THE INTERNATIONAL ENERGY AGENCY

PROGRESS TOWARDS SUSTAINABLE TRANSPORTATION

Report by the IEA Implementing Agreement for Hybrid and Electric Vehicle Technologies and Programmes for the year 2000

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1. Rona Lane, Stirling R, 'A Performance Evaluation of EV Chargers', EA Technology, March 1996
2. Rona Lane, Stirling R, 'The Development of EV and EV Infrastructure Standards', EA Technology, March 1996
3. Rona Lane, R Stirling, 'Progress in the Development of EV Infrastructures' EA Technology, January 1997
4. Rona Lane, Lee Juby, 'Update of Charging Technologies', EA Technology, March 1997
5. Alan Collinson, 'Guidelines for Infrastructure Modelling', EA Technology, March 1997
6. Mike Mangan, 'Status of EV Infrastructure Standardisation Development', EA Technology, March 1997
7. Rona Lane, 'A Preliminary Study into the Cost of EV Infrastructure', EA Technology, October 1997
8. Rona Webster, Rod Townend, 'Barriers to the Development of Electric Vehicle Infrastructure', EA Technology, August 1999

BATTERY AND SUPERCAPACITOR TASK FORCE (ANNEX 5)
Selected Battery Topics – Electrochemical Society volume number PV 98-15. To order contact Keri Ahern <books@electrochem.org>
Annex V Outlook Document 1996/97 – no longer in print
Annex V Outlook Document 1998 – available on request

HYBRID VEHICLES (ANNEX 7)
Overview Report 2000 - Worldwide developments and activities in the field of hybrid road vehicle technology.

MARKET DEPLOYMENT STRATEGIES (ANNEX 8)
Market Deployment Strategies for Clean Vehicles - Report on a workshop held in Kyoto, Japan, on June 6, 2000. - available on request

EXECUTIVE COMMITTEE
Annual Reports for 1994, 1995, 1996, and 1997/98 – available on request.
Hybrid and Electric Vehicle Programmes 1993-1999 - available on request

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CHAIRMAN'S MESSAGE

THE FOG IS LIFTING

The Governments of IEA member countries continue to pursue their transportation sector objectives of cleaner air, reduced greenhouse gas emissions, and reduced dependence on imported oil supplies. At the start of our Implementing Agreement, there was considerable uncertainty about how technologies would evolve, but the work our task forces have done during phase 1 and are continuing to do during the current phase are gradually answering some of the important questions. Slowly, almost imperceptibly, steady progress is being made in dozens of research programmes, demonstration projects, infrastructure projects, and marketing programmes. To achieve a sustainable transportation sector is an enormous task, but industry and governments are making strong efforts, and our Implementing Agreement is making its contribution by supporting international collaboration among governments.

Some of the questions facing Governments are:

- What is the state-of-the-art of hybrid, fuel cell, and electric vehicle technologies?
- What are the environmental impacts of the new technologies?
- What can Governments do to accelerate technology development?
- How can these technologies be introduced to the market, and how long will it take before they obtain an important market share?
- What are the barriers to market deployment, and how can they be addressed?

The fog which prevented a clear vision of the transportation technology future is slowly lifting, and the path forward is gradually becoming clearer. This Annual Report for the year 2000 reveals some interesting trends in the technology and marketing areas. Many of the countries participating in our Agreement seem to be arriving independently at similar answers to the above questions.

WHAT IS THE STATE-OF-THE-ART OF HYBRID, FUEL CELL, AND ELECTRIC VEHICLE TECHNOLOGIES?

Our task forces on Information Exchange (Annex 1), and Hybrid Vehicles (Annex 7), constantly keep their participants and their governments up to date. By definition, the state-of-the-art keeps changing, and the only way to keep up is to frequently report on progress in the countries which are the leaders in technology development. Annex 1 collects data on technical progress and government programmes by means of an annual questionnaire and an annual technical report. At the Expert Meetings, there is also a much more immediate updating of knowledge by means of "mini-presentations", in which participants give verbal reports on the state-of-the-art in their countries. The state-of-the-art of hybrid vehicles is covered by Annex 7 and that of fuel cell vehicles by Annex 10 entitled "Electrochemical Power and

Energy Storage Systems". Jointly, these three Annexes enable participants to maintain an up-to-date overview of technology advances and market developments in our member countries.

WHAT ARE THE ENVIRONMENTAL IMPACTS OF THE NEW TECHNOLOGIES?

During phase 1 of our Agreement, Annex 2 entitled "Environmental Impacts" produced a report not only on the environmental impacts of electric vehicles, but also on the progress expected with conventional, internal combustion engine vehicles. It also described the overall framework within which new technologies appear on the automobile market, and gradually attain an increasing share of a country's vehicle fleet (or vehicle parc, as it is also known). Annex VII, on Hybrid Vehicles, has added to this work. Improvements are needed both in drivetrains and in the remainder of the vehicle and its systems (the glider). Improvements in the glider, including reduction of weight, improvement of aerodynamics, and increased energy efficiency of ancillary equipment are particularly important because they can usually be applied to almost all types of vehicles entering the market in a given year. Their benefits can be immediate and widespread, and are usually not restricted to the market success of a particular drive train technology. Many of the country articles in this Annual Report refer to advances being made in ancillary equipment and other parts of the glider. With respect to drive-trains, major improvements in energy efficiency and reduced emissions are possible in all four technologies, ICE, fuel cell, battery electric, and hybrid, and work should continue on the development of all four. In addition, the importance of the primary energy used by the vehicle is gaining increasing recognition. In most cases the total "well-to-wheel" environmental impacts of automobiles depend as much on the kind of primary energy which is used as it does on the drivetrain technology. Our Implementing Agreement intends to start up a new Annex on the subject of "Renewable Energy for the Transportation Sector", perhaps in partnership with other Implementing Agreements.

WHAT CAN GOVERNMENTS DO TO ACCELERATE THE DEVELOPMENT OF THESE NEW TECHNOLOGIES?

Our Annex 10 entitled "Electrochemical Power Sources and Energy Storage Systems" is contributing to exploratory research in batteries and supercapacitors by maintaining a network among international researchers. The Annex will coordinate closely with Annex 7 on hybrid vehicles, and with the Fuel Cell Implementing Agreement. Governments can accelerate technology development by funding exploratory (or pre-competitive) research and through joint industry-Government programmes.

Although industry is putting a lot of effort into fuel cell, battery, and supercapacitor research, there is still an important role for exploratory research such as basic properties of materials and development of new materials for electrodes and electolytes. The longer term improvement of fuel cells and batteries will depend on the exploratory research being done today.

As for join industry-government programmes, some examples are the "Partnership for a New Generation of

Vehicles – PNGV" in the USA, the "Advanced Clean Energy – ACE" programme in Japan, and the "Car of Tomorrow" programme in Europe. Being closer to the market, they are usually not suitable for close international collaboration. However, the publicly available information produced by these programmes is made available to our participants during our information exchanges.

Both the exploratory research programmes and the Government-Industry programmes have succeeded in accelerating the rate of technical progress in our countries. Annex 10 has contributed by encouraging international collaboration in exploratory research .

HOW CAN THESE TECHNOLOGIES BE INTRODUCED TO THE MARKET, AND HOW LONG WILL IT TAKE BEFORE THEY OBTAIN AN IMPORTANT MARKET SHARE?

Annex 8 entitled "Deployment Strategies" is studying the market introduction programmes supported by Governments in many of our member countries. It will sytematically collect case studies and analyze them to extract the lessons that can be learned.Before a new technology can be introduced to the market, it has to be demonstrated that it works, and the public has to be aware of its existence. This has led to Government supported fleet demonstration programmes and public awareness programmes. These are followed by market introduction programmes themselves which often aim at specific market niches. During the past ten years, a lot of experience has been accumulated by our member Governments in all three types of programmes, and reporting on this experience can be instrumental in improving future programmes. The preliminary results about measures that have been shown to be effective on the one hand, and about pitfalls to avoid on the other hand, reveal that large amounts of public funds could be saved in the future. A workshop was held in Kyoto, Japan in June 2001 to determine what lessons could be learned from all these projects and programmes. One of the main conclusions was that the experience gained with one project or programme often is not sufficiently shared with others, and that effectiveness and efficiency could be improved if experience and lessons learned were shared more widely.

This report mentions some market segments in which clean air vehicles have been successful. Examples are electric bicycles and motor scooters in France and Italy, and the innovative electric scooter rental scheme in Rome. Another interesting development is the "neighbourhood vehicle" in several states of the USA, which is allowed to drive on roads where the speed limit is less than 35 mph. Initially, subsidies or other incentives from Governments may be required. For the car market as a whole, it is not easy to predict which models will succeed and which will fail, and the same is generally true for clean air vehicles. Different initiatives have to be tried, the successful ones should be enlarged and exploited and the less succcesful ones terminated.

Obtaining market share is crucial to achieving our sustainability and energy objectives. If only one or two percent of the new vehicles sold have more

sustainable drive trains, then it will take 10 to 15 years until one or two percent of the entire vehicle fleet in a given country has sustainable drive trains, and the reductions in emissions or dependence on imported oil will hardly be measurable. Market shares of thirty percent or more will be needed for ten to fifteen years in a row in order to make significant progress towards the objectives. This, in turn, can only be expected if the price of sustainable vehicles goes down. Environmentally friendly vehicles will obtain a major market share only when car buyers find them more attractive from a cost or other point of view than the other cars in a dealer's showroom. How long this will take is hard to predict, but joint industry-Government technology development and market introduction programmes could be instrumental in bringing this about in a matter of years, rather than in a matter of decades if nothing is done.

WHAT ARE THE BARRIERS TO MARKET DEPLOYMENT, AND HOW CAN THEY BE OVERCOME?

The main barriers to the market deployment of battery electric vehicles have been obvious for many years. Firstly, the technology has to be improved so that the vehicle can meet customer expectations, secondly a sufficient manufacturing volume has to be attained to make the vehicle cost competitive, and thirdly the energy and service infrastructures have to be provided. Progress has been made in all three areas. In certain niche markets such as car free tourist villages, demonstration projects, and company car fleets, customers have been educated about what electric vehicles can and cannot do so that they had realistic expectations when they purchased or leased an EV. These realistic expectations could then be met, also with the assistance of good after-sales service programs. Secondly, manufacturing volumes for vehicles and battery packs have gradually increased, but they are still far from the level required to significantly reduce costs. Thirdly, in some of the niche markets an adequate infrastructure of charging facilities and customer support has been created.

Hybrid vehicles have not had to address these barriers to the same extent, little adjustment is needed to customer expectations. Because of this, substantial manufacturing volumes could be attained in a short time. The existing infrastructure for fuel supply and customer support can be used. Hybrid technology appears to have reached a self-sustaining path, and manufacturers have announced that they will increase production volumes. This should lower costs even more and enable the further strengthening of the sales and service infrastructure. Another advantage of hybrid vehicle technology is its evoluationary, rather than revolutionary, nature. A "mild" hybrid vehicle consists of some relatively small changes to the starter and alternator, a stronger hybrid consists of larger changes to batteries, generators, and electric motors. These vehicles can be introduced on the market smoothly and progressively, and as the technology improves their performance can gradually be enhanced.

When fuel cell vehicles reach the market in four or five years the challenge of their fuel infrastructure will need to be addressed. If they use gasoline, they will face stiff competition from hybrid vehicles. If they use methanol, new pumps will have to be installed in gas stations. If they use hydrogen, a whole new gas infrastructure will have to be created. The fuel cell

vehicle would have to be very attractive to consumers from the cost point of view or from some other point of view in order to compensate for the initial inconvenience of a limited infrastructure.

Governments can overcome these barriers through a variety of policy tools. They can subsidize the purchase price of environmentally friendly vehicles through tax concessions or subsidies, and they can encourage the development of an alternative fuel infrastructure by subsidies for the installation of new equipment, and by tax concessions on environmentally friendly fuel. Our Implementing Agreement will continue to monitor the policies and programmes aimed at overcoming the barriers to market deployment of all three technologies, and continue to exchange information and experience among our members.

A key prequisite for a transition from an older, obsolescent technology to a newer one which serves society better is the existence of a smooth development and transition path from the one to the other. No country can abruptly switch from one energy source and transportation technology to another, it can only gradually increase the market share of the preferred technology while the market share of the obsolescent one decreases. It is not so much a question of a barrier, which, once it is removed, would allow free passage, but more a question of a long and sustained process which eventually reaches its goal. Hybrid and electric vehicles would allow such a smooth transition to occur, and fuel cell vehicles would also create such an opportunity, although it would require more effort.

The intoduction of these technologies would also facilitate a transition from the current oil and gas energy vectors to those of electricity and hydrogen. Our Implementing Agreement is looking into the possibility of doing further work in the area of renewable energy for the transportation sector, perhaps in cooperation with other Implementing Agreements.

CONCLUSION

The answers to the questions that Governments have on the development of sustainable road transportation technologies are gradually becoming clearer. It has been convincingly demonstrated that better technologies do exist, and can take a share of the market. Government programmes to accelerate technology development and to encourage market introduction have generally been successful and have shown the way forward to a more sustainable future. Our Implementing Agreement has contributed by facilitating international collaboration among Governments, and by exchanging experience of how to do even better in the years to come.

Urs Muntwyler
Chairman

INFORMATION EXCHANGE ON HYBRID AND ELECTRIC VEHICLES (ANNEX 1)

CHAPTER 1

THE CHALLENGE

Governments need basic information about clean energy vehicles in other countries. In order to plan their programmes, they need to know the numbers of clean energy vehicles on the road in other countries, their technical capabilities, and how owners use them. They also need to know about the programmes of other Governments, and what new technologies are being developed.

THE RESPONSE

The Information Exchange Task Force (Annex I) has systematically collected information about hybrid and electric vehicles for the past 6 years. Four broad categories of information are collected:

- Census information about the number of hybrid and electric vehicles, the type of vehicle (cars, trucks, buses), and the category of owner (private, commercial, government)
- Technical information about the hybrid and electric vehicles under development or on the market.
- Information about Government policies, regulations, and programmes to encourage clean energy vehicles
- Behavioural information about how owners operate their vehicles, including driving and recharging patterns.

THE WORK PROGRAMME

At Experts' meetings, member countries give "mini-presentations" about the hybrid and electric vehicle situation in their country, giving an up-to-date overview to all participants. In addition, member countries annually complete a questionnaire about the four broad categories listed in the previous paragraph. The Operating Agent then collects and analyzes the information, and produces an annual technical report.

THE ACHIEVEMENTS

- The Experts' Meetings have enabled participants to remain up-to-date about the hybrid and electric vehicle situation in the member countries.
- Annual Technical Reports have been produced every year since 1995.
- Two Summary Reports with highlights from the Annual Technical Reports have been published for 1995 and 1998.
- The Operating Agent has published papers at technical conferences, and provided information for the web-site.

CHAPTER

2

ENVIRONMENTAL AND ENERGY IMPACTS (ANNEX

THE CHALLENGE

Governments needed reliable information on the environmental and energy impacts of electric vehicles. In 1994, when the task force started, few studies had been done on this subject, and some of the available information was contradictory.

THE RESPONSE

The Environmental and Energy Impact Task Force (Annex II) worked for five years (1994-99) to produce a report on the impacts of electric vehicles. The following topics were studied:

- The environmental and energy impacts of electric vehicles at the national level were studied by means of a spreadsheet model which could calculate the results of the introduction of electric vehicles into a country's vehicle parc, using various initial assumptions and scenarios of market introduction.
- The environmental impacts of electric vehicles at the local level, i.e. at the street level, were studied using various assumptions about the relation between emissions from vehicles and the resulting concentrations of pollutants in the air.
- The environmental impacts of the manufacturing, use, and recycling of various types of batteries was studied.
- The possibilities were studied of introducing innovative new transportation chains in which one link was an electric vehicle.

THE WORK PROGRAMME

The work was divided into one sub-task for each of the above studies, they were led by the Netherlands, Germany, Canada, and Austria respectively. There were five participating countries in total, the four previously mentioned and Switzerland. All participating countries provided information for all the sub-tasks. Two Expert meetings were held every year, where the work done to date was exchanged, and plans were made for the remaining steps in the work programme. The Operating Agent produced an annual report for the Executive Committee and the participants. All the work was included in a final report which was completed in 1999. The Annex has now successfully completed its work programme, and has been closed down.

THE ACHIEVEMENTS

The final report provided definitive answers to many questions about the environmental and energy impacts of electric vehicles. It clearly set out the main factors related to reductions of noxious and greenhouse

gas emissions. Some of the main findings were:

- It takes a long time, from ten to fifteen years or more, to replace a country's vehicle fleet. Various introduction scenarios for electric vehicles showed that even if EV's capture a large market share of 15 or 25 %, it would still take many years before the vehicle fleet as a whole would consist of 15 % of electric vehicles. For this reason, improvements in internal combustion engines will account for the major share of air quality improvements by 2015, and the assumed introduction of EV's would account for a relatively smaller share.
- The environmental impacts of EV's depends strongly on the way in which electricity is generated in specific countries. As a generality, this conclusion is not surprising, but the extent to which the generation mix influenced the impacts was. In countries with a high proportion of thermal electricity generation ("brown" electricity), the only advantage of EV's was that emissions were shifted from the tail pipe of the vehicle to the generation plant, and this is important for urban air quality. In countries with a high proportion of nuclear and hydropower electricity generation, EV's had strong advantages for clean air, greenhouse gas reductions, and diversification of energy supplies.
- The environmental impacts of batteries were not negligible, in a life cycle analysis of EV's they could add up to 20 % to the impacts of some parameters. The diversity of battery technologies is reflected in the diversity of environmental impacts, and more work will be needed to determine the impacts of the newer technologies.
- Various innovative transportation chains were described, and in each case their possible share of the total number of trips in a city was estimated.

CHAPTER

3

INFRASTRUCTURE (ANNEX 4)

THE CHALLENGE

The introduction of electric vehicles would require both a physical infrastructure, such as charging facilities, and a service infrastructure for the repair of vehicles, training of emergency personnel such as police and fire fighters, etc. The international compatibility of technical infrastructure would reduce costs for manufacturers and consumers. Governments, electric utilities, and the auto industry needed information about the compatability, cost, and technical issues related to infrastructure.

THE RESPONSE

The Infrastructure Task Force initially investigated the possibility of encouraging standard setting organizations to cooperate in setting internationally compatible infrastructure standards for EV's. It then studied specific infrastructure topics, such as barriers to infrastructure deployment and costs of infrastructure.

THE WORK PROGRAMME

Most of the work was done on a cost sharing basis, where participants shared in the cost of studies done by the Operating Agent. Participation in the work changed during the five years, at Canada, Korea, The Netherlands, the UK, and the USA were involved for varying lengths of time. The UK Operating Agent produced a series of studies which were available only to the participants. The Annex has now successfully completed its work programme, and has been closed down.

THE ACHIEVEMENTS

The initial study on international compatibility of standard setting found that the different standard setting organizations in Asia, America, and Europe pursued independent paths. There were similar standards for each continent, but very different standards among the continents. It was also found that there was little the Implementing Agreement could do to contribute to international compatability of technical standards.

The studies on infrastructure topics yielded more positive results, and produced reports on EV chargers, infrastructure modelling, barriers to infrastructure development, and the cost of infrastructure.

EXPLORATORY RESEARCH IN BATTERIES AND SUPERCAPACITORS (ANNEX V)

CHAPTER 4

THE CHALLENGE

Few enabling technologies in the world today have the same potential for transforming the road transportation sector as batteries, supercapacitors, and fuel cells. Better and cheaper batteries and supercapacitors would enable hybrid vehicles to capture a large market share, and, in the long run, might provide battery electric vehicles with the desired performance and range. Fuel cell vehicles could reduce environmental problems if their fuel (hydrogen) is derived from renewable sources or non-carbon sources. The potential is enormous, but further research and development work needs to be done to improve the technologies and to bring down the costs.

THE RESPONSE

The task force on exploratory research in batteries and supercapacitors focussed its efforts on those areas where Governments are the main actors in research, namely in pre-competitive exploratory research. Industry has long recognized the potential of improved batteries, and is investing heavily in research closer to the market. Another IEA Implementing Agreement deals with fuel cells. Annex V strengthened international collaboration in exploratory research, thereby supporting progress in the ultimate development of better batteries and supercapacitors.

THE WORK PROGRAMME

Participants exchanged information on the exploratory research projects being done in each country. As well, they organized two symposia jointly with the Electrochemical Society on electric vehicle batteries and supercapacitors. In addition, they published two "outlook" reports on the current state-of-the-art of vehicle battery development.

THE ACHIEVEMENTS

The task force brought together experienced electrochemical researchers from different countries, and one of the important benefits was the networking and informal exchange of information that took place. More concretely, the two symposia (In San Antonio in 1996 and in Boston in 1998) were well attended by researchers from industry and Government, and their proceedings were published by the Electrochemical Society. The "outlook reports" were well received, and were distributed to all participants in the Implementing Agreement.

CHAPTER 5

HYBRID VEHICLES (ANNEX 7)

THE CHALLENGE

Hybrid drivetrains can double the energy efficiency of internal combustion engine drivetrains. Governments are interested in further development of the technology, and rapid introduction on the market. Government officials need reliable reports on this new technology, including comparisons of the various types of hybrid vehicles, their environmental impacts, testing methods, use of alternative fuels, etc.

THE RESPONSE

The hybrid vehicle task force started its work in 1998 to study and report on hybrid vehicle issues of interest to Governments and automotive research organizations.

THE WORK PROGRAMME

The Annex has divided is work into two major sub-tasks, the first is an overview of hybrid vehicles, and the second is the study of a number of special topics related to hybrid vehicles. In view of the need to produce results quickly, the Annex holds three Experts' Meetings per year.

The first six topics selected were:

1. Definitions of hybrid vehicles
2. Comparative Assessment of different HEV configurations using ADVISOR (a U.S. software package)
3. Alternative motor fuels and hybrid vehicles
4. Test methods for hybrid vehicles
5. HEV's and regulations.
6. Energy consumption and emissions.

The possible future topics are:

- the trend from charge depleting to charge sustaining hybrids
- sustainability of the HEV market share after the first market introduction.
- fuzzy logic and learning effects in HEV control strategies.
- temperature/climate dependence of emissions, energy consumption and performance
- demands on power electronics
- relation between ITS and HEVs
- cost aspects

THE ACHIEVEMENTS

In 2001, the Operating Agent completed a major report in printed and CD-ROM format. It contained an overview of hybrid vehicles and reports on the first six topics above. It also includes a data base of all the known types of hybrid road vehicles as of 2001. This comprehensive, 200 page report is the result of collaboration among all member countries, and provides an excellent description of the hybrid vehicle situation today. Presently, the report is only available to participants in the Annex, but the Executive Committee is considering wider dissemination, and the posting of the report on the web-site.

CHAPTER

6

MARKET DEPLOYMENT STRATEGIES (ANNEX 8)

THE CHALLENGE

Many IEA member Governments implement programmes to increase public awareness of clean energy vehicles, to test these vehicles in pilot projects, and to demonstrate their use in small or large fleets. All have the ultimate aim of introducing clean energy vehicles to the market and increasing their market share. Governments wish to learn more about the effectiveness of these programmes, mainly which types of measures, interventions, and regulations work and which ones don't. Many programmes consist of a combination of measures, and some combinations are more successful than others. Governments are also interested in efficiency, that is to achieve the desired results at the lowest possible cost.

THE RESPONSE

The Market Deployment Strategies Task Force started in 2000 to exchange information and experience acquired in Government programmes which encourage the use of clean energy vehicles. The Annex will study both the "theory" and the "practice" of such programmes. The study of theory will consider the management structures, measures, and budgets put in place to achieve the project objectives, mechanisms for learning from experience as the project goes along, and also for learning from the experience of others, and evaluation and feedback mechanisms. The study of practice will consider several case studies from different countries, and determine what went right and what did not turn out as expected, and the lessons to be learned.

THE WORK PROGRAMME

The Annex is implemented jointly with the Advanced Motor Fuels Implementing Agreement, and covers all types of clean energy vehicles, not only hybrid and electric vehicles. The work is divided into four sub-tasks. The first sub-task, led by Italy, will collect essential descriptive information on a large number of Government supported fleet tests in order to allow for the selection of case studies, and also to determine what can be learned at this global level. The case studies will then be examined in detail, and a report will be written on experience with fleet tests, and lessons that can be learned from them. The second sub-task deals

with Government Support and Regulations, and will adopt a similar approach of gathering information on a relatively large number of Government support programmes and regulations, and then selecting case studies for closer examination. It will consider restrictions which limit Internal Combustion Engines using gasoline or diesel fuels, and favour hybrid, electric, or alternative fuel drive trains. It will also examine experience with Government financial support for clean energy vehicles. The third sub-task will study the role of stakeholders such as local governments, utilities, gas companies, alternative fuel suppliers, fleet owners, etc. in this type of Government programme. It will analyze their roles and responsibilities, and it will report on the lessons learned from existing and completed programmes, and on what can be done in the future to ensure that each stakeholder plays its appropriate role, and contributes effectively to program objectives. The fourth sub-task will draw on the work of the first three to prepare a report on market introduction strategies. It will analyze market niches and their potentials, and elaborate recommendations for successful market introduction strategies.

THE ACHIEVEMENTS

Since the year 2000 was the first year of operation of the Annex, the main achievement was the completion of the organizational phase, i.e. bringing the participants together and organizing the work programme. In June 2001 a successful workshop was hosted in Kyoto by the Government of Japan, and specifically by LEVO and NEDO, on "Market Deployment Strategies for Clean Vehicles". The report of this workshop will be posted on the web-site.

Country	Programme / Measure
Austria	Breitentest
	EV's in Vienna
	LPG buses in Vienna
	Car free tourism resorts
Finland	MobilE
	EVD Post
	ZEUS Helsinki
France	Praxitèle
	LISELEC
Germany	Prokom
Italy	ATAF Florence
	EV Lombardia
	Pro MOTORI-Ecologici Roma
Japan	LEV Diffusion Plan
	Subsidies for Diffusion and Promotion
The Netherlands	Het Nieuwe Rijden
	Stiller, schoner en zuiniger verkeer
	Rational use of Energy in Transport
Sweden	KFB Ethanol and Biogas Programmes
	Environmentally friendly vehicles in Stockholm
	ZEUS Stockholm
	Ethanol and Hybrid buses in Stockholm
	EV's in Goteborg
	EV's in Skane
	Flexible fuel leasing
Switzerland	Large Scale Test in Mendrisio
	City Car
	Easy Move
USA	Clean Cities
	SCE Electric Transportation
	Pilot EV loan & lease
	Fleet EValuation

Table 1: The programmes being studied by Annex 8.

NEW ANNEXES: CLEAN CITY VEHICLES FOR DEVELOPING COUNTRIES

CHAPTER 7

CLEAN CITY VEHICLES

THE CHALLENGE

Many large cities in developing countries have serious air quality problems which in turn lead to serious health problems. Some succesful projects have been implemented to replace two-stroke engine rickshaws with electric rickshaws (Kathmandu), to introduce electric bicycles (China), to manufacture a low cost battery electric vehicle (India), and to introduce ethanol as a fuel (Brazil). Encouragement of these new technologies, and a transfer of technology among developing countries, might be highly beneficial both for the health of urban populations, and for the economic growth of the country.

THE RESPONSE

A new Annex X called "Clean City Vehicles" is in the planning stage. Its objective is to share technology and experience with hybrid, electric, and alternative fuel vehicles between industrialized and developing countries, and equally important, among developing countries.

THE WORK PROGRAMME

An interim Operating Agent from Sweden has prepared a proposal for the Annex. Wide consultations will be held on this proposal, since it is essential that a project of this nature has a high priority for the developing countries concerned and fits in with their own strategies. It will also be necessary to obtain support from international development organizations. It is intended to organize a workshop during the second half of 2002 which includes both developing countries and IEA member countries to prepare both a work plan and an organizational structure for the proposed new Annex.

RENEWABLE ENERGY

NEW ANNEX – RENEWABLE ENERGY FOR HYBRID AND ELECTRIC VEHICLES

THE CHALLENGE

Both hybrid vehicles and fuel cell vehicles could obtain a major market share within the next ten years, and become a major share of a country's vehicle parc within the next twenty years. Their contribution to reduction of greenhouse gas emissions will depend on the type of primary energy that is used to produce

electricity, and fuel for hybrid and fuel cell cars. If the primary energy is from fossil fuel sources, there would not be a significant reduction in greenhouse gases unless carbon is sequestered from oil and natural gas. If the primary energy is from renewable sources, the greenhouse gas reductions would be very substantial, and allow for the achievement of environmental targets similar to the Kyoto targets. In view of the very large amounts of energy required by the transportation sector, planning would have to start now if the objectives are to be achieved by 2020.

THE RESPONSE

The IEA Secratariat will conduct a major study on renewable energy for the transportation sector, and the initial work on this has already started. The Executive Committee of the Hybrid and Electric Vehicle Implementing Agreement has also discussed this issue, and is in the early planning stage of starting an Annex on this subject. Among the initial steps are identifying an interim Operating Agent, preparing a preliminary proposal, and holding a workshop to plan a work programme.

ENVIRONMENTAL TARGETS

NEW ANNEX – TECHNOLOGY PATHS TO REACH ENVIRONMENTAL TARGETS.

THE CHALLENGE

Many IEA countries have prepared plans to achieve clean air targets and the Kyoto targets. Generally, these plans rely on both mobility behavioural changes, and on technology improvments. Various technologies have been proposed to address the problems, and many claims for and against them are made. Governments would be interested in an objective, neutral study which would examine the technology paths which could contribute to the achievement of national environmental targets.

THE RESPONSE

The Executive Committee would see work of this nature as being a good follow up to the environmental and energy assessment work done in Annex II, which is now completed. The first steps in starting a new Annex on this subject would be to identify an interim Operating Agent, and to determine the level of interest in participating in work of this nature.