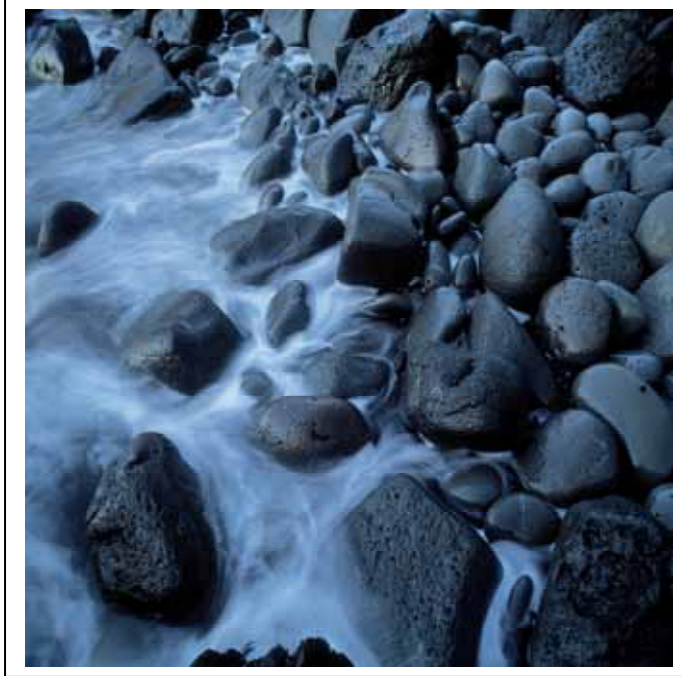


2nd year Report

ECTOS



*Ecological City
Transport System.
Demonstration,
Evaluation And
Research Project Of
Hydrogen Fuel Cell Bus
Transportation System
Of The Future.*

Contract: EVK4-CT-2000-00033

April 2003



European Commission
City of tomorrow



Fifth Framework For Research
And Development

Icelandic New Energy

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1. Section 1 Management and resource usage summary for the 2nd year (months 13 – 24)

Cooperation within the group has been very good and all parties show high dedication to create a unique project, an unforgettable experience and make results that will make a difference within European and even the global community.

Complexity has arisen in the field of work load and costs as it is now evident that most categories were underestimated regarding the costs. However the consortium has reached an agreement that each responsible partner will cover increased cost in their fields and at the same time maximize the results that will be generated through the project. This shows the strong commitment of all partners to create results of value for the future.

The work during the second project year can be divided according to subjects into: Firstly the work on formulation of the *Methodology*; Secondly the preparations and testing of the *hydrogen fuelling station* and thirdly; the construction of the *hydrogen fuel cell buses*.

As a basic management overview the progress has been according to schedule and the project is now shaping to the form that was expected at the beginning. Details on all WP are described later in the document except for Dissemination WP 7 which is included in this chapter here below.

Finally specific effort has been put into managing the international conference that is held in conjunction to the opening of the hydrogen fuelling station. The international community has shown the Iceland project a considerable attention and in an effort to fulfil the need for giving information it was decided to have a conference at the same time as the opening would take place. During the same time the mid-term meeting will be held.

1.1 Dissemination activities during the 2nd year (WP 7)

Dissemination activities are a natural part of the project. Wherever the partners appear in public they present the events within ECTOS and recognise that the interest within the international media is very high. Media activities have not slowed down during the second year of the project; journalists and news agents still visit INE frequently. Already the attention to the “hydrogenization” in Icelandic is mostly brought forward by the ECTOS project and it is making an international impact. These media activities are taking up a lot of time from INE.

Detailed dissemination list is given later in the report.

The inauguration as an international event

A particular effort will be put into the dissemination about the ECTOS, the fuel station and future scenarios with hydrogen around the inauguration of the electrolysis hydrogen fuel station in Reykjavik. All partners, the international corporations that back up the ECTOS and the holding company EcoEnergy and the state of Iceland have joined hands to send a message out from Iceland to mark this important milestone.

Constructions of the filling station began in February and the delivery of the station to Iceland is planned on March 10th 2003. Designing process is also over and

at a PR-groups¹ meeting late February it was decided to send out a press release from the ECTOS-partners in the week of 10th-14th Feb. At that time the design of the station was made public. It was also decided that each partner is allowed to publish their own statements but there should be some common text which will be provided from INE. INE and Skeljungur will make a joint press release, which will be available for all partners. In March the details of the approach to the EC PR-activities will be discussed and planned. The PR-group has hired a special public relation agency to cover the inauguration event and also to service the press arriving to the event on April 24-25th. Already it is expected that there will be 50-70 journalists from abroad covering the event. The Ministry of Industry is directly involved and they will actually invite key guests to an official dinner on April 24th. The whole event has caught more attention than expected and taken up much more resources from INE and other partners than planned, both financial resources and non-financial ones.

All of the partners directly involved in the fuel station have drastically overspent their budgets (as well as INE) but all of the extra costs are covered by the companies themselves.

It is therefore expected that the delivery in March and the start up in April will be more than satisfactory.

The Mid Term Meeting

The Mid-Term meeting of the consortium will be held in Iceland on April 26th and shortly a meeting will be held between DaimlerChrysler, INE and the EC to discuss the fulfilment of the delivery of the buses that are part of the Mid-term assessment clause, to evaluate the risk of “non delivery”, so that the original budget plans can be applied.

There is now a full understanding between all related partners regarding this issue. As the project moves closer to the delivery of the buses dates have been discussed for the inauguration of the buses. This is expected to take place in August or September. On this occasion there will be the second ECTOS-group meeting. Unfortunately the final date cannot be issued until later this year, hopefully no later than August.

There are no conflicts within the group and everyone is extremely committed to make this a successful project, and communication to the European Commission has been excellent.

¹ The key partners in the project established a PR-group to cover the activities related to the media people, information flow to the public, the organising of the inauguration conference and other activities. All information from the PR-group work has been disseminated to the Scientific officer at the meeting in Brussel in January and then again in March.

1.2 Objectives of the reporting period

The goal of the second year report is to try to give a good overview of the process of the project. It will also briefly discuss the milestones and deliverables that have been obtained. The bulk of the document is though focused on the status of the different WorkPackages.

The original plans

According to the Gantt chart (page 13 in the ECTOS DoW) the time table shows that the following activities were planned for the reporting period:

- Project management
- Methodology, air quality monitoring, noise monitoring,
- Fuelling station preparations and construction, tests of production and storage of hydrogen
- Hydrogen buses: Preparation for arrival, training of personnel, buses in operation
- For the Maintenance and Staff training. Building the maintenance garage. Tools and equipment and training of personnel
- Evaluation and assessment: Comparative assessments, opinion polls, European impacts, and technical evaluation. Life cycle analysis
- Dissemination

Deliverables 1-6 are now finished and have been handed to the EC.

1.3 Milestones and deliverables obtained

The work within ECTOS during the second year has gone as planned Yet after some re-organisation (see 1st year report) the group is catching up with the schedules. Therefore the report begins with a short on the status of various project parts.

Comments on the status of each deliverable and milestones

The ECTOS partners have already sent to the Commission deliverables 1-6.

Due to the changed approach and delayed delivery of the combined Methodology for ECTOS the approach and timing from the Environmental Study will be somewhat different than originally planned. The team realised that monitoring the air quality in Reykjavik needs very delicate equipment. It is only recently that Reykjavík's Institute for Environment and Public Health began measuring the air quality on a continuous basis, in spite of plans for doing so for the last 3 years. But their results will fit the objectives of the ECTOS project quite well. On top of that, as indicated in the Methodology a more direct monitoring approach will be applied for a better comparison between normal diesel buses and the hydrogen buses. But the Mid Term Environmental study will arrive later than originally planned or during the autumn months 2002.

1.4 Coordination of the information between partners and communication activities

The tasks for each part of the ECTOS do not overlap much on a daily basis. Therefore the work teams have been allowed to continue their work in sub-groups without too much formal management. Yet, good and frequent contacts via email and fruitful telephone meetings and discussions have led to smooth working procedures and easy problem solving. Two project – board meetings and two meetings within the research groups were held during the reporting year:

15th of May 2002 Meeting in Copenhagen between the research team and the project manager – Agenda; introducing ideas for the social, environmental and economic research, - discussion about how to combine and synchronize them, which overlaps should be avoided and the possibilities for processing the data. A preliminary agreement was made on work and task delegation within research team.

27th – 28th May board meeting with workshops concerning the design of the fuel station and fuel cell buses on the one hand and task division within the data collection for the research on the other hand. A Primary methodology introduced to the project team and ideas

25th of September 2002 Research – team meeting in Iceland for the compilation of the Methodology drafts introduced time tables set up for the 5-7th of October, bus group meeting in Hamburg to discuss the planned arrival, maintenance and driving of the buses

September – March 2002-2003, frequent meetings between Skeljungur, Norsk Hydro, Shell Hydrogen and Icelandic New Energy Ltd, to finalise the design, structure and buildings of the hydrogen filling station. Also to inform Icelandic authorities of the planned activities.

The coordinator would first like to state that the cooperation within the groups has been very fruitful and enjoyable.

Dissemination activities

This chapter is compiled from the partners' inputs. As the issues are similar in most cases the activities are presented in a simple list. The ECTOS group has tried to reduce the interest of newsagents to visit Iceland during 2002 and recommended rather to cover the events after the inauguration of the fuel station in 2003. Some of them have yet decided to cover the events both before and after!

- INE
- A keynote presentation at the World Hydrogen Conference in Montreal and the ECTOS project was the focus of the speech. At the same conference two presentations were made on the CUTE project and both gave a good overview as well on the ECTOS.
- Minnesota
- New York
- Denmark
- Barcelona for CUTE?
- The Stockholm Partnership for sustainable cities
- Lecture at the International Institute for Industrial Environmental Economies,

Lunds University, Guest lecture on the Master's programme, Environmental Management and Policy within the course: Cleaner Production, Prof Donald Huisingh

- Sustainable Island , - an energy forecasting workshop for Hydrogen use on the island of Texel, The Netherlands
- Japan before 1st march?
- 8 reporters have been in Iceland during 2nd year. These include:
- BBC radio,
- The science and energy day to commemorate the 100th anniversary of the Royal Technical University of Stockholm
- NBC,
- Introduction on the ECTOS project at a meeting with the directors for the following institutions: Pohto, Finland; AEL, Finland; Technological Institute, Norway; SIFU, Sweden; IceTec, Iceland, September 2002.
- Specialists and managers at IceTec have introduced the ECTOS project at several occasion when presenting the ongoing projects and environmental work at the Institution.
- Introduction on ECTOS on IceTec's homepage, www.iti.is
- French radio made a telephone interview for their science program, September 2002
- Dutch radio,
- Swiss TV made a 7 minutes report for the main news in December plus a 25-minute program, which was narrated both in English and

French, on hydrogen and energy opportunities. The United Nations Environmental Program sponsored the program.

- Japanese newspaper
- Finnish Morning paper
- Carola for the women's Magasine Brigitte in Germany.
- A group of 9 media people from various news agents in Germany.
- A second "Iceland New Energy Day" was held in Brussels on October 14th. This was mainly to inform those who are involved at the European level of the progress of hydrogen projects in Iceland, specifically ECTOS, and the next steps towards creating a hydrogen economy in Iceland.
- BBC World News,
- BBC Scotland
- CBS Canada.
- A number of Icelandic media both newspapers and radio and television, internal Shell magazines both for employees world wide and customers have also interviewed us. We have listed the hydrogen conference on our web site and inform our Shell colleagues abroad about the conference. An interview on the hydrogen fuel station will be published in Shell newsletter in April 2003.

Cooperation with other projects

Finally the ECTOS group has provided considerable information to the joint CUTE-ECTOS brochure that will be published early winter. Collaboration with the CUTE project, both on the level of dissemination and information exchange has been very smooth and fruitful.

CEA of France (The Nuclear Energy Agency) asked for cooperation and exchange change of students within hydrogen issues – This has been delegated towards the University of Iceland because INE has no resources for student work for the time being.

A meeting between responsible partners of the Perth (Australia), so-called STEP-project and ECTOS was held with very positive results. The coordinator is now waiting for a formal letter from the coordinator of the Perth project to suggest the first steps of cooperation. Both parties have agreed that cooperation will be beneficial for both projects.

General conclusions

Within the ECTOS project things have evolved according to initial plans, yet the final delivery of the buses will be a few months behind schedule. Dissemination has taken more resources than expected, but have not taken much effort to market the ideas, - the interest is already there and the partners are simply responding to the demand. This fact inevitably raises public expectations – not only in Iceland! Much more resources have been put into the inauguration of the fuel station than originally planned, resulting in a much broader audience than anyone could foresee.

All in all the project has already made a large impression in Iceland and the international community and the quality of the project work is very good. The latter half of the project is still to be seen but hopefully all parts will be finished according to plans.

1.5 Scientific/technical progress made in various work packages according the planned time schedule

The Environmental monitoring (WP 2) and comparative impact assessment (WP 6)

On the Methodology

Early within the process of the ECTOS project problems came up at one of the project's partners that had taken on large parts of the planned research. However with some restructuring of the group the methodology for both WP2 & 6 was developed as a joint package. The division of the research was reorganised and new plans established, which yet covered all the descriptions in the ECTOS project application. The needed time was taken to make an appropriate approach, reorganise the task division in order to avoid overlap and make the best of the allocated resources. It was necessary to evaluate all the different parameters for data collection so nothing would be left out and to secure useful quality outcomes. The proposed partners come from Stuttgart University (Ge) and their work will focus on the life cycle analysis of the equipment used within the project: all components of the electrolysis fuel station, the fuel cell, the bus and Icelandic fuel chain.

A meeting was called on by the coordinator the 15th of May within the group undertaking the Environmental, Economic and Social Studies (Nicknamed "GUESS" within the project group!). However in order to make the best of the project time the summer of 2002 was used for data collection within the frames laid out during the spring meeting. A second GUESS meeting was held in September to discuss suggestions for topics, approaches, procedures for the processing of the data and internal evaluation was outlined. This compilation was called the "Primary Methodology" and was sent to the Commission as a draft of the scheduled

Methodology (deliverables 2 and 3) before launching further formulation for the studies. It became the basis for ECTOS Methodology that was finally turned in as a deliverable the first week of March 2003.

Environmental Monitoring

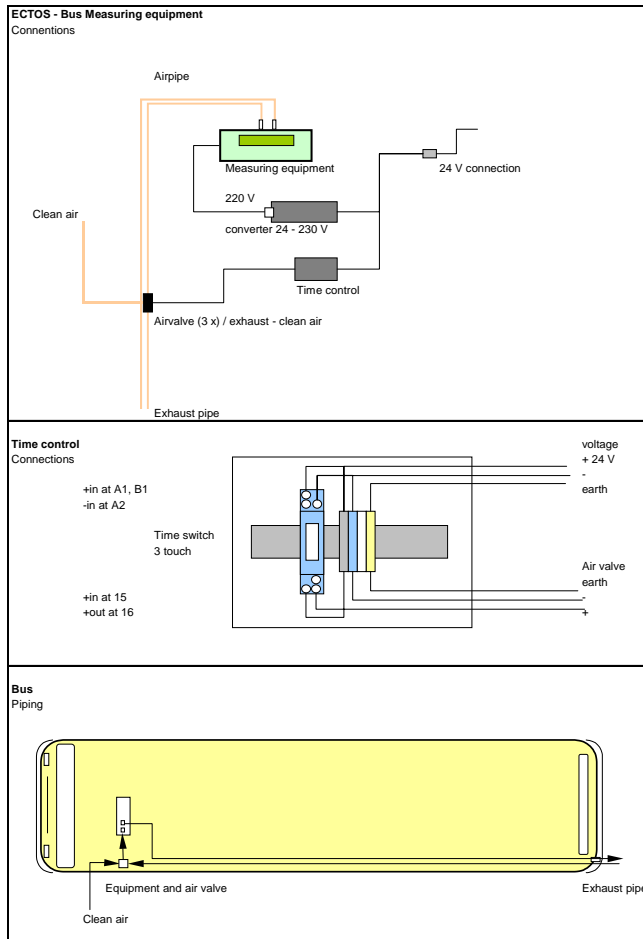


Figure 1. Installation of measuring equipment in Reykjavik bus fleet.

A monitoring plan has been developed for the next three years, as presented in the methodology. The monitoring actions performed in the reporting period are:

- Stationary measurements at Grensasvegur in central Reykjavik
- Development of a measuring system to monitor the air quality around buses. The installation is shown in figure 2.
- Bus monitoring was performed for several days and the installation was adjusted.

Measurement tools were placed on the front side of the buses and another one at the rear end. The equipment can then compare the air quality on these sides of the buses and show the results as the difference in various gas concentrations and therefore the direct effects of the buses on the air quality.



Figure 2. Information leaflet to drivers regarding air pollution measurements.

Problems arose at the first measuring day as the equipment shut off during the day, giving information for only during the morning. The reasons remain unknown, a human or technical error, but the following days the measurements were successful. The quality of the data is being analysed. The installation of the equipment was done in good cooperation with STRAETO bs, the staff at the garage and the bus drivers. The drivers received an information leaflet, as shown in figure 2. Translation of the text in the information leaflet presented in figure 2 is presented in Appendix II.

Well-to-wheel resource consumption for the fuel

A methodology for the well-to-wheel study was finalised and it is presented in the methodology paper. Work on the analysis for the Icelandic Energy scenario began during the summer of 2002.

Evaluation and Transport analysis

Key transport analysis will be performed by Vinnova and will be the following:

1. Supporting the ECTOS partners in developing the methodology
2. Supporting the ECTOS partners in the LCA for the Fuel-cells and other alternative fuel systems.
3. Development of an urban transport system model
4. Transferability of technology to other cities, "Simple Best Practice Handbook".
5. Dissemination activities.

The basic structure of the Urban Transport System Model has been outlined and presented in the ECTOS methodology. The next step is to fill the model with the first set of data and to test the structure with the future users for prompt feedback. An investigation of relevant tools for handling the data in this kind of data base has started.

One study has been undertaken in Sweden within the work of developing the Urban Transport System Model. A questionnaire has been sent out and interviews made with local politicians and bus operators. They were asked to state the most common and for them most accurate questions that they face while deciding if they will invest in a new public transport system, e.g., buses run on alternative fuels. The politicians were also asked what they believed that the bus operators asked for and vice versa. The result of the study helps to structure the model and to make it user friendly. Vinnova has started the search for relevant literature and charting research activities within the area. This information will later on become the "knowledge bank" of the model and of the Handbook.

The hydrogen station Fuel supply (WP 3)

Due to high commitment, frequent meetings and communication as well as excellent collaboration between the partners Skeljungur (Shell in Iceland), Norsk Hydro and Shell Hydrogen about the final layout of the filling station, the end-design for the fuel station became a major mile stone during the second project year. The formal inauguration will take place on April 24th of 2003 and following that there will be a 2 day conference in Iceland by the title: Making hydrogen available to the public.

Much more emphasis was put into the lay out, graphic work and information panels of the electrolysis fuel station than ever planned within the project plans. No specific capital had been set aside from the ECTOS budget to create any kind of design nor architecture at the site, so this initiative taken by the Shell-group has added an extra dimension to the outcomes of the ECTOS assumed without draining the project's resources. The layout and the design will be made available for the international press, shortly before the international conference to be held in April 03. It took a while for the fuel company Shell in Iceland to pinpoint a good strategic point

for the station but finally all parties agreed on a lot belonging to Shell, Iceland on the eastern outskirts of Reykjavík, well situated at main roads that lead to new suburbs of town and also to highway no 1, the main road that connects all rural areas to the capital city. The colours of the panels, the plan of the building site, the overall appearance is strategically chosen to look modern, attractive and informative, a success in its own rights (for details see deliverable 5).

Shell Iceland has chosen the staff that will be responsible for the station, operation and maintenance, and Norsk Hydro will start testing some of the equipment as early as December 2002.

A handful of unforeseen issues concerning the fuel station have yet emerged during the process. These issues had no major impacts of the erection of the station but did impact the learning curve, i.e. for example authorities came up with two changes at a late stage, stranger walls and lightning protection. The issues mainly seem to arise because the station is planned as a commercial station, built in a residential area but not as an industrial plant (chemical hydrogen production). This has been a valuable lesson, which other projects are not dealing with and the experience of this and the cost increases will be reported later.

Design

In the reporting period the detailed technical design was finished. Norsk Hydro Electrolysers (NHEL) have not come across any major problems for the electrolysis unit. This was not expected either, because the concept has been constructed and tested by NHEL before. However some design problems arose due to demand for higher pressure in the storage cylinders and decrease of the pressure on board the buses. This asked for a change in the detailed design of the pressure vessels. The problem was overcome by changing the prerequisites for all pressure increases and decreases and then repeat the accurate calculations for the expected performance of the electrolyser, compressor, storage cylinders and the dispenser. The pressure vessels showed to be OK. The dispenser has also caused some smaller problems due to the approval of the maximum pressure on the filling nozzle. Confirmations from the supplier are expected in due time.



Fig 4 The Electrolyser standing in the cargo port in Reykjavík

Progress in building

The preparations for the final placement erection and combination of all the hydrogen station units have been according to schedule. The Equipment has been tested according to original schedule, transported by sea to Reykjavík delivered and moved to the place all according to time schedules.

Safety issues within the fuel station design

During the engineering work NHEL has incorporated international norms where applicable plus the stringent safety policy within the company. As we are dealing with Hydrogen very few international regulations or norms are available. Norsk Hydro is currently participating in several work groups on standardization of hydrogen protocols, and these have been applied with good success to the ECTOS project. We have been using the knowledge gained during this work, as well as norms that have been developed for other gas-fuels and that can be used for Hydrogen. Therefore NHEL has incorporated many safety measures and security barriers to ensure that safety is reliable. There is also performed a hazard analysis for the filling station's production-units and we have used 3rd party independent inspection authorities to verify and certify the equipment and the unites.

Cooperation

The cooperation between NHEL, INE and Shell Iceland has been good. Meetings, emails and phone calls have been used to sort out questions and allowed for continued work with minimum delays. There have been three groups working during this period concerning the station; a sub group on construction; a group on the design and artwork for the staion and a PR group, preparing for the inaugeration of the station. A number of meetings have been held in all groups.



Fig 5 the construction of the auxiliary parts of the hydrogen station. The ready made components are all in place.

The last 6 months have been the busiest so far conerning Skeljungur's activities in relation to the hydrogen station. All necessary licenses had to be obtained from the City of Reykjavik and the various Health and Safety institutions. The new local plan for the area including the hydrogen station had to undergo official hearing for 8 weeks.

Neither objections nor comments were received and therefore the construction of the station could start early February 2003.

A lot of effort has been put into the design and construction of the station. It will be unique in so many ways, therefore the ambition level for the design is high. To assist Shell with the design we have been assisted by the ConranDesign Group in London. The inauguration day is the 24th of April. Figure no 3 is a photograph of the station during the construction time, but a series of photos will be made accessible to the press on the internet by the time of the opening sermony.

Hydrogen buses (WP 4) and maintenance and staff training (WP 5)

INE, Ræsir, the retailer of Daimler Benz in Iceland, Strætó the public bus company in Reykjavík, EvoBus, who manufactures the Citaro buses and supervisors from DaimlerChrysler, form the bus group within ECTOS. The bus group held a meeting in Hamburg during the CUTE – ECTOS meeting 7th-9th of October 2002, and many clarifications were made at that meeting. An intensive dialogue about the responsibilities of each detail concerning the maintenance and running of the fuel cell buses was carried out as well as agreements about tools, work methods, costs and safety precautions. There are no conflicts within the group only tasks to be solved and delivered. Regarding the buses themselves progress by the Daimler – EvoBus group is going as planned.

The schedule for the arrival of the buses is the third quarter of 2003, and the inauguration of the buses is expected a couple of weeks after the arrival.

The main activities of DaimlerChrysler AG and Evobus GmbH within the ECTOS project have been to see to all aspects of the development of a well functioning fuel cell bus. The issues can be divided into four main parts, namely: Design and testing of the vehicle components; the manufacturing of the vehicle and design to fit the respective refuelling service, homologation and approval and lastly the maintenance and service requirements.

Development of vehicle

The development of the vehicle proceeds successfully along the set milestones. Details are given in the following sections.

Preparation of small series production

The production process for the fuel cell buses including the integration of the production process into the series production in the Evobus plant in Mannheim has been defined. Necessary preparations have been implemented. This includes the installation of an experimental hydrogen refuelling station for the final quality checks of the vehicles and hydrogen safety equipment for the final assembly hall.

Vehicle safety concept and vehicle approval initiative

The development of the safety concept and the vehicle approval initiative proceeds successfully along the set milestones. A German certification (general type approval) has been obtained. As earlier discussions have shown this certificate will be reliable and accepted for the approval in Iceland.

Communication of the required infrastructure preparations to the project co-ordinator

All necessary information about the design of details that make the filling of hydrogen possible from the fuel station onto the storage cylinders on the on board the buses is now available. An up-to-date data summary was compiled and will be handed over to the project co-ordinator during the CUTE kick-off conference, Barcelona, February 2002. As of February 2003 all the required details for the project are known to the NHEL, the provider of the filling station and incorporated into the design.

As the project proceeds, update to the list is regularly sent out. These updates reflect the learning obtained from the ECTOS and the CUTE projects. In this sense a

close exchange of information takes place - even prior to the actual demonstration phase of the vehicles.

Status of Bus development

All development steps are currently taken according to schedule. A so-called European test bus has been build in the Evobus Mannheim plant. This vehicle serves for testing the handling characteristics of the fuel cell bus, i.e. driving dynamics and software fine-tuning of the bus and drive train logic. In order to obtain the necessary certificate for the use of the fuel cell buses in public transport by the German road administration ("Kraftfahrtbundesamt" (KBA)) a large effort has been devoted to fully document the vehicle development including its fuel cell specific components.

A so-called "design freeze" had been achieved beforehand. This allows that the Reykjavik buses will be technically identical to the tested and documented European test bus vehicle. The interior components, seats, handles and bars, will however be specific for each city and therefore meet the requirements stated by Straeto as the operator of these vehicles.

The fuel cell bus prototype in Vancouver, Canada, has been used for an extensive lifetime and reliability was tested in the reporting period. The aforementioned software improvements have been verified on so-called engine test stands, which emulate fuel cell buses including the high power electrical drive train.



The work during the last weeks has been focused on fine-tuning of the fuel cell system and bus software. For this purpose software updates developed and tested on the fuel cell prototype bus in Vancouver have been installed and verified on the European test bus. The technical design itself was almost completed during the preceding reporting periods.

Figure 4: Citaro European fuel cell test bus during public presentation at the joint CUTE/ECTOS meeting (Hamburg, Germany, October 2002).

Status of Production

The preparations for the small series production in the Evobus plant in Mannheim have been completed. Towards the end of the reporting period the production of the first couple of vehicles of the fleet has started already. In the beginning of the pro-duction process tasks, such as body and paint work are in the focus. Later on the fuel cell drive train will be placed in vehicles and finally the last combinations will occur equipped workshop will conclude the production process. As per today all specific productions tasks have been planned precisely, skilled personnel has been identified and trained and all facilities have been adapted to the required

tasks. In the case of the final assembly a hydrogen safe workshop has been made available which allows for the set up of the buses with filled tanks of hydrogen fuel.

At the same time the assembly and test of the fuel cell engines is progressing and the first units have been factory tested and transported to the Mannheim plant. A full system test will be performed after the vehicles are fully assembled as major components arrive directly from the respective suppliers due to the size and weight limitations, i.e. the hydrogen tank system, the transmission, etc.

Development of the service and training concept

Outlines have been developed for the service and training concept - and are included in the up-to-date summary as presented in Barcelona (cf. preceding item). The training materials have been detailed in the reporting period.

Homologation and approval

During a meeting with Icelandic authorities in May 2002 an Icelandic certificate was exclusively made dependent on the reception of the appropriate German approval. The German certificate for use of the vehicles as means of public transport has been received in the meantime. Therefore, no difficulties to obtain the approvals from the Icelandic authorities are expected.

The main components which render the fuel cell bus homologation process very different from conventional vehicles is the type of fuel (hydrogen), the elevated pressure (350 Bar) and the high voltage of the drive-train (800 volts). Unlike prior efforts the chosen path of approval has not been a so-called prototype approval as is usual with such early technologies. Instead the so-called general type approval, which requires detailed analyses and certificates for all components has been obtained. In this sense the fuel cell buses of this project have set a new standard.

Service and maintenance

A few considerations

Due to the specific situation in Reykjavik that maintenance is fully sourced out by the bus operator (Straeto) the search for a qualified alternative and location has been in the focus of work in the reporting period. A specific site has been identified and the requirements to adapt the site for the maintenance of these vehicles have been defined.

Due to the nature of the maintenance works, i.e. most of the work is performed on the bus roof, certain preparations regarding access to components need to be performed. Moreover, the necessities to safely work on the hydrogen vehicles have been assessed as well and requirements have been adapted to the specific situation in the chosen workshop. The installation of equipment is foreseen to start in the middle of 2003.



Map of Reykjavik with locations of filling station and workshop.

Training

Training modules specifically adapted to the work tasks that will be performed by the maintenance staff has been set up. The supplier of the fuel cell system will perform some of the more detailed training at their facilities. An important component of the training is the onsite training and the training on the job during the course of the project.

Appendix I

An English translation of the information leaflet for bus conductors and staff of the Reykjavík bus company. It explains how the system works, the goal for the air monitoring and what to expect from the hydrogen fuel cell

Hydrogen-bus project

POLLUTION MEASUREMENTS IN THIS BUS

Equipment for measuring exhaust gases has been installed in this bus.

This is done as a part of the hydrogen bus project which STRAETO bs. participates in. Measurements will be performed in busses in Reykjavik during the years 2003 - 2004. Several measurements will be done each year for 1 - 3 days at a time.

The equipment consists of a measuring unit, a time control and a transformer. The measuring unit is placed besides the drive's seat. We wish for a good cooperation with the drivers and hope that this will not cause disturbance in their work. Turning the seat might be inhibited a little, we apologise for that and ask the driver to show consideration regarding this.

The equipment starts automatically when the bus is started. Every 2 - 3 minutes the equipment makes a low buzz lasting for around 15 seconds. A small air sample is then taken into the equipment for measuring and the sample is returned to the car's exhaust.

Do not hesitate to ask for further information on these measurements and if any questions arise regarding the equipment please contact Hermann Þórðarson at Efnagreiningar Keldnaholti, tel: 5707100 (Íðntæknistofnun) or 699 6874. Questions can also be sent to herth@iti.is.