the pro-gramme.
- **Education and training measures:**
  Development and distribution of training-packages for vehicle-sales-personnel, mechanics (repair-, maintenance- and service-personnel) and conversion-shop-employees is essential in order to establish both, a sound standing pre-sales-service and a good after-sales-service. Additionally, also education and training measures for emergency services personnel, fleet operators, driving-school personnel etc. must be offered.
- **Persuasion and lobbying activities:**
  Persuasion and lobbying activities (on local, national and international level) with the objectives to get additional partners (e.g. governments) committed to the market introduction programme and to achieve more favourable framework conditions for alternative fuels and vehicles are one of the most important measures within every market introduction strategy.

Each of these supporting measures can be best introduced by certain stakeholders. National and local governments can utilise all of the mentioned supporting measures, whereas other stakeholders have a more limited repertory of supporting measures which they can apply: Regulatory and legal measures, e.g., can only be implemented by national and local governments, whereas financial

[60] There is an existing legally binding EU directive

measures may also be implemented by some other stakeholder groups (like vehicle manufacturers, fuel providers, and NGOs), and informational and educational activities can actively be carried out by all stakeholders. However, the implementation of most measures, especially the implementation of governmental measures, can be effectively supported and (to a certain degree) enforced or hindered by other stakeholder groups.

IV.5 General Recommendations for Government Measures

The role of the government, government measures, regulations and incentives, and their results in different countries have been analysed within Subtask II. Based on the experiences made, it is recommended that governments should follow an approach based on the following considerations:

- Governments cannot steer the clean vehicles and fuels market by themselves, but they can give positive impetus.
- Give priority to network management as instrument to prepare the market introduction of clean vehicles and fuels. This means the inclusion of manufacturers and fuel suppliers in a network to come to a common and economically viable strategy that favours the introduction of clean vehicles and fuels into the mass market.
- The effectiveness of this approach may be fostered if it is combined with credible legislation (including sanctions) on quotas and/or emission-limits.
- Financial incentives can play an important but only complementary role. However, tax reductions (fuel, vehicle taxation) should be bound to a certain degree of market penetration of corresponding clean vehicles and fuels. Flexible bonus-malus-models seem to be an adequate instrument in this respect.
- Deployment strategies should be carried out with continuity and they may be necessary for quite a long period.
- Focus deployment strategies, especially direct market intervention, to marketable technologies that either offer the users substantial personal advantages or require no or only little change in user behaviour.
- An important task of the government is to push for more formation and information of the citizens.

Since the vehicle and fuel market is a global market, national governments should not only facilitate networking inside their countries, but also on a transnational level. Partially this already happens (*e.g. Kyoto protocol, European Commission Directives*), but more international co-ordination is necessary.

IV.5.1 Combination of Supporting Measures

Each of the measures to support the market introduction of clean vehicles and fuels may be introduced as a ‘stand-alone’ measure. However, the effect will be greater if several measures are implemented as a package that is tailored to the unique framework conditions of the concerned country or region. Actors in the field of market introduction of clean vehicles and fuels have to select that combination from a variety of measures that will most likely be able to remove the actual existing barriers to the successful introduction of clean vehicles and alternative fuels in their country. The various measures of the market introduction programme and the overall national policy must be co-ordinated one another.

Since the market introduction of clean vehicles and fuels is a long process, it is necessary to perpetually adjust the selection and implementation of supporting measures to changing framework conditions.

For the selection of supporting measures some general recommendations concern the following points:

- Carefully analyse the framework conditions and possible barriers to the market introduction of clean vehicles and alternative fuels in the concerned city/region/country.
- The combination of measures that shall be applied in order to facilitate the market introduction of clean vehicles and alternative fuels must be tailored according to the specific framework conditions of the target city/region/country.
- The measures must be introduced in a co-ordinated manner as a 'bundle of measures'.

Since every 'bundle' of supporting measures must be tailored according to the specific framework conditions of the individual market introduction programme, it is not possible to give a general recipe for a promising combination of supporting measures. But it may be useful to have a look at the different approaches that existing market introduction programmes have taken. Some examples for a successful combination of supporting measures can be found in sub-section IV.9.1.

IV.5.2 Networking

None of the concerned stakeholder groups has all alone enough resources to successfully establish clean vehicles or fuels on the market. Since the market introduction of clean vehicles is a highly interdependent und complex issue, initiators of market introduction programmes have to give priority to network management, i.e. inclusion of other relevant stakeholders in a network to come to a common and economically viable strategy that favours the introduction of cleanly fuelled vehicles. Co-operation and collaboration among the stakeholders, and persuasion and lobbying activities are essential for the success of a market introduction programme.

IV.5.3 After-sales Service

After-sales service is certainly not a governmental task. But during the setting up of demonstration programmes, together with other stakeholders, the importance of the development of a sales- and service-system and the difficulties related to this task are often under-estimated. In so far programme managers have to deal with this problem and sometimes have to initiate the relevant steps, together with the vehicle supplier network. It must not be neglected that the introduction of a new vehicle concept is a big challenge for both, salespersons and mechanics. Even if the manufacturer of the clean vehicle is a big, well known company that can utilise the already established network of sales- and service-points for its conventional vehicles, not all of the established dealers are enthusiastic about the new technology. Furthermore, if the number of clean vehicles to be serviced by a certain dealer is small, he will not be able to get enough experience and competence and will loose interest in selling and servicing clean vehicles. Therefore the training of salespersons and mechanics in order to guarantee a well developed service network to the customer is crucial for the success of a market introduction programme.

IV.5.4 Timing and Monitoring

Setting the Timeframe

It is not possible to give general guidelines for setting the timeframe of a market introduction programme. However, it is important to remember that the successful outcome of an clean vehicles/fuels programme is attained gradually and can not be forced in an untimely manner. Therefore, it is essential that a market introduction programme is scheduled for a long period to bring along changes of the framework conditions and allow the market to react. Market introduction programmes must be in place long enough and funded at a consistent level in order to form a reliable base for developmental plans of industries and consumers.

Monitoring and Assessment of Results

One noticeable result of the analysis of existing market introduction programmes is the fact that there is a striking lack of independent, policy-oriented evaluations open to the public. Most projects have, if any, only technical evaluations of function and reliability of the introduced clean vehicles. More systematic, policy oriented programme evaluations would facilitate to learn from the programme's success and failure and would thus contribute significantly to a better design of future policy programmes. The design for monitoring and evaluation must already be included in the design of the programme. Continuous monitoring can facilitate the assessment of the strategy, so that the applied measures can be adjusted whenever necessary throughout the operational time of the programme.

IV.6 Niche[61] Markets

Vehicle technologies that are not able to compete with conventional gasoline and diesel vehicles in terms of vehicle performance cannot successfully be introduced into the general vehicle market. However, such vehicle technologies may be successfully introduced into market niches that offer special framework conditions where they can compete with conventional vehicles. Such market niches may be certain areas (e.g. inner cities, nature preservation areas, airports, corporate/academic campuses, tourist resorts), certain transport modes (e.g. car-sharing), certain transport purposes (e.g. shopping, commuting to work,), certain vehicle-fleets (e.g. post, courier services), certain types of vehicles (e.g. two-wheelers, garbage-collection trucks) or a combination of certain areas, transport-modes, vehicles and -purposes.

IV.6.1 Key Factors for Success and Failure of Niche-Market-Introduction of Clean Vehicles and Fuels

In principle, market introduction programmes aiming at the introduction of clean vehicles and fuels into market niches face the same problems and barriers and apply similar strategies to overcome these problems and barriers as market introduction programmes that aim at introducing clean vehicles and fuels into the general market. Therefore the same factors for success and failure are applicable.

However, some issues are stressed especially, since they often have turned out to be pitfalls for the introduction of clean vehicles and fuels into market niches:

- Before starting a market introduction programme, carefully analyse the framework conditions of the targeted market niche.
  e.g. Within the *'Kyoto Public Car System'* the users' demand is not satisfying. An analysis of the framework conditions (e.g. mobility studies) before the start of the project would likely have shown this risk in advance.
- Do not try to introduce vehicle-technologies that are not marketable.
  Vehicle technologies, that do not serve the demand of the users for high reliability, can not be successfully introduced to the market - there are no (!) market niches for vehicles with long and frequent 'down'-times. The combination of large-scale introduction and technology testing costs more money than needed and, what is even more disastrous, a lot of good-will will be lost.
- It seems to be wise to try one thing at a time: Try to introduce a new mobility concept using marketable technology or try to introduce new technology using well-known concepts.
  Many projects have experienced that the introduction of new mobility concepts in combination with new vehicles (possibly prototypes) costs more money and good-will than needed (*e.g. CityCar Martigny* where the electric vehicle model did not meet the increased demands on a vehicle used in a public car sharing system). Therefore, first the innovative mobility-concept (e.g. car sharing) must be introduced and then, if the 'market introduction' of the mobility-concept has been successful and people are already

[61] Niche = A place or activity for which something is best fitted

familiar with the concept, the introduction of new vehicle technologies into this niche market may be started.

IV.6.2 Niche Markets for Electric Vehicles

Many market introduction programmes aim/aimed at the introduction of electric vehicles into market niches (*e.g. Praxitèle (F), Liselec (F), ELCIDIS (EU-project), Station-car projects (U.S.), EVs in Gothenburg (S), etc.*).

Several studies produced surveys and interviews of user attitudes and expectations of EVs. According to these surveys most current users of EVs work for public authorities or public-owned companies and use EVs as general service pool cars and delivery vehicles. The majority of drivers feel that the EVs meet their transportation needs on the job, but most of them are not interested in owning an EV themselves. - EVs are suitable for various company applications but less useful for households, especially if the household only can afford one car.

Possible niche markets for EVs may be:

- 'City Cars'
  The development of a market for EVs as 'City Cars' depends partly on local regulations: if vehicles with tailpipe emissions are prohibited to operate in sensitive urban areas, EVs can help users retain access to these areas, etc.
- Shared cars
  There are two major drawbacks for EVs as shared cars:
  - There might be problems with the range of the vehicles, because if the car-sharing programme is successful, cars are used almost continuously and no time remains for recharging
  - The high purchase cost make EVs less attractive for private car-sharing organisations. How-ever, using small, inexpensive, short-range EVs in car-sharing fleets, which include also larger and more powerful vehicles, can help car-sharing organisations to offer an environmentally friendly option for short trips, without excessive added cost.
- Self-Service Systems for short-time and short-range vehicle-rental
  Some pilot-projects aiming at the introduction of such systems (e.g. *CityCar-Martigny, Praxitèle*) have been running recently or are still running. However, these systems have difficulties to position themselves in the transport market and face problems with users ' acceptance, since they require major behavioural changes. Once such transport systems are established on the transport market, they could offer a good application-field for EVs.
- Delivery vans and service vehicles
  Within several projects EVs have been tested as delivery vans and service vehicles for postal service, utilities and messenger/delivery services. As with 'City Cars', the development of a market for these vehicles depends partly on local regulations, i.e. restrictions for conventional vehicles to enter certain sensitive urban areas. But as with shared cars, some vehicles in delivery services are utilised almost continuously, making short range associated with battery electric vans a problem.
- Cycles, scooters, mopeds and motorcycles
  These two-wheelers are popular in southern European cities and in Asia, and electric drive could offer both reduced emissions and reduced noise. But, especially in these densely populated areas, where people mostly live in flats and park their two-wheelers on the streets, successful introduction of electric-drive would require the establishment of extensive public recharging facilities.

IV.7 Conclusions

IV.7.1 General Recommendations for Initiators of Market Introduction Programmes

General recommendations for those who want to design and implement a market introduction programme for clean vehicles and fuels can be formulated as „Ten Commandments“:

The "Ten Commandments" for Market Introduction Initiatives

1. Analyse the framework conditions thoroughly before starting a market introduction programme, and do not forget to include social, cultural and behavioural issues as well as technical and infrastructure issues.
2. Learn from others' experiences, from the success and failure of previous market introduction programmes in order to find out the most feasible way to promote clean fuelled vehicles and clean fuels – but do not forget to keep in mind that the adaptation of a successful concept to the unique framework conditions of your target market is absolutely necessary.
3. Do not try to bring technologies on the market that are not yet marketable - bad experiences will determine people's attitudes for a long time.
4. Either choose vehicles/fuels that can compete with conventional technologies in terms of performance, or select a market niche where the targeted vehicles/fuels are competitive to existing technologies: keep in mind: market introduction of a technology that requires (substantial) behavioural changes from the users is really a challenge - such technology must offer outstanding advantages to the users, otherwise they will not accept it.
5. Work hard to bring aboard all relevant stakeholders - don't forget to include stakeholders (misleadingly) perceived to be 'unimportant'.
6. Large scale market introduction of the targeted vehicles/ fuels must bring advantages (or at least no disadvantages) for all relevant stakeholders - in the majority of cases modification of framework-conditions will be necessary to comply with this condition:
   use supporting measures to 'shape' the framework conditions favourably - and design the applied bundle of supporting measures tailored to the (unique) framework conditions of your target market.
7. Include continuous monitoring into the programme-design throughout the entire term of the programme - regular independent assessment of the programme results, regular analysis of (rapidly changing) framework conditions and regular adjustment of the applied measures is absolutely necessary.
8. Set a high value on information, awareness, education and marketing activities since the success of a market introduction programme strongly depends on social change and on behavioural change.
9. Set a high value on the quality of after sales service, since the customers (i.e. vehicle-purchasers) will also set a high value on this issue - and they will spread their experience…
10. When selecting a market niche, keep in mind that it is wise to try one thing at a time: try to introduce a new mobility concept using mature technology or try to introduce new technology using well-known concepts.

… and do not forget to keep in mind, that market introduction of clean vehicles and fuels will take time …

Abiding by the (above stated) rules is no assurance for a successful market introduction of clean vehicles, but non-observance of one of these basic rules will most likely lead to a flop.

IV.7.2 Recommendations for Stakeholders for Market Introduction Activities

Recommendations for Government Administrations on All Levels

intergovernmental authorities

- act as a facilitator of networking
- provide funding of networking
- provide standards for technical design, quality, safety of clean vehicles, fuels and needed infrastructure
- reform inappropriate existing standards and regulations unnecessarily discriminating clean vehicles
- provide stringent emission regulations
- enact regulations and laws flexible enough not to discriminate innovative clean technologies
- initiate information and awareness campaigns

national/federal governments

- define long-term, medium-term and short-term goals
- act as a facilitator of networking
- provide funding of networking
- establish collaborative agreements with vehicle- and fuel-industries
- co-operate with environmental and health organisations
- certification and labelling
- initiate information and awareness campaigns
- encourage/mandate "green procurement" for public fleets, taxi, public transport, ...
- leadership by example (purchase clean vehicles for the government's fleet)
- provide favourable framework conditions in terms of "green" taxes
- provide favourable regulations (flexible enough to fit more than one technology)
- encourage/mandate eco-labelling
- provide funding of research, development, demonstration and deployment
- evaluate the effects of the promotion measures during and after the implementation
- identify and use 'symbolic' measures to send a signal and show the commitment of the government (e.g. labelling like "Energiestadt")
- establish financing schemes for the purchase/conversion of clean vehicles and the needed infrastructure

local/regional authorities

- collaborate with vehicle- and fuel-industries (especially seek collaboration with local vehicle-retailers, local service and maintenance providers, local fuel providers, etc.)
- provide favourable framework conditions by 'green' local taxes/fees
- provide necessary infrastructure
- engage in city-networking
- establish priority lanes and special parking zones for clean vehicles
- implement exemptions for clean vehicles from restrictive regulations (e.g. access restrictions)
- leadership by example (purchase clean vehicles for the local/regional authority's fleet)
- encourage/mandate use of clean vehicles for public transport, freight transport services, …
- create a purchase consortium for clean vehicles
- provide stations where users can change to "clean vehicles"
- provide funding of demonstrations
- initiate information and awareness campaigns (car-free days,....)
- include environmental criteria in contracts for procurement of public services and public vehicles
- initiate quality partnerships (e.g. with public transport providers, municipal service providers,…)
- initiate regional transportation centres dedicated to clean vehicles and fuels
- establish financing schemes for the purchase/conversion of clean vehicles and the needed infrastructure
- provide subsidies for public transport companies directed at clean vehicles
- provide subsidies for infrastructure construction
- evaluate the effects of the promotion measures during and after the implementation
- engage in lobbying and persuasion activities

Recommendations for Industrial Partners

fuel industries (providers and distributors of clean fuels)

- co-operate with the vehicle industry
- co-operate with fleet owners
- co-operate with environmental and health organisations
- provide the necessary infrastructure
- organise information and awareness campaigns
- establish financing schemes for the purchase/conversion of clean vehicles and the construction of infrastructure
- leadership by example
- engage in lobbying and persuasion activities
- initiate information and awareness campaigns

vehicle manufacturers

- co-operate with the fuel industry
- co-operate with fleet owners
- co-operate with environmental and health organisations
- enable joint research with competitors
- develop vehicles for niches
- training of retailers and mechanics
- establish a distribution and maintenance network
- build up „competence centres“
- agreements with governments on development and selling of clean vehicles
- establish financing schemes for the purchase/conversion of clean vehicles and the construction of infrastructure
- engage in lobbying and persuasion activities
- initiate information and awareness campaigns

supporting industry

- commit in coalitions
- engage in lobbying and persuasion activities

local vehicle retailers and providers of maintenance and service

- co-operate with fleet owners
- co-operate with local authorities
- engage in lobbying and persuasion activities
- disseminate information and initiate local awareness campaigns
- establish a market for used clean vehicles

Recommendations for Users and Lobbying Groups

vehicle users/fleet operators/car-rental and car-pool organisations

- identify and analyse application niches
- identify user behaviour

car users associations and business associations

- identify needs of the users
- disseminate information and initiate awareness campaigns
- organize test driving events
- engage in lobbying and persuasion activities

environmental organisations / health organisations

- initiate awareness campaigns
- provision and dissemination of information
- engage in lobbying and persuasion activities

Of course these lists of recommended actions can not be universal and comprehensive, since the applicability, necessity and usefulness of each measure depends on the local/regional/ national framework conditions.

Additionally to the deployment activities included in these lists, activities to further develop and improve clean vehicles and fuels (research, pilot schemes, demonstration programmes, etc.) are also important and must not be neglected.

IV.8 Open Questions

Existing strategies for the market introduction of clean vehicles and fuels focus on the near future, trying to stimulate the diffusion of those technologies and concepts that are close to the market phase. Market introduction of these clean vehicles is also the scope of this report.

However, this approach is likely to solve only part of our problems: Optimisation of the current transport regime by introducing clean vehicles may solve some of the traffic and transport related problems (like vehicle emissions), but to tackle other major transport related problems (like congestion) more profound changes will be needed - a different long-term target should be set, i.e. the aim should be 'regime renewal', change of people's transport behaviour and mobility perceptions.

Such long term strategies aiming at creating sustainable transport by changing people's choice of means of transport and mobility perceptions are not within the scope of this report, since they are not primarily focussed on vehicle concepts. However, these strategies could create favouring framework conditions for clean vehicles. It should be investigated in-depth how such long term strategies, aiming at changing people's transport behaviour and mobility perceptions, influence the market introduction of clean vehicles and fuels.

IV.9 Appendices

IV.9.1 Appendix 1: Some examples for successful combination of supporting measures

1.1 CNG Egypt

Some background information:

Egypt has abundant resources of natural gas - natural gas is therefore comparatively cheap. The Egyptian government wanted to introduce CNG as a vehicle fuel, in order to utilize these natural gas resources and in order to solve the problem of disastrous air quality in the metropolitan area of Cairo.

Main barriers for the introduction of CNG as a vehicle fuel:

- the 'chicken and egg' problem[62]:
- people cannot afford the price of the vehicle conversion
- construction of CNG-refuelling stations is expensive

Package of supporting measures:

- Pricing policy

  The government establishes both the CNG pump price and the price of the vehicle conversions.
- Setting standards

  The petroleum ministry issued a decree to insure the safety and performance of the CNG fuelling stations and customers' vehicles conversions. This decree established that only companies approved by the petroleum ministry could engage in CNG-vehicles activities.
- Measures to overcome the 'chicken & egg' dilemma

  The petroleum ministry instructed that companies approved for CNG-vehicle activities would have two very specific corporate objectives: The first would be to construct and operate CNG fuelling stations and the second would be the construction and operation of vehicle conversion centres. As a result, each vehicle conversion produces a customer for the CNG fuelling stations and CNG market development is more efficient customer-focused.
- Taxes

  A five year tax holiday is granted to each approved CNG-vehicle company.
- Restrictions for conventional vehicles

  The council of ministries has decreed that all taxis and microbuses in the greater Cairo area must convert to CNG within the next three years or they will not get a license to do business after these three years. In addition diesel powered school and public transit buses are not allowed to be imported.
- Mandates

  Most likely the Cairo governor will instruct that all new public transit buses must be CNG powered.
- Financing schemes for vehicle conversions

  Most potential CNG customers do not have the financial capacity to pay the $ U.S. 1500 for the vehicle conversion. All CNG-vehicle-companies approved in Egypt offer customer financing programmes that require little or no money down with payments spread over a 12 to 30 month period [63]. In this way the customer has the capability to repay the loan from monthly fuel cost savings. These terms motivate high fuel-use customers (e.g. taxis) to convert which, in-turn, provides the necessary base load of vehicles to justify CNG fuelling station expansion.

[62] Chick&Egg problem: nobody wants to convert vehicles to run on CNG if there is no refuelling and service infrastructure and nobody wants to construct CNG-refuelling and service infrastructure if there are no CNG-vehicles on the road…

[63] The CNG-vehicle companies are taking advantage of a special financing program offered through the government's social development fund. The purpose of this fund is to encourage the formation and operation of small businesses. Taxi and microbus owners meet the criteria to qualify for this funding. The CNG-vehicle companies have been authorized by the social development fund to administer their program:
The CNG-vehicle companies receive a increments (of about $U.S.880,000) at 4% annual interest. The CNG-conversion customers are assessed 7% annual interest with payments spread over 12 to 30 months with no down payment required. In addition the customer pays a 2% fee for insurance. This insurance feature provides the CNG-vehicle companies with a guarantee that they will receive 70% of the monthly payments in the event that the customer becomes delinquent.
This financing tool promotes CNG conversions, provides the CNG-vehicle companies with payment in advance (positive cash flow) and mitigates 70% of the companies' risk in the event of non-payment by the customer. In addition this program grants the CNG-vehicle companies a one year grace period before the loan payment begins. The companies then pay over a five-year period.

- Financing schemes for fuelling stations
  through USAID Commodity Import Programme [64]
- Infrastructure development
  as the petroleum ministry encourages expansion of the natural gas pipeline network into new regions, also the introduction of CNG as a vehicle fuel in these new regions becomes viable
- Partnerships with conventional retail fuel companies
  Since land is very expensive and not readily available, the CNG-vehicle companies have entered into agreements with conventional retail fuels companies to construct, operate and maintain public CNG fuelling stations. This agreements helps optimise the capital for CNG infrastructure development, provides many convenient fuelling locations for the existing customers and promotes growth by attracting new CNG-customers.

1.2 CNG-Liverpool (Australia)

Some background information:
Australia has abundant resources of natural gas - natural gas is therefore comparatively cheap. The County council of Liverpool wanted to introduce CNG as a vehicle fuel, in order to solve the problem of disastrous air quality in the metropolitan area of Liverpool.
Main barriers for the introduction of CNG as a vehicle fuel:

- the chicken&egg problem
- nobody else in Australia seems to be interested in CNG as a vehicle fuel

Package of supporting measures:

- Big efforts by the initiator of the project to persuade additional stakeholders
  The Council recognized that it did not have the financial or human resources, technical knowledge, lobbying and marketing skills, or the influence needed to achieve the aims without external support: therefore the Council invited government and private industry groups to join a Task Force to develop strategies and links needed to bring the project to life.
- Leadership by example
  Liverpool City Council resolved to convert its entire fleet to natural gas operation (within five years)
- Networking and Information
  The strategy adopted by the Task Force was to progressively develop a refuelling network by encouraging local governments to make a commitment to NGVs and provide leadership in their respective communities. Following a series of seminars for local governments, which have been conducted by the Task Force, more than 100 councils have expressed interest in the project and several of the largest councils have formally committed to a NGV strategy.
- Lobbying for infrastructure subsidies
  Through lobbying by the members of the Task Force the Australian Government recognized the national significance of the Liverpool project – a grant to support the rollout of a national public refuelling network for CNG was made available.
- Lobbying for favourable tax system
  Through the lobbying by the members of the Task Force a package of support measures for the Clean Transport Fuels market has been included into the legislation for a new taxation system.
- Lobbying for conversion grants
  In 1999 more than $A 100 million have been provided for conversion grants and fuel rebates over the next four years.
- Public relations activities
  The project is being recognized in the Australian media as a viable option to help to reduce Australian's urban air pollution and greenhouse gas emissions.
- Sales of used converted vehicles at public auction
  The success of the project in raising community awareness is demonstrated by the fact that Liverpool Council now has a waiting list of local environmentally conscious residents who are keen to buy its NGVs as they are scheduled for disposal.

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[64] USAID 'Commodity Import Program': To qualify, a company must purchase U.S. goods and receive their delivery via U.S. registered flagship. Meeting these criteria results in an 18 month interest-free and payment-free grace period. The U.S. supplier is paid in full by USAID at the time of shipment. Since the U.S. suppliers of CNG-fuelling station equipment provide good technology and performance at competitive prices, all NGVC fuelling stations to-date have been supplied by U.S. vendors and financed through the Commodity Import Program. Recently a new environmental category was established within this Commodity Import Program which doubles the interest-free and payment-free grace period to 36 months for 'environmental' purchases. All CNG fuelling station and vehicle conversion equipment have been classified as 'environmental' by USAID.

- Appointment of a project Manager
  Crucial for the success of the project was that the Council appointed a Natural Gas Vehicle Project Manager to drive the project forward and to coordinate the myriad of issues that have surfaced as the project has progressed.
- Quality contracts
  Council specifies CNG as a requirement for any vehicle operated by a contractor (e.g. domestic garbage collection contract)
- Education and information of the public
  continued public and business education about the benefits of natural gas as an alternative fuel for private and commercial vehicles
- Education and training for service personnel and special target groups
  development and distribution of training packages for NGV installers and repairers, emergency services personnel, fleet managers and operators
- Lobbying for commitment from vehicle manufacturers
  Coordinating the purchasing requirements of those instrumentalities, government departments and business fleet owners prepared to take up NGVs will provide a critical mass for Australian vehicle manufacturers to overcome their inhibitions to develop and market CNG fuel as an OEM supplied option for their vehicles.
- Lobbying for stricter vehicle emission limits
  Negotiations will continue to pressure the State and Federal Governments to impose stricter emission control limits on the road transport industry, acting as a further incentive for manufacturers to offer NGVs in an attempt to capture of market share of new vehicle sales.
- Internal media and education:
  much effort has been placed on an external media campaign to promote the benefits of CNG, but unfortunately much less attention was paid to the internal media and education requirements of Council staff. This lack of communication has resulted in some loss of confidence in CNG among users. Vehicle faults and difficulties experienced by operators have been rectified, but there has been no feedback mechanism emplaced to ensure incorrect information was not passed amongst Council staff. It is essential that facts associated with each problem be communicated to all users of the vehicles.
- Negotiations for warranty
  Fitting an after-market fuel system conversion potentially voided sections of the manufacturer's warranty. Agreement was negotiated with both the CNG installers and the vehicle manufacturers to provide warranty cover for their respective systems.

1.3 The Powershift Programme (UK)

Some background information:
The British government wanted to introduce clean vehicles, in order to solve the problem of harmful emissions from transport and in order to achieve the CO_2 savings committed to in the Kyoto protocol.
Main barriers for the introduction of clean vehicles and fuels:

- the chicken&egg problem
- clean vehicles are much more expensive than conventional vehicles
- customers are not informed about clean vehicles

Package of supporting measures:

- Subsidies for vehicle purchase
  The main tool is the provision of subsidies of up to 75% of the incremental cost of buying a cleaner vehicle. A key feature is that the subsidies are graded into bands according to the NO_x emissions performance of the vehicle (e.g. 40% (75%) subsidies of the incremental vehicle cost for a reduction of NO_x emissions of up to 49% (of more than 65%) over Euro III…).
- Subsidies for installation of refuelling stations
  Limited support is also provided for infrastructure. At present, grants are available for new CNG refuelling stations, which have a high capital cost.
- Buyer's guide
  Powershift maintains a Register of cost and performance information on approved vehicles which are eligible for funding. This acts as a buyers guide to help fleet managers in their purchasing decisions. Manufacturers have to apply to get their vehicles on the register.
- Continuous revision of support criteria
  Emission-Bands (for determination of the vehicle subsidies) are revised at intervals to take account of new standards and to ensure that support is progressively shifted to cleaner vehicles.

- Demonstration projects
  Well-funded demonstration projects were used to attract manufacturers initially.
- Common procurement
  The initial targeting of manufacturers was followed by the creation of a purchasing consortium to buy 350 vehicles worth £20 million for 30 fleets, both public and private sector, including several important customers.
- High profile programme launch
  Finally there was a high profile programme launch at a clean fuel motor show held in parallel with a conventional motor show.
- Private-private Partnerships
  In the UK, suppliers of alternative fuels expressed an interest in funding the fuel supply infrastructure themselves. Their capital costs are recovered through a long-term fuel supply contract with the fleet operator (typically 10 years).
- Exit strategy
  The programme plans to gradually cut back funding for the most mature technologies as the price of new vehicles falls. Alternatively the standards will gradually be tightened.
- Reduced tax on gaseous fuels
  There is reduced tax on gaseous fuels – this is viewed as being essential to the success of the Powershift support programme. However, buses in the UK receive a rebate of fuel tax of 60% for diesel. Although the rebate for gaseous fuels is 100%, this reduces the incentive for bus operators to invest in cleaner fuels.

1.4 The Netherlands

Some background information:
The Dutch government wants to introduce clean vehicles in order to reduce harmful emissions and greenhouse gas emissions of the transport sector.
Main barriers for the introduction of CNG as a vehicle fuel:

- the chicken&egg problem
- clean vehicles are much more expensive than conventional vehicles
- customers are not informed about clean vehicles

Package of supporting measures:

- Research & Development of vehicle technology
  there's a government programme for technology development and testing aimed at vehicles which are 'cleaner, quieter or more efficient'
- Research to address market barriers (e.g. infrastructure, awareness, safety,…)
- Advice to fleet managers on greening their fleets
- Subsidies for clean vehicle projects
  The programme classifies projects into four types (practical tests, demonstration, market introduction, application), which receive different subsidy levels: The level of subsidy decreases as the project approaches the market.
  There is a minimum project size, in terms of the number of vehicles involved, to ensure that projects are of sufficient size to have an impact on the market. This size increases as projects approach the market.
- Environmental tax on fossil fuels
- Eco-labelling of vehicles
  which divides cars into seven bands based on relative fuel efficiency, depending on how much CO_2 is emitted per kilometre relative to what is technically feasible for cars in the same size class.
- Vehicle purchase tax based on fuel efficiency
  The purchase tax on relatively fuel-efficient cars will be lowered, and the tax on relatively inefficient cars will be raised.

1.5 Californian Zero Emission Vehicle Programme

Some background information:
In order to reduce the harmful emissions of the transport sector, the Californian Air Resources Board introduced the ZEV-programme.
Main barriers for the introduction of CNG as a vehicle fuel:

- the chicken&egg problem
- clean vehicles are much more expensive than conventional vehicles
- customers are not informed about clean vehicles

Package of supporting measures:

- Mandates[65]
- Voluntary agreements

  In 1996, instead of the original mandate to sell ZEVs in model years 1998 through 2002, the Air Resources Board (ARB) initiated and designed a Memorandum of Agreement (MOA) [66] together with the seven largest auto manufacturers (Chrysler, Ford, General Motors, Honda, Mazda, Nissan and Toyota).
- Awareness and information activities

  'showcase' events to inform the public of the latest zero emission technoly
- A 'try before you buy' scheme

  An EV Loan Programme has been implemented to encourage the leasing of EVs by public fleets; through this short-term loan programme, state and local government agencies can experience the benefits of an EV.
- 'Non financial' incentives for clean vehicles

  allowing certain EVs and clean vehicles to use carpool lanes during peak hours
- Vehicle purchase subsidies

  purchase incentives for clean cars to reduce the price for the consumer;
- Tax incentives

  reduced licence fees for clean vehicles bought between 1999 and 2003;
- Infrastructure subsidies

  local infrastructure incentives which can provide up to 90% of the installation charges for an EV charger;
- Green fleet initiatives

  to influence public and private fleet purchasing.
- Setting standards

  In January 2001, through an amendment to the ZEV-mandate, California has standardised electric vehicle recharging equipment: From 2006 on, conductive charging systems (used e.g. by Ford and Honda) will be standard. Existing inductive chargers (e.g. used for General Motors, Toyota and Nissan vehicles) will continue to be operated and maintained, but will not be expanded.

1.6 US Clean Cities programme

Some background information:

The U.S. Department of Energy initiated this initiative in order to help concerned fleets to fulfil the requirements of the EPAct[67].

Main barriers for the introduction of CNG as a vehicle fuel:

- the chicken&egg problem
- customers are not informed about clean vehicles
- customers are not informed about existing supporting measures and incentives for clean vehicles

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[65] In 1990 the California Air Resources Board (CARB) produced an unprecedented mandate for vehicle manufacturers to sell a certain minimum number of zero emission vehicles (ZEVs). This was unique: California did not only expect from the carmakers that they themselves shall pay the development costs for alternative vehicles, it also expected that the carmakers shall create the market. The original regulations required the seven largest automakers to sell EVs from model year 1998 onwards: In model year 1998 through 2000 2% of the sold new vehicle fleet was required to be ZEVs and this percentage was to increase to 5% in model years 2002/3 and 10% in model year 2003 and beyond. However, the regulations were relaxed in 1996 and again in 1998 because the level of battery technology was not sufficient to warrant widespread introduction of battery electric vehicles. The 10% requirement was allowed to include partial credits for other clean vehicles including SULEVs (super ultra low emission vehicles) running on gasoline or natural gas as well as hybrid electric and fuel cell vehicles. Large manufacturers still have to meet part of the requirement using vehicles receiving a full ZEV allowance. Recently it has been enacted, that the requirement of selling ZEVs will gradually increase from 10% in 2003 up to 16% in 2018. In February 2000 the requirement was extended to include buses: certain operators must demonstrate ZEV buses in 2003 and must begin purchasing 15% ZEV buses in 2008.

[66] The automakers agreed to

- opt in to the National Low-Emission Vehicle Program already in 2001 (instead of 2004)
- continue in ZEV and battery R&D
- demonstrate up to 3750 battery powered ZEVs in 1998/99 and 2000
- offering ZEVs to consumers in accordance with market demand
- provide annual and biennial reporting requirements

The ARB has committed to

- facilitate the purchase of ZEVs in state fleets
- work with other authorities and private industry to address various infrastructure issues
- support reasonable incentive programs

[67] EPAct (1992) mandates the purchase of alternative fuel vehicles by federal, State, fuel provider and utility fleets. This may be extended to cover local government and private fleets. The U.S.Department of Energy (DOE) will also explore means to focus on niche markets, providing some form of credit for voluntary alternative vehicles purchases or alternative fuel usage, and a possible mandate on urban area transit bus operators.

Package of supporting measures:

- Public-private Partnerships

  Clean Cities is a locally based voluntary government/industry partnership to expand the use of alternatives to gasoline and diesel fuel. It was designed as an umbrella programme to achieve the objectives established by the Energy Policy Act of 1992.

- Informational and educational activities

  Clean Cities works directly with local businesses and governments, guiding them through each step of the process of building an active local organisation, providing tools such as training, publications, websites and networking opportunities and providing information about funding sources.

- Networking

  Members of the Clean Cities network help each other by sharing information on innovations, solutions to obstacles and general experience.

- Up-scaling of local projects

  The programme recognises the importance of developing a transport infrastructure that enables travel from State to State and across the country. Therefore the Clean Corridor concept has been developed, to ensure that refuelling facilities for alternative fuels are available for regional transit, between existing Clean Cities in the first instance.

IV.9.2 Appendix 2: List of analysed case studies

List of case studies analysed in subtask IV:

Programme	Country
AR-Sub	Argentina
AR-CNG	Argentina
AU.CNG	Australia
A-Biodiesel	Austria
LPG-Vienna	Austria
EG-CNG	Egypt
EU-ALTER	European Union
EU-ZEUS	European Union
FIN-MOBILE	Finland
UK-PowerShift	Great Britain
IN-CNG	India
I-CNG	Italy
I-LPG	Italy
J-LEINTRO	Japan
J-EV	Japan
J-EVDIFF	Japan
J-LPG	Japan
'Strategic Council of New Market Creation'-Tokyo	Japan
EVs and Biofuels in Sweden	Sweden
CH-CityCar	Switzerland
CH-CNG	Switzerland
CH-Mendrisio	Switzerland
NL-DEMO	The Netherlands
NL-LPG	The Netherlands
USA-Clean Cities	USA
USA-CNGAmoco	USA
USA-EPAct	USA
USA-Ethanol-Minnesota	USA
USA-EV Market Launch	USA
USA-EVready	USA
USA-FO	USA
USA-Ford	USA
USA-Clean Fleets	USA
USA-ZEV	USA
USA-StationCar	USA

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V. Appendix

V.1. The participating Implementing Agreements

OVERVIEW OF THE IEA IMPLEMENTING AGREEMENT FOR HYBRID AND ELECTRIC VEHICLE TECHNOLOGIES AND PROGRAMMES

THE INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA) was founded in 1974 and is based in Paris. Its mandate is to encourage international collaboration in many aspects of energy policies, programmes, and technologies. It has enhanced international collaboration in the energy sector among the 25 industrialized countries which are members of the OECD and of the IEA. Within this IEA framework over forty „Implementing Agreements" have been set up to deal with specific energy technology issues. Each Implementing Agreement consists of a number of task forces, known as „Annexes". The work of these task forces is directed by an Executive Committee consisting of representatives of the member Governments.

THE HYBRID AND ELECTRIC VEHICLE IMPLEMENTING AGREEMENT

is a collaborative programme among 12 countries (2002): Austria, Belgium, Denmark, Finland, France, Italy, Japan, Korea, The Netherlands, Sweden, Switzerland and the United States. The overall objective is to assist electric, hybrid and fuel cell vehicles in reaching their market potential. The first phase started in 1994 and was completed 1999. The second phase will be continued until 2004.

ACTIVITIES

Four tasks are operational (2002): Information Exchange (Annex I), Hybrid Vehicles (Annex VII), Deployment Strategies for Hybrid, Electric and Alternative Vehicles (Annex VIII joint with Annex XXI of the Implementing Agreement Advanced Motor Fuels), Electrochemical Power Sources and Energy Storage Systems for Electric and Hybrid Vehicles (Annex X). An additional task force on „Clean City Vehicles" is under consideration.

OVERVIEW OF THE IEA IMPLEMENTING AGREEMENT FOR ADVANCED MOTOR FUELS

THE ADVANCED MOTOR FUELS AGREEMENT

is a collaborative programme among 10 countries: Canada, Denmark, Finland, France, Italy, Japan, Spain, Sweden, the United Kingdom and the United States. The overall objective is to assist participating members in the development of knowledge and understanding of advanced motor fuels, vehicle systems and transportation efficiencies for energy diversity and environmental enhancement. The Agreement started in 1984 (under „Alcohols and Alcohol Blends as Motor Fuels") and has been continued in various phases. The latest phase will end in 2004, and the formal documents for a continuation are in preparation.

ACTIVITIES

Nine tasks are operational (2002): Biodegradable Lubricants (Annex XVI), Future Greener Diesel Fuels (Annex XVIII), DME as Automotive Fuel (Annex XX), Deployment Strategies for Hybrid, Electric and Alternative Vehicles (Annex XXI joint with Annex VIII of the Implementing Agreement Hybrid&Electric Vehicles), Low Temperature Particulates (Annex XXII), Information Exchange IEA AFIS (Annex XXIV), Non Road Engines (Annex XXV), Oxygenates in Diesel (Annex XXVI).

V. 2 Participating Countries/Organizations/Country Experts

AUSTRIA
Mr. Willy Raimund
E.V.A. The Austrian Energy Agency
Otto-Bauer-Gasse 6
A-1060 Wien, Austria
Phone +43 1 586152437
Fax +41 1 5861524-40
E-mail: raimund@eva.ac.at

FINLAND
Ms. Sari Nobell
VTT Processes
P.O.Box 1601
FIN-02044 VTT Espoo, Finland
Phone +358 9 45657
Fax +358 9 460493
E-mail: sari.nobell@vtt.fi

ITALY
Mr. Mario Conte
Ente per le Nuove Tecnologie ENEA
Via Anguillarese 301
I-00060 Roma, Italy
Phone +39 06 30484829
Fax +39 06 30486306
E-mail: conte@casaccia.enea.it

JAPAN
Mr. Koujirou Miyake
Mr. Masaru Obuchi
NEDO
Sunshine 60 27 F
1-1Higashi-ikebukuro
3-chome Toshima-ku
J-170 6028 Tokyo, Japan

Mr.Ichiro Kasamtsu (retired)
Mr. Toshiyuki Shimode
Mr. Yutaka Takada
LEVO
2-14-8 Yotsuya
Shinjuku-ku
J-160 Tokyo, Japan
Phone +81 3 33598461
Fax +81 3 33535430
E-mail: t-shimode@levo.or.jp

THE NETHERLANDS
Mr. Arie Brouwer
NOVEM
Catharijnesingel 59
NL-3503 RE Utrecht, The Netherlands
Phone +31 30 2393601
Fax +31 30 2316491
E-mail: a.brouwer@novem.nl

SWEDEN
Mr. Mikael Fjällström
P.O.Box 310
S-63104 Eskilstuna, Sweden
Phone +46 16 5442604
Fax +46 16 5442099
E-mail: mikael.fjallstrom@stem.se

SWITZERLAND
Mr. Martin Pulfer
Bundesamt für Energie
CH-3003 Bern, Switzerland
Phone +41 31 3224906
Fax +41 31 3824307
E-mail:martin.pulfer@bfe.admin.ch

THE UNITED STATES
Mr. James Francfort
Idaho National Laboratory
Idaho Falls
Idaho 83415-3830, USA
Phone +1 208 5266787
Fax +1 208 5742102
E-mail: francfje@inel.gov

V.3 The Authors of this Report:

Antonio Mattucci
MSc. in Nuclear Engineering with special focus on Automatic Controls
Professional Position: Senior Engineer Hydrogen Programme of ENEA (Ente per le Nuove Tecnologie; Agency for New Technology, Energy and the Environment)
Main Activities: leader of several research and demonstration projects (THERMIE-REGIT, THERMIE-FLEETS, In.PUT. ESTO, etc.). Italian representative to the AUTOOIL II programme activities and other European working groups; environmental impact assessment of the National Policy Plan through the use of forecast models Present interest in energy sources for Hydrogen production.
Professional Address: ENEA Div. ERG-TEA, C.R.Casaccia
Via Anguillarese 301, I-00060 Roma (Italy)
phone +39 06 30484394, FAX +39 06 30486315
E-mail: mattucci@casaccia.enea.it

Stefan Rieder
PhD in Political Sciences
Professional Position: Senior Project Manager at INTERFACE Institut für Politikstudien, responsible for public energy policy and evaluation
Main Activities: comparison study of the energy policies of Denmark, Germany and Switzerland; elaboration of evaluations concerning energy policy and New Public Management in order of the Swiss Federal Government and several Cantonal Governments. Lecturer at the Institute of Social Work Lucerne.
Professional Address: INTERFACE Institut für Politikstudien
Kapellgasse 1, CH-6004 Luzern
Phone +41 41 4120712, FAX +41 41 4105182
E-mail: rieder@interface-politikstudien.ch

Christoph Bättig
Graduated Geographer
Professional Position: Project Manager at INTERFACE Institut für Politikstudien, responsible for environmental and tecno-political studies.
Main Activities: study on government possibilities to promote networking of private and government stakeholders; development of a concept for an integrated observation of environmental planning policies
Professional Address: INTERFACE Institut für Politikstudien
Kapellgasse 1, CH-6004 Luzern
Phone +41 41 4120712, FAX +41 41 4105182
E-mail: baettig@interface-politikstudien.ch

Tommy Månsson
MSc. in Civil Engineeing, BSc. in Management Economy and Political Economy
Professional Position: founder and executive director of The Environmental Experts Network EnEN
Main Activities: consultant for private and government bodies in issues related to sustainable transportation, advisor to the Swedish Minister of Environment, member of delegations with official missions in EC and UN bodies, lecturer in developing countries
Professional Address: EnEN
Toppvägen 36 A, S-17740 Järfälla, Sweden
Tel+FAX +46 8 58034506
E-mail: tommy.mansson@enen.se

Michaela Kargl
MSc. in Electrical Engineering
Professional Position: Project manager at the Department of Innovative Transport Systems of the Forschungsgesellschaft Mobilität - Austrian Mobility Research FGM-AMOR
Main Activities: leader of several national projects and co-operation in EC-projects concerning innovative transport systems
Professional Address: Forschungsgesellschaft Mobilität - Austrian Mobility Research (FGM-AMOR)
Schönaugasse 8A, A-8010 Graz, Austria
Phone +43 316 810451 15, FAX +43 316 810451 75
E-mail: kargl@fgm-amor.at

Sigrid Kleindienst Muntwyler
PhD in Musicology, History and Philosophy
Professional Position: project manager at the Engineering Office Muntwyler
Main Activities: event management (Tour de Sol solarmobile races, conferences), publisher of periodicals on lightweight electric vehicles, co-operaition in national projects concerning electric vehicles
Professional Address: Engineering Office Muntwyler
P.O.Box 512, CH-3052 Zollikofen, Switzerland
Phone +41 31 9115061, FAX +41 31 9115127
E-mail: muntwyler@solarcenter.ch

Martijn van Walwijk
MSc. in Mechanical Engineering
Professional Position: project manager at Innas BV founder and manager of IEA AMF/AFIS (the Automobile Fuels Information Service) operated under the auspices of the Advanced Motor Fuels Implemeting Agreement of the International Energy Agency
Main Activities: acquisition, management and execution of international projects on energy carriers for transportation, on behalf of policy makers in governmental bodies, research institutes and industry, answering strategic and policy questions on the different aspects of the full life cycles of conventional and alternative auto-motive fuels
Professional Address: Innas BV
Nikkelstraat 15, NL-4823 AE Breda, the Netherlands
Phone +31 76 5424080, FAX +31 76 5424090
E-mail: mvwalwijk@innas.com

V.2 Abbreviations Used in the Final Report

ACEA	Association des Constructeurs Européens d'Automobiles (European Automobile Manufacturers Association
AFV	alternative fuel vehicle
AMF	advanced motor fuels
CNG	compressed natural gas
EEV	environmentally enhanced vehicle
ENEA	Ente per le Nuove Tecnologie
EnEN	Environmental Experts Network
EU	European Union
EV	electric vehicle
E85	blend of 85% ethanol and 15% gasoline
FGM-AMOR	Forschungsgesellschaft Mobilität – Austrian Mobility Research
HDV	heavy duty vehicle
HEV	hybrid electric vehicle
HOV	high occupancy vehicle
ICE	internal combustion engine
IEA	International Energy Agency
LDV	light duty vehicle
LEV	low emission vehicle
LPG	liquefied petroleum gas
NGO	non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
P+D	pilot and demonstration
R+D	research and development
RME	rape seed methyl esther
RTC	Regional Transportation Centre
UN	United Nations
ZEV	zero emission vehicle

V.3 Glossary ANNEX VIII/XXI „Deployment Strategies for Hybrid, Electric and Alternative Fuel Vehicles“

term	description
programme	a set of organized, different activities (measures, processes or services) directed towards the achievement of specific objectives. A programme is delimited in terms of time schedule and get
fleet test	fleet tests have the purpose to test special vehicle technologies (e.g. battery technologies) or vehicle types in not changing conditions.
pilot programme	pilot programmes have the purpose to test the technical system. As this Annex is dealing with vehicles, the term „fleet test“ is used instead.
demonstration programme	demonstration programmes have the purpose to test practical and economical aspects concerning the market. They are designed in a 1:1-scale and make a strict technical and economical evaluation possible in view of a commercial introduction hoped for. They draw the attention of potential users to the new technologies or products. Also economic and social effects of the application of this technology have to be taken into account.
deployment programme	deloyment programmes have the objective to promote the large scale dissemination of vehicles
clean vehicle	any autonomous vehicle using fuels (inclusive of electricity) showing better values concerning pollutants and/or CO_2 emission
electric vehicle	any autonomous vehicle with an electric motor used for the propulsion of the vehicle and a battery as the major energy storage device („battery electric vehicle“)
hybrid vehicle	any autonomous road vehicle with two major energy storage devices and with two major energy conversion devices used for the propulsion of the vehicle. (definition IEA I/A Hybrid&Electric Vehicles)
alternative fuel vehicle	any autonomous road vehicle using alternative fuels as energy storage
dual fuel vehicle	vehicle that can run on each one of two different fuels (excluding electricity
bi-fuel vehicle	=dual fuel vehicle
fuel flexible vehicle	vehicle that can run on different fuels or any mixture of those fuels (excluding electricity)
fuel cell vehicle	any autonomous road vehicle with a fuel cell in the propulsion system between the on board energy storage and the wheels
alternative fuel	any automotive fuel not being gasoline or diesel (excluding electricity) (definition IA Advanced Motor Fuels)
biofuel	fuel produced from biomass for ICE with positive ignition (definition IA Advanced Motor Fuels)
fatty acid methyl ester	fuel produced by the esterification of oil (e.g. frying oil) with methanol
fossil fuel	fuel produced froma fossil feedstock (definition IA Advanced Motor Fuels)
liquid hydrogen	Hydrogen is a gaseous fuel; can be obtained from electrolysis of water or through a reformer process (on board a vehicle) from methanol or gasoline; for use in fuel cells. For use in ICE only as a liquid (definition UTOPIA)
blends	mixture of fuel types. For PSIA: gasoline&alcohol. For PSIB: diesel&synthetic diesel or diesel&FAME/FAE (definition UTOPIA)

term	description
CNG	Natural gas in compressed form for use mainly in ICEs with positive ignition (some applications include use in diesel engines (definition UTOPIA)
LPG	Petroleum gas in liquefied form, also referred to as propane (or propane/butane); byproduct of petroleum refining process; for use in ICEs with positive ignition.
DME	Dimethyl Ether, LPG-type fuel with ignition properties, potentially suitable for diesel process (definition UTOPIA)
refined vegitable oil	obtained by the seeds of fruits (e.g. palm oil) of variious plants containing fatty acids. Due to their high viscosity, their use in pure form in ICEs with auto-ignition requires a lot of modifications and is therefore limited to very few isolated cases
synthetic diesel	made from natural gas, high quality, high cetane fuel (definition UTOPIA)
refuelling facility	refuelling facilities for alternative fuel vehicles except gasoline and diesel (private and public)
fuel cell	an electrochemical cell that converts chemical energy directly into electric energy, as the result of an electrochemical reaction be-tween reactants continuously supplied, while the reaction products are continuously removed. The most common reactants are hydro-gen (fuel) and oxygen (also from the air). (definition IEA I/A Hybrid&Electric Vehicles)
price	monetary amount the consumer has to pay for the vehicle
fuel price	monetary amount the consumer has to pay for the fuel
operating costs	the monetary amount the owner/user has to pay for the operation of the vehicle
subsidy	by governments, local administrations and stakeholders for the market introduction of electric, hybrid and alternative fuel vehicles and the establishment of recharging and refuelling facilities
tax incentive	preferential taxation for electric, hybrid and alternative fuel vehicles and recharging and refuelling facilities
number of registrated vehicles	the number of vehicles registrated per year
accumulated number of vehicles	the total number of vehicles
market share	share in the market segment of the relevant vehicle category
transport system	technical and economical structure which allows the needs of mobility to be satisfied
transport chain	A transport chain is defined as the possibility of sequential use of one or more transport modes to facilitate a trip from origin to destination (definition UTOPIA)
transport concept	A transport concept is defined as the organisational form of possible use/operation of vehicles and associated infrastructure. Thus, a transport concept more or less involves the functional aspects of using a vehicle concept and a propulsion system. In principle each combination of transport concept, vehicle concept and propulsion system can be though of. Of course, some combinations are more useful than others. (definition UTOPIA)

term	description
collective transport	The transport concept is designed to transport passengers at a large scale and in large numbers. Departure time, route and access are all fixed, and only stop-to-stop travel is covered. This guarantees the least degree of demand-responsiveness compared with all other transport concepts (definition UTOPIA)
individual	people transported in an individual manner with a high degree of flexibility regarding departure time , route, stops etc. Use, owner and driver are often identical and closely related private individuals
evaluation	judgement of public interventions according to their relevance, efficiency or effectiveness and based on specially produced information
strategic/strategy	definition of the main goals and objectives of an organization or project or programme

V.4. MEASURES FAVOURING THE MARKET INTRODUCTION OF CLEAN VEHICLES USED FOR THE EVALUATION: LIST OF ACRONYMS

acronym	country	Title of the Programme (period)	Short description	Sub-task
A-Biodiesel	**Austria**	**Biodiesel Graz (1994 - .....)**	**Objective:** to replace diesel in public transport and municipal fleets by biodiesel (FAME) produced by recycled frying oil **Vehicle Types**: buses, trucks, taxis **Test area/operator**: Municipality of Graz, Grazer Verkehrsbetriebe (public transport service) **Funds:** no details available **Results:** the results of the fleet tests (1994-97) have been positive, by the end of 2001 30% of the bus fleet of the public transport service already rund on biodiesel, all diesel vehicles of the public transport service and the fleet of the greatest taxi firm will be replaced	**IV**
A-Breit		**Breitentest (1992 – 1993)**	**Objective:** investigate user knowledge and acceptance, changing of mobility pattern and user behaviour. Small subsidies for vehicle purchases provided **Vehicle Types:** 135 electric vehicles **Test Area/operators:** Austria (Technical University Graz) **Funds:** 80'000 US$ (Ministries of Science, Transport, Economy) **Results:** „1st generation" EVs showed many failures, applicabiity in niches proven when technology was improved	**I, II**
A-EVVienna		**EV Promotion in Vienna (1995 - ....)**	**Objective:** to support the deployment of electric vehicles by subsidies (20% of the purchase price) only for citizens of Vienna **Vehicle Types:** 1782 electric passenger and light duty vehicles (425 in 2001) **Test Area/operator:** City of Vienna (City authority of Vienna) **Funds:** 500'000 EURO (1995-2001) **Results:** no details available	**III**
A-LPGBus		**Use of LPG-buses in Vienna (1970 - .....)**	**Objective:** to replace diesel by LPG by subsidizing the fuel **Vehicle Types:** buses **Test Area/operator:** City of Vienna (Wiener Verkehrsbetriebe) **Results:** continued	**III, IV**
A-Tourism		**Car-free Tourism Resorts (1998 - 2003)**	**Objective:** to demonstrate the use of electric vehicles in tourism resorts **Vehicle Types:** 30 electric bicycles, 51 electric scooters, 3 lightweight electric vehicles, 7 electric vehicles, 8 electric vans **Test Area/operators:** Bad Hofgastein, Werfenweng (Prov. Salzburg), Austria **Funds:** 8 million Euros (Ministries of Transport, Environment, Economics&Labour, Province of Salzburg, cities Bad Hofgastein and Werfenweng, European Union) **Results:** vehicles accepted by tourists and local business, continued	**II, III**

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acronym	country	Title of the Programme (period)	Short description	Sub-task
AR-CNG	**Argentina**	**CNG cars in Argentina (1980ies - .....)**	**Objective:** **Vehicle Types**:600'000 gasoline passenger cars converted to CNG by small enterprises **Test area/operator**: Argentina **Funds:** low CNG prices **Results:** share of CNG in the fuel market has grown from 24% (1970ies) to 47% (2000): 600'000 CNG conversion cars, 800 refueling stations, domestic industry (for compressors, cylinders etc.) users save 60% fuel costs, important success factor was the private interest in CNG stations	IV
AR-Sub		**National Programme for Substitution of Liquid Fuels (1980ies)**	**Objective:** substitution of diesel oil in the public passenger transport by CNG (target: 134'000 conversion vehicles within 10 years) **Vehicle Types:** buses **Test area/operator**: Argentina (public transport services) **Funds**: no details available **Results:** targets not achieved. Reasons:diesel is subsidized (for supporting farmers) and cheaper than CNG; bus fleets are privately owned and transport issues therefore become socio-political issues; bus manufaturers lobbying against CNG buses („not mature"-argumentation)	IV
AU-CNG	**Australia**	**CNG Liverpool (1997 - .....)**	**Objective:** introduction of CNG vehicles to solve the problem of poor air quality by leadership by example; networking (partnership with private enterprises) and lobbying **Vehicle Types**: CNG vehicles in municipal fleets **Test area/operator** City of Liverpool (fastest growing in Australia) **Funds**: no details available **Results:** programme influenced national air quality improvement and greenhouse gas reduction programme	IV
C-FCBuses	**Canada**	**Fuel cell buses in Vancouver (1998 - 2000)**	**Objective:** to test fuel cell buses (technical reliability, service requirements, regulation aspects) **Vehicle Types:** 3 fuel cell buses (compressed gaseous H_2; tanks on the roof with max. capacity 52 kg at 240 atm) **Test Area/operator:** City of Vancouver, Canada **Funds:** 5,3 million US$ **Results:** reduction of emissions and noise pollution proven	I, II
CH-CityCar	**Switzerland**	**CityCar (1998 – 2001)**	**Objective:** to test electric vehicles as a public individual means of transport **Vehicle Types:** 30 two-seater electric vehicles with telematic systems **Test Area:** City of Martigny **Results:** successful test of the infrastructure (20 stations, electronic guidance system), vehicle type not reliable enough	II, III, IV
CH-CNG		**CNG in Switzerland (1992 - ....)**	**Objective:** to introduce CNG into the Swiss fuel market **Vehicle Types** CNG passenger cars, buses and trucks **Test area/operator**: Switzerland (gas industry) **Funds**: no details available **Results:** since 10 years the Swiss gas industry funds CNG R&D projects, CNG is expensive, the infrastructure insufficient. Since 1994 biogas is produced („Kompogas" made from compost), partly feeding the gas grid, partly available at filling stations. „Kompogas" is subsidised and exempted from taxes (as renewable energy) and cheaper than CNG. There is growing interest in „Kompogas" in regions around filling stations	IV
CH-EasyMove		**Easy Move (1999 -)**	**Objective:** to provide electric vehicles for hire at railway stations in the Canton of Ticino **Vehicle Types:** electric passenger vehicles **Test Area/operator:** Canton of Ticino (Swiss Federal Rail) **Funds:** no details available **Results:** acceptance increases, not enough known among tourists	III

acronym	country	Title of the Programme (period)	Short description	Sub-task
CH-MENDRISIO	**Switzerland**	**Large Scale Test with Lightweight Electric Vehicles + Partner Communes (1996 – 2001)**	**Objective:** to demonstrate the effects of a wide use of electric vehicles in a defined area, subsidizing of EV purchases **Vehicle Types:** electric vehicles in Mendrisio, in the Canton of Ticino, in 7 partner communes in the rest of Switezrland **Test Area/operator:** Commune of Mendrisio, then extended to the Canton of Ticino, 7 partenr communes **Funds:** ca. 22 million US$ (Swiss Federal Office of Energy, The Canton of Ticino, buyers of EVs) **Results:** people look for additional benefits (only subsidies are not enough motivation to change to EVs), chain vehicle manufacturer-importer-retailer-service does not work properly	**I, II, III, IV**
D-Hydrogen	**Germany**	**Hydrogen vehicle technology (1997 – 2000)**	**Objective:** infrastructure for hydrogen vehicles (GH_2 and LH_2), establishing a working/lobbying team (Transport Energy Strategy) **Vehicle Types:** by now BMW 7-Series, Airport shuttle at the Munich Airport **Test Area/operator:** Munich Airport (ARGEMUC =14 industrial partners from Germany) **Funds:** 15 million US$ (Bavarian Ministries of Economic Affairs, Transportation and Technology) **Results:**	**I**
D-PROKOM		**ProKom (1990 -)**	**Objective:** to promote the use of EVs by cummunal authorities **Vehicle Types:** 15 electric passenger cars, 34 electric vans, mini buses. Inclusion of hybrid vehicles planned **Test Area/operator:** municipalities in the supply area of RWE Energie **Funds:** ca 3.7 million US$ **Results:** application niches in municipal fleets identified, but still no wide acceptance by communal fllet managers	**II, III**
D-RUEG		**e-mobile Rügen (1992 – 1996)**	**Objective:** test of advanced battery technologies **Vehicle Types:** 60 electric vehicles (minibuses, vans and private cars) **Test Area/operator:** Island of Rugen, Germany, project management DAUG (Research Centre of the German Car Manufacturers) **Funds:** 30 million US$ (Ministry of Science, car- and battery manufacturers) **Results:** some of the advanced battery types showed problems (NaS: no longer produced; NaNiCl); but an increased range could be achieved compared with lead-acid battery types	**I**
EG-CNG	**Egypt**	**CNG in Egypt**	**Objective:** to introduce CNG in metropolitan areas to fight air pollution **Vehicle Types**: 32'000 passenger cars and buses **Test area/operator** started in Cairo area, expanding to all major cities **Funds**: no details available **Results:** 86% of taxis/microbuses are running on CNG, 52 public filling stations (fuelling 600-1'000 vehicles/day), CNG vehicle manufacturers have agreements with conventional fuel companies to construct and operate CNG stations. Success-factors: CNG is cheaper than gasoline and diesel, CNG vehicle manufacturers at the same time provide vehicles and fuel stations and by that efficiently are focussing the customers needs	**IV**
EU-ALTER	**European Union**	**Alternative Traffic in Towns (1998 - .....)**	**Objective:** to facilitate the market introduction of alternative vehicles (based on ZEUS experiences) **Vehicle Types**: zero and low emission passenger vehicles, buses and trucks **Test area/operator**: 150 European cities based on a voluntary approach to greener procurement by locla authorities **Funds**: **Results:** expansion from electric vehicles (ZEUS) to low emission vehicle types, continued	**IV**
EU-ZEUS		**Zero and Low Emission Vehicles inUrban Society (1996 – 2000)**	**Objective:**to show how cities, by forming purchasing consortia, can trigger a market for alternatively fuelled vehicles **Vehicle Types**: more than 1'000 zero and low emission passenger vehicles, buses, trucks, 225 + 150 electric vehicles **Test area/operator**: 8 cities **Funds:** 58 milliion Euro (total), 5.5 million Euro contribution EU Results: some suppliers reduced the prices. Purchase conditions have been directly negotiated with the manufaturers. By that problems with the local retailers resulted that have not been trained well enough for service and maintenance and have not been motivated (for they did not profit from selling the vehicles)	**IV**

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acronym	Country	Title of the Programme (period)	Short description	Sub-task
FIN-EVDPost	Finland	**EVD-Post (1997 – 2000)**	**Objective:** to show the viability of electric vehicles in postal fleets **Vehicle Types:** 16 electric vehicles **Test Area/operator:** City of Turku, City of Kajaani (Finland Post) **Funds:** 1 million US$ (European Commision 40% as Part of EVD-POST/THERMIE programme) **Results:** battery type was exchanged. Project serves for decision making concerning the use of EVs in postal fleets	III
FIN-MOBIL		**MOBILE (1993 – 1998)**	**Objective:** framework programme with 75 single projects aiming at research, demonstration an testing of alternative fuels **Vehicle Types:** electric vehicles, CNG, LPG **Test Area:** Finland **Funds**: 101 millions FIM **Results:** CNG and LPG buses in the City of Helsinki as a follow-up	II, IV
FIN-ZEUS		**ZEUS Bus Conversion (1996 – 2000)**	**Objective:** conversion of diesel buses to LPG **Vehicle Types:** 5 buses **Test Area/operator:** City of Helsinki (Helsinki City Transport) **Results:** difficulties in the conversion (VOLVO could not deliver LPG system, therefore MAN system had to be adapted); higher fuel consumption but lower NOx emissions, conversion costs reasonable	I, III
F-PRAXI	France	**Praxitèle (1997 – 1998)**	**Objective:** providing of publicly available EVs for rental („self-service EV system"), testing the user acceptance **Vehicle Types:** 50 electric passenger vehicles with telematic systems **Test Area/operator:** St.Quentin-en-Yvelines, France (EdF) **Funds**: EdF, CGFTE (transport service), Renault **Results:** used for shopping (44%), going to work (26%), get to railway station (25%). replaced: bus trips (33%), company vehicle trips (20%), taxi (12%), private vehicle trips (9%)	II, III
F-VELR		**Vehicules Electriques in La Rochelle (1993 – 1995)**	**Objective:** testing of 50 PSA electric vehicles **Vehicle Types:** 50 electric passenger vehicles **Test Area/operator:** City of La Rochelle, France **Funds:** City of La Rochelle/PSA/EdF **Results:** high acceptance, experiences influenced follow-up programmes	I
I-ATAF	Italy	**ATAF Florence (1996 -.....)**	**Objective:** use of advanced technologies in public transport **Vehicle Types:** 26 electric minibuses, 50 CNG buses, 96 buses adopted for GECAM diesel emulsion **Test Area/operator:** City of Florence, Italy, ATAF (public transport service) **Funds:** **Results:** success is dependent on additional non-rechnical measures (e.g. no access of private cars in city centre), continued	I
I-ATENA		**ATENA (1997 – 2001)**	**Objective:** developping of a simulation model to assess the impact of low emission vehicles by a measuring campaign **Vehicle Types:** electric, GNG, hybrid, CNG+Gasoline passenger vehicles, minivans with telematic systems **Test Area/operator:** City of Napoli, Italy (Centro Ricerche FIAT) **Funds:** 19 million US$ (Ministry of Science) **Results:** benefits of telematic systems proven	I
I-CNG		**CNG in Italy (1930ies -.....)**	**Objective:** since 1930 – 1950: to be self-reliant regarding fuels, 1970ies: oil crisis, since 1980: to reduce air pollution **Vehicle Types:** passenger cars, buses, trucks **Test Area:** Italy **Funds**: no details available **Results:** 370'000 CNG vehicles on the road (2001) new bi-fuel vehicles available (FIAT Marea, Multipla), oiol companies interested in CNG sale	IV
I-FLEET		**FLEETS + Terni (1996 – 2000)**	**Objective:**evaluation of the use of hybrid buses **Vehicle Types:** 24 hybrid buses, 2 biofel buses (comparison vehicles) **Test Area/operator:** City of Terni, City of Rome, City of Ferrara, Italy **Funds:** 3 million US$ **Results:**technical failures during the test helped to improve the technology, emission reduction proven	I

acronym	Country	Title of the Programme (period)	Short description	Sub-task
I-GECAM	Italy	**Diesel Emulsion (1999 - ……..)**	**Objective:** to reduce NOx and PM by the use of emulsion diesel GECAM (10,3% water, 88 % diesel, 1,7% additive) **Vehicle Types:** 4000 buses **Test Area:** Italy **Funds:** **Results:** reduction of NOx and PM has been proven, continued	I
I-LEG426		**Law 426/98 (1999 - ....)**	**Objective:** improve air quality **Vehicle Types:** hybrid and electric vehicles, CNG, LPG for fleet users in cities with more than 25'000 inhabitants **Test Area/operators:** major cities in Italy **Funds:** 60 million US$ **Results:** important for promoting the use of hybrid and electric vehicles (less for alternative fuels)	II
I-LPG		**LPG in Italy (1950ies - ……)**	**Objective:** to utilize LPG produced by CNG explored in the Po valley. Local enterprises developed kits to convert gasoline cars for LPG use **Vehicle Types:** 1'000'000 mostly passenger cars (2001) **Test Area:** first years northern part of Italy, infrastructure in the south still poor **Funds**: **Results:** LPG is cheaper than gasoline (lower excises), infrastructure available (especially in the north)	IV
I-ProMOT		**ProMOTORIEcologici (2000 -)**	**Objective:** substitution of 2-stroke engine mopeds by electric twowheelers **Vehicle Types:** ca 470 electric bicycles and electric scooters **Test Area/operators:** City of Roma, Italy **Funds:** depending on the applications **Results:** homologation problems, infrastructure not yet ready	III
IN-CNG	**India**	**CNG in India (1992 – 1993)**	**Objective:** to identify and resolve technical, institutional, regulatory and economic issues regarding the use of CNG as an automotive fuel in India **Vehicle Types:** 25'000 passenger cars, 200 buses, trucks **Test Area:** 5 great cities (including Delhi and Mumbai) **Funds**: details not available **Results:** infrastructure available (more than 50 CNG stations in Delhi, 20 in Mumbai etc)	IV
J-CEVDiff	**Japan**	**Clean Energy Vehicle Diffusion Plan (1998 - 2010)**	**Objective:** by 2010 3,65 million „clean energy vehicles" shall be introduced in the overall vehicle fleet (special target numbers for each prefecture e.g.: Tokyo Metropolitan Area: 40'000 electric vehicles, 35'000 CNG vehicles, 230'000 other clean energy vehicles), 10% of the government fleet **Vehicle Types:** electric (target: 100'000), hybrid (target: 2'060'000), CNG (target:1'000'000), LPG (target: 260'000), fuel cell (target: 50'000) **Test Area:** Japan (Ministry for Economy, Trade and Industry, Ministry for Land, Infrastructure and Transport) **Funds**: 100 million US$/year **Results:** continued	IV
J-EVSharing		**EV Sharing System (1999 -)**	**Objective:** to promote the use of electric vehicles by using it in niches where they show their specific advantages (publicly available electric vehicles with telematic system), development as commercial systems **Vehicle Types:** electric vehicles **Test Area/operator:** Inagi (30, for commuters), Kyoto (35, for residents&tourists), Osaka (28 for delivery), Yokohama (50, for business use), membership systems (Japan Electric Vehicle Association) **Funds:** **Results:** average mileage between 21.5 (Osaka) and 9.22 km (Inagi), no fee yet (will be between 0.10-0.20 c/minute), only paying its cost when each vehicle is used 4 times/day (now between 2.11 and 0.43 times/day)	II, III, IV

acronym	country	Title of the Programme (period)	Short description	Sub-task
J-LEINTRO	Japan	**Low Emission Truck Introduction and Promotion Plan**	**Objective:** to replace diesel trucks by clean energy vehicles, subsidies: ½ of the price difference compared with similar conventional trucks, leasing: 30% of usual prices are taken on by the programme **Vehicle Types:** hybrid, CNG, Methanol, LPG trucks, only members of the truck association (which is the great majority) **Test Area:** Japan (Ministry for Land, Infrastructure and Transport, Japanese Truck Association) **Funds:** 120 million US$/year **Results:** continued	IV
J-LEVDIFF		**LEV Diffusion and LEV Support Plan**	**Objective:** to improve the air quality and avoid health damage **Vehicle Types:** electric vehicles (passenger), CNG, LPG, Methanol (Trucks) **Test Area/operator:** Japan **Funds:** Ministry of the Environment **Results:** continued	II, IV
J-LPGTaxis		**LPG Taxis in Japan**	**Objective:** to reduce harmful substances in urban areas **Vehicle Types:** passenger cars as taxis **Test Area:** metropolitan areas **Funds**: details not available **Results:** 90% of tasis in Japan are LPG powered, Nissan and Toyota produce LPG mono-fuel taxis, 45'000 LPG taxis/year are produced to replace existing ones	IV
J-PLEV		**Pioneer Low Emission Vehicles Evaluation Plan (1998 – 2000)**	**Objective:** monitoring of the use of pioneer low emission vehicles in practice, subsidies for test vehicles **Vehicle Types:** 43 CNG and hybrid buses, hybrid passenger vehicles (+diesel buses with DPF) **Test Area/operator:** Japan **Funds:** (Ministry for Land, Infrastructure and Transport) **Results:** lead to the follow-up programme within the Clean Energy Vehicle Diffusion Plan	I, II, IV
J-REGNE		**Regional New Energy Introduction Promotion Plan**	**Objective:** to improve the emissions by the energy supply and to increase the energy efficiency, is the framework of EV subsidies **Vehicle Types:** electric vehicles **Test Area:** Japan **Results:** parallel action to the programmes of METI but less known	II, IV
J—SUBLEV		**Subsidies for Diffusion and Promotion LEV (**	**Objective:** to increase the number of low emission vehicles by subsidizing the purchases **Vehicle Types:** electric, hybrid, CNG, Methanol **Test Areaoperator:** **Funds:** (Ministry of METI, Ministry of Transport) **Results:**	II, IV
J-TAX		**Tax Incentives for LEV (1999 - .....)**	**Objective:** to increase the number of low emission vehicles by lowering the taxes. 1. Automobile Tax: Vehicles older than 10 years (diesel) or 13 years (gasoline) pay +10%, taxes are reduced between 13% and 50% according to the emission reduction of the vehicle compared with the Japanese 2000 Emission Standard 2. Automobile Acquisition Tax: between –2,3% (in NOx polluted areas) and –0,5% when replacing an old diesel car, -2.7% for electric, hybrid, CNG, Mathanol bus and tracks, -2.2% for hybrid passenger cars **Vehicle Types:** all technologies **Test Area/operator:** Japan **Results:** has hardly any effect on the vehicle cost	II
NL-Bio-E	The Netherlands	**Three regional buses running on bio-ethanol (1992 – 1995)**	**Objective:** evaluation of the benefits compared with diesel buses **Vehicle Types:** 3 buses **Test Area/operators:** Groningen, The Netherlands (OBL=Ethanol producer; Gado=Bus company) **Results:** operating costs significantly higher, consistent emission reduction proven. Experiments not continued	I, III

acronym	country	Title of the Programme (period)	Short description	Sub-task
NL-DEMO	**The Netherlands**	**DEMO (1998 – 2003)**	**Objective:** to demonstrate advanced technologies for all transport modes **Vehicle Types:** passenger, buses, vans, trucks, inland ships with electric, hybrid, CNG, LPG drives **Test Area/operator:** The Netherlands (NOVEM) **Funds:** 5 million US$/year (Ministry of Planning and Environment) **Results:** continued	**II, IV**
NL-HNR		**Het Nieuwe Rijden (1999 – 2003)**	**Objective:** driving training to reduce the energy consumption of professional drivers **Vehicle Types:** all propulsion technologies **Test Area/operators:** The Netherlands **Funds:** (Ministries of Environment and Transport) **Results:** continued	**(II)**
NL-LPG		**LPG in the Netherlands**	**Objective:** to promote the use of LPG as a refinery by-product by the oil companies and the government via fuel tax incentives **Vehicle Types:** passenger cars **Test Area:** The Netherlands **Funds:** details not available **Results:** in 1990 11% of the passenger cars run on LPG, since then steadiliy decline (6% in 1998) because of tax changes. Because of more stringent emission legislation LPG fuel systems became complexer and more expensive (the annual mileage for financial benefits increased steadily)	**III, IV**
NL-RATIO		**Rational Use of Energy in Transport (1983 – 1999)**	**Objective:** to reduce te energy consumption in transport systems by developping components, logistics, driving training **Vehicle Types:** passenger cars, buses, vans, trucks (conventional, CNG, LPG) **Test Area/operator:** The Netherlands (Ministry of Economic Affairs) **Funds:** (ca 3,5 million US$/year) **Results**: „mother" of all clean vehicle projects in the Netherlands, sucessful in technology development less in bringing clesn vehicles on the road	**II**
NL-SSZ		**Stiller, Schoner en Zuiniger Verkeer (1993 -)**	**Objective:** reduce the energy consumption of good transport in urban areas **Vehicle Types:** buses, vans (conventionsl, LPG) **Test Area/operator:** The Netherlands (The Ministry of Transport) **Funds:** (ca 3 million US$/year) **Results:** continued	**II**
S-BLEND	**Sweden**	**Field Test with Blend Fuels Ethanol Diesel (1994 – 1997)**	**Objective:** testing of a ethanol blended diesel as a fuel **Vehicle Types:** 21 trucks **Test Area/operator:** Sweden **Funds:**120'000 US$ (KFB, now Vinnova) **Results:** tests are continued to identify possible emulgators to increase the stability	**I, IV**
S-ELCIDIS		**ELCIDIS (1998 – 2002)**	**Objective:** to test and demonstrate electric vehicles for goods delivery in cities **Vehicle Types:** 9 hybrid and electric vans **Test Area/operator:** City of Stockholm, Sweden (Environment and Health Protection Administration), Part of EU-ELCIDIS **Funds:** 980'000 Euro (6.4 Euro for the European project) **Results:** not yet available	**IV**
S-ETOUR		**E-TOUR (2000 – 2003)**	**Objective:** to demonstrate the advantages of electric two-wheelers in city traffic **Vehicle Types**: 25 electric bicycles **Test Area/operator:** City of Stockholm (part of the EU-E-TOUR) (Environment and Health Protection Administration) **Funds:** 230'000 Euro (4.5 million Euro EU-project) **Results:** not yet avilable	**II, IV**

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Acronym	country	Title of the Programme (period)	Short description	Sub-task
S-EVDPost	**Sweden**	**EVD-Post**	**Objective:** to test electric vehicles for postal delivers **Vehicle Types:** 5 electric passenger cars **Test Area/operator:** Stockholm/Nacka (Swedish Posten AB; part of EU EVD POST-programme)) **Funds:** (2,6 million Euro (40% from EU) **Results:**	**IV**
S-FFVLeasing		**Leasing Programme for Flexible Fuels Vehicles**	**Objective:** see S-FFVprocurement **Vehicle Types:** target: 4000 flexible fuel passenger vehicles **Test Area:** Sweden **Results:** not yet available	**III**
S-FFVPro-curement		**Technology Procurement for Flexible Fuels Vehicles (1999 – 2001)**	**Objective:** to initiate an international tender for buying 4000 flexible fuel vehicles in Swedeni **Vehicle Types:** target: 4000 flexible fuel passenger vehicles **Test Area/operator:** Sweden (Swedish FFV Buyer Consortium) **Funds:** **Results:**	**III**
S-GÖTEBORG		**Electric Vehicles in Göteborg (1993 – 1999)**	**Objective:** to introduce 1000 electric vehicles /repolced by: to introduce electric vehicles step by step **Vehicle Types:** 64 electric vehicles **Test Area/operator:** City of Göteborg **Funds:** 4 million US$ (City of Göteborg, Vattenfall, VOLVO) **Results:** is continued as a follow-up	**I, II, IV**
S-GTHEVTest		**FleetTests of Gas Turbine Hybrid Buses (1996 – 2000)**	**Objective:** to demonstrate low emission propulsion systems for buses **Vehicle Types:** 2 hybrid buses (gas turbine-electric) **Test Area/operator:** City of Göteborg, Sweden (VOLVO Bus corp.) **Funds:** KFB (now Vinnova), STEM **Results:** NOx emissions less than 1/10 of Euro 2	**I**
S-HEVTest		**Hybrid Vehicles in Field Test (1996 – 2001)**	**Objective:** to evaluate hybrid drivetrains in everyday experience **Vehicle Types:** 1 hybrid pick-up, 1 hybrid van (series with diesel ICE) **Test Area/operator:** City of Göteborg, Sweden (VOLVO truck Corp) **Funds:** (31 million Skroner)(KFB, STEM) **Results:** battery life and monitoring system below expectations, higher consumption than expected, reliability good for 1 vehicle, less good for the 2nd vehicle	**I**
S-LEVStockholm		**Environmentally Friedly Vehicles in Stockholm (1994 -)**	**Objective:** to overcome barriers for low emission vehicles; ½ of City administration fleet should be electric **Vehicle Types:** 600 passenger vehicles and vans (electric, hybrid, biogas, ethanol: all vehicles of all programmes run in Stockholm are summarised here) **Test Area/operators:** City of Stockholm (Environment and Health Protection Administration) **Funds:** **Results:** infrastructure (8 ethanol stations, 4 biogas stations, 1 electric fast charging station), coordinated procurement lowers vehicle price, great awareness of the public	**I, II**
S-PROC1		**Technology Procurement 1 (1993 – 2000)**	**Objective:** coordinated procurement for electric vehicles **Vehicle Types:** 150 electric passenger vehicles (Renault Clio élecrique) **Test Area/operator:** City of Stockholm (Swedish Electric/Hybrid Car Consortium=20 Swedish municipalities) **Funds:** 400'000 US$ (STEM, KFB) **Results:** 150 EVs on the road; more realistic knowledge about th performance and application of electric vehicles	**III**

S-PROC2		**Technology Procurement 2 (1997 – 2000)**	**Objective:** coordinated procurement for electric vehicles **Vehicle Types:** 86 small electric vans (Renault Berlingo électrique) **Test Area/operator:** City of Stockholm (Swedish Electric/Hybrid Car Consortium=20 Swedish Municipalities) **Funds:** 500'000 US$ (STEM, ZEUS project Stockholm) **Results:** target of 150 EVs not achieved	**III, IV**
acronym	**country**	**Title of the Programme (period)**	**Short description**	**Sub-task**
S-SKÅNE	**Sweden**	**Electric Vehicles in Skåne (1995 – 2000)**	**Objective:** to find application niches for electric vehicles **Vehicle Types:** more than 100 electric passsenger vehicles, vans, garbage collection vehicles, hybrid buses **Test Area:** started in Malmö, extended to the Skåne region **Funds:** 3,5 million US$ **Results:** market chain (producer-> importer ->retailer) does not work satisfactory, lack of stable demand for EVs	**I, III, IV**
S-SKARABORG		**Ethanol buses in Skaraborg (1992 – 1997)**	**Objective:** to test and demonstrate the potential to design an environmentally friendly public transport system in rural areas **Vehicle Types:** 15 buses (10 converion to ethanol, 5 new developments) **Test Area/operator:** County of Skaraborg **Funds:** 550'000 US$ (KFB) **Results:**	**I, IV**
S-SLBus		**Ethanol and Hybrid Buses in Stockholm (1990 – 2000)**	**Objective:** to test and demonstrate a large-scale introduction of ethanol and hybrid buses **Vehicle Types:** 200 ethanol and 6 hybrid buses **Test Area/operator:** City of Stockholm (Stockholm Transport SL) **Funds:** 6 million US$ (KFB, STEM, SL) **Results:** good reliability	**I, III, IV**
S-SVENOL		**Fleet Tests of Ethanol Trucks (1995 – 1997)**	**Objective:** to test ethanol for the use in trucks in urban areas **Vehicle Types**: 7 trucks (converted diesel) **Test Area/operators:** Cities of Stockholm, Göteborg, Falun, of Örnsköldsvik, Växjö (Strateco Utveckling AB) **Funds:** 600'000 US$ (KFB, private companies) **Results:** technically successful, ethanol is more expensive than diesel and not supported by the Swedish government	**IV**
S-TROLLHÄTTAN		**Biogas in Trollhättan (1995 – 1997)**	**Objective:** to demonstrate the potential of biogas mainly from slaughter waste as fuel for city buses and cars **Vehicle Types:** 15 buses, 2 trucks, 5 passenger cars **Test Area/operator:** City of Trollhättan **Funds:** 5 million US$ (City of Trollhättan, KFB, Vattenfall) **Results:** solving regional waste problems, expanded as soon as the infrastructure can be extended	**IV**
S-UPPSALA		**Biogas in Uppsala (1996 -)**	**Objective:** demonstrate the potential of using biogas from organic waste as a fuel **Vehicle Types:** 20 city buses, 6 passenger vehicles, 2 refuse collector trucks **Test Area:** City of Uppsala **Funds**: 600'000 US$ (KFB – now Vinnova) **Results:**	**I, IV**
S-WNORRLAND		**Ethanol buses in Western Norrland (1985 – 1997)**	**Objective:** to test ethanol as fiuel for buses in practical operation **Vehicle Types:** 9 ethanol buses **Test Area/operator:** County of Wester Norrland **Funds:** 600'000 US$ (county, KFB) **Results:**	**I, IV**
S-ZEUS		**ZEUS Sweden (1994/1997 – 2000)**	**Objective:** to demonstrate the use of electric and alternatively fuelled vehicles in urban areas **Vehicle Types:** 70 electric vehicles, 20 electric mopeds, 4 biogas trucks, 6 gasoline-electric hybrid buses partly converted to ethanol **Test Area:** City of Stockholm (startet 1994 as „Environmental Vehicles in Stockholm", from 1997 as part of the EC „ZEUS"-programme) **Funds:** 60 million US$ **Results:** vehicles mainly used by City companies and authorities	**III, IV**

K-PowerShift	**United Kingdom (1996 -)**	**Powershift**	**Objective:** to develop a sustainable market for cleaner fuel vehicles to deliver air quality, climate change and noise benefits **Vehicle Types:** electric, hybrid, CNG, LPG, fuel cell (target: 40'000 overall by 2003/2004) **Test Area:** United Kingdom (Energy Saving Trust) **Funds:** 16 million US$/year (Department of Environment, Transport and the Regions) **Results:** cleaner fuel vehicles above all in fleets in cities, above all LPG for trucks and buses, infrastructure established	**II, IV**
Acronym	**country**	**Title of the Programme (period)**	**Short description**	**Sub-task**
SA-leanCities	**USA**	**Clean Cities Program (1993 - ....)**	**Objective:** to reduce greenhouse gases and dependence on imported oil, to improve air quality. Cities have to form coalitions (fuel providers, local fleets, dealers, environmental groups etc.) **Vehicle Types:** electric (3'300 light duty), hybrid (?), Methanol (2'300 light duty), Ethanol (14''600 light duty), Propane (66'000 light and heavy duty), CNG (80'000 light and heavy duty) LNG (900 heavy duty) **Test Area:** cities in the USA **Funds:** 8 million US$/year (Department of Energy) **Results:** 78 cities (end 2000), guidebook for Clean Cities, use above all in fleets (public, commercial, taxis), 5000 alternative fuel stations	**II, III, IV**
US-Clean Fleets		**Clean Fuel Fleets Programme (1990 - ....., Clean Air Act Amendment)**	**Objective:** to improve the air quality in the 22 cities with greatest smog problems by mandating fleets to shift to clean fuel vehicles **Vehicle Types:** passenger cars, light trucks, vans, buses, trucks in fleets with more than 10 vehicles with central refuelling **Test Area:** of 22 US cities in the original planning 16 have opted out of the programme (by 1997) **Funds:** details not available **Results:**The original plan to start in 1998 had to be postponed for 1 year since there was a lack of vehicle models meeting the Clean Fuel Vehicle Standards offered for sale. Credit trading programme. States that want to opt out must offer an equivalent VOC and NOx reduction by clean fuel fleet programmes of their own desigh or by other means.	**IV**
USA-CNGAmoco		**CNG Experience Amoco (1992 – 2000)**	**Objective:** to offer CNG refuelling stations to overcome the „chicken-and-egg"-barrier **Vehicle Types:** **Test Area:** USA **Funds**: details not available **Results:** 37 retail refuelling stations operated by AMOCO in the USA. No economic return of the substantial capital investment could be attained. AMOCO suspended the expansion, divested itself of all but 5 stations.	**IV**
USA-ENVVEST		**ENVVEST EV Pilot Program (1999 – 2002)**	**Objective:** to reduce pollutants and CO_2 emissions (part of US ENVVEST) **Vehicle Types:** electric vehicles (50), hybrids may be included **Test Area:** City of Vandenberg CA **Funds:** 1million US$/year (City of Vandenberg, Department of Energy, car manufacturers, utilities) **Results:** EVs provided for test driving, user training, maintenance traininginfrastructure established	**II**
USA-EPAct		**Energy Policy Act (1992)**	**Objective:** to reduce dependency on foreign oil and establish energy security. Certain public leets must be refuelled by domestic fuels **Vehicle Types:** passenger cars, trucks **Test Area:** USA **Funds:** **Results:** more than vehicles are acquired by state fleets. As the act does not require the use of (but only the capability to be used by) alternative fuels, many vehicles are bifuel and flexible fuel vehicles and run by gasoline or diesel	**IV**
USAEthanol		**Ethanol in Minnesota**	**Objective:** to encourange owners of flexible fuel vehicles (capability to use Ethanol E85) to use it instead of gasoline by information and education campaigns **Vehicle Types:** mostly passenger cars **Test Area:** Minnesota **Funds:** **Results:** more than 45'000 flexible fueln vehicles registered in Minn and 400 E85 stations planned by the end of 2002	**IV**

USA-EVLoan		**Pilot EV Loan/Lease Program for Washington Fed. Fleets (1998 – 1999)**	**Objective:** EVs made available for free for 1-3 months to give fleet managers the chance to test them **Vehicle Types:** electric vehicles **Test Area:** Washington D.C. **Results:** additional steps for the acceptance of fleet manager must complete the programme (e.g. infrastructure, standards, subsidies...)	III
acronym	**country**	**Title of the Programme (period)**	**Short description**	**Sub-task**
USA-EV MarketLaunch	**USA**	**EV Market Launch Framework (1998 -)**	**Objective:** to demonstrate 5'000 electric vehicles in 11 municipalities **Vehicle Types:** electric vehicles (5'000) **Test Area/operator:** 11 municipailies (Sacramento, Los Angeles, San Diego, Phoenix, Fort Lauderdale, New York, Boston, Richmond, Detroit, Washington, Atlanta) (Electric Transport Coalition: automotive and electric utility industries) **Results:**	IV
USA-EVready		**Developping the EV ready Communities (1998 -)**	**Objective:** to prepare the framework for the EV Market Launch (charging facilities, health&safety codes, information campaign etc.) **Vehicle Types:** electric vehicles **Test Area/operator:** 11 cities **Results:**	IV
USAFleetEV		**Fleet EValuation (1997 -)**	**Objective**: to familiarise fleet customers to the use of electric vehicles by organising events **Vehicle Types:** electric vehicles (150) **Test Area:** Atlanta area **Funds:** (Georgia Power) **Results:** high attendance of the events, but lack of vehicles meeting the demands (variety), incentives needed	II
USA-FO		**Field Operations Program (1996 -)**	**Objective:** to provide unbiased information on performances of alternative vehicles to fleet managers by standardized tests, cooperation with EV Loaner Programme **Vehicle Types:** more than 500 electric vehicles, more than 500 alternative fuel vehicles **Test Area/operator:** USA Department of Energy/National Laboratories **Funds:** **Results:** additional steps for the acceptance of fleet manager must complete the programme (e.g. infrastructure, standards, subsidies...)	I, IV
USA-Ford		**Ford Commitment in Clean Vehicles**	**Objective:** to create a market for alternative vehicles by partnerships with the fuel industry and Clean Cities Coalitions **Vehicle Types:** electric, LPG and CNG vehicles, vehicles able to run on E85 **Test Area:** USA, Vancouver, Toronto	IV
USA-SCE		**Southern California Edison Electric Transport Program (1989 -)**	**Objective:** to support and integrate electric transportation in Southern California **Vehicle Types:** 300 electricvehicles **Test Area:** Southern Californbia (region Rosemead-Pomona) **Funds 4 –5 million US$/year (SCE, Department of Energy, EPRI, California Air Resources Board, S.Cal.Air Quality Management District, CALSTART) **Results:** infrastructure established	III
USA-StationCar		**Station Car**	**Objective:** to provide electric vehicles at stations of public transport systems for commuters **Vehicle Types:** small electric vehicles **Test Area:** various cities (San Francisco Bay Area, region of Boston) **Funds:** details not available **Results:** only successful when clear advantages for the users (e.g. avoiding jams at rush hours etc.)	I, IV
USA-ZEV		**Zero Emission Vehicle Mandate (2003 -)**	**Objective:** to lower the air pollution by agreements with the car industry (percentages of newly sold cars must be ZEV) **Vehicle Types:** electric vehicles (ZEV) or specified low emission vehicles **Test Area:** California (California Air Resources Board **Results:** not yet available	IV

The details are based on the questionnaires and additional sources and may not be complete or reliable in every aspect.

Delineation, Information Sources and Acronyms for Japanese Programmes (Subtask 2)

Programme	Source used to fill in the questionnaire	Contraction
Car sharing project in Kyoto	Presentation at the Workshop June 2001 in Japan	J-CARShar
Subsidies for the introduction of LEV (this is a bundle of 7 programmes)	Low emission Vehicles in Japan, Current Diffusion Status and promotional Measures for Diffusion, Organisation for the promotion of low emission Vehicles, April 1999, Pages 8-15 Low emission Vehicles in Japan, Current Diffusion Status and promotional Measures for Diffusion, Organisation for the promotion of low emission Vehicles, Update April 2001	J-SUB*
Greening Automobile Taxes (This is a bundle of three sort of Taxes	Low emission Vehicles in Japan, Current Diffusion Status and promotional Measures for Diffusion, Organisation for the promotion of low emission Vehicles, April 1999 pages 16-18 and Update 2001 Presentation at the workshop June 6. 2001 Kyoto by LEVO	J-TAX*
Financial Investments and Loans on Introduction of LEV	Low emission Vehicles in Japan, Current Diffusion Status and promotional Measures for Diffusion, Organisation for the promotion of low emission Vehicles, April 1999, Pages 18- 19 Presentation of NEDO at the workshop June 6, 2002 Kyoto	J-LOAN
5 EV-Sharing System (four car-sharing projects, car sharing System in Kyoto is one of them	EV Sharing System in Japan, Presentation by JEVA at the workshop June 6, 2001 Kyoto	J-EVShar

*including: (1) J-CEVDiff; (2) J-LEVDiff; (3) J-REGNE; (4) J-PLEV; (5) J-LEINTRO; (6) J-SUBLEV; (7)Subsidy for Purchasing Air Environment Patrol Car

** including: (1)reduction of annual automobile tax and acquisition tax for LEV (national level); (2) increase of tax for old model vehicles (diesel); (3) reduction of automobile acquisition tax and tax reduction in specific areas for diesel vehicles (local level)