PROJECT FACTSHEETS

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KELLEN europe

HYLIGHTS

Disclaimer

This document is the result of a collaborative work between HyLights Industry and Institute partners. The results of the research were subsequently elaborated and presented in a coherent manner, which involved extensive stakeholder consultation in locations around the world as well as feedback from the “HyLights” Industry Partners.

The ideas presented in this document were reviewed by certain "HyLights" project partners to ensure broad general agreement with its principal findings and perspectives. However, while a commendable level of consensus has been achieved, this does not mean that every consulted stakeholder or "HyLights" Industry Partner necessarily endorses or agrees with every finding in the document. The producer of this document is the sole responsible for its content and recommendations.

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Introduction

This document contains information that was gathered over phone and on-the-spot-interviews, publicly available documents as well as the Internet. The project findings were subsequently analysed and used for the report on “Legal forms and Management Structures for future Hydrogen road transport LHPs”.

The objective of the research exercise was that this information is correctly reflected and is as complete as possible. However, due to the spread of the projects, the quantity of information requested and the short time frames, not all necessary information was retrieved and hopefully this is correctly reflected herein. The aim is that in the due course this document is continuously updated with the needed information.

Projects' Results

ARGEMUC

1. General Information

1.1 Project Duration
1997-2006
The project consists of 4 phases

1.2 Brief Description of Activities & Background Info
Founded on the initiative of Bavarian technology leaders and with financial support from the Bavarian state government, H2argemuc has for many years been testing the permanent operation and suitability for everyday use of hydrogen.
Within the framework of a public-private partnership the Bavarian state, Bavarian State Ministry of Economics, Transport and Technology (BStMWVT) government is supporting the project members.
Currently the spectrum of services from H2argemuc ranges from the daily operating business with gaseous and liquid hydrogen refuelling of buses and passenger cars, through the operation of various forms of production (incl. steam reformer, electrolysis), to the testing of the robot filling station.
In addition the partners are continually working on and researching into new components for fuel cell technology. Hydrogen-powered passenger cars with an internal combustion engine as well as forklift trucks with fuel cell technology are also undergoing practical testing for the hydrogen future.
Today the project runs its fourth and last phase under the motto "Opening up of the project": Accordingly the wide breadth of experience from six years of successful operating activity is to be passed on to other hydrogen projects and new users are to be acquired for the hydrogen filling station
To date:
Over 12,000 visitors to the filling station
Over 400,000 kilometers covered by the hydrogen-powered passenger vehicles and buses without any incidents
Nearly 1,000 refuelling procedures with some 60,000 liters of liquid hydrogen used for refuelling

1.3 Project Partners
Aral/BP, Bayerngas, BMW Group, E.ON Bayern, Flughafen München GmbH, GRIMM Aerosol Technik, Linde Gas, MAN Nutzfahrzeuge AG, Proton Motor, Siemens, as well as the project management ET Energy Technology and TÜV SÜD

1.4 Host Country-ies
Germany - Munich

2. Contractual Issues

2.1 Type of Entity
Civil Law Association (BGB-Gesellschaft of German Law) non-registered
Horizontal structure – Partnership where partners have equal rights and obligations
This legal form is usually chosen when different partners decide to work together towards the realisation of a common goal and they bring different knowledge and expertise in the project.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

See lessons learned/recommendations

2.3 Public procurement procedure (Yes/No-why)

No – bilateral discussions.

2.4 Existence of agreements between project partners

No.

3. Financing Issues

3.1 Total Budget

Overhead costs DM 35,000 approx. EUR 17,500

3.2 Owner of assets (land, equipment, etc)

At the end of the contract the project partners are owners of the project hardware that they need to dismantle and retrieve. For example ARAL/BP had to dismantle the refuelling station. Each company bears the dismantling costs but public funding of certain percentage contributes to this costs..

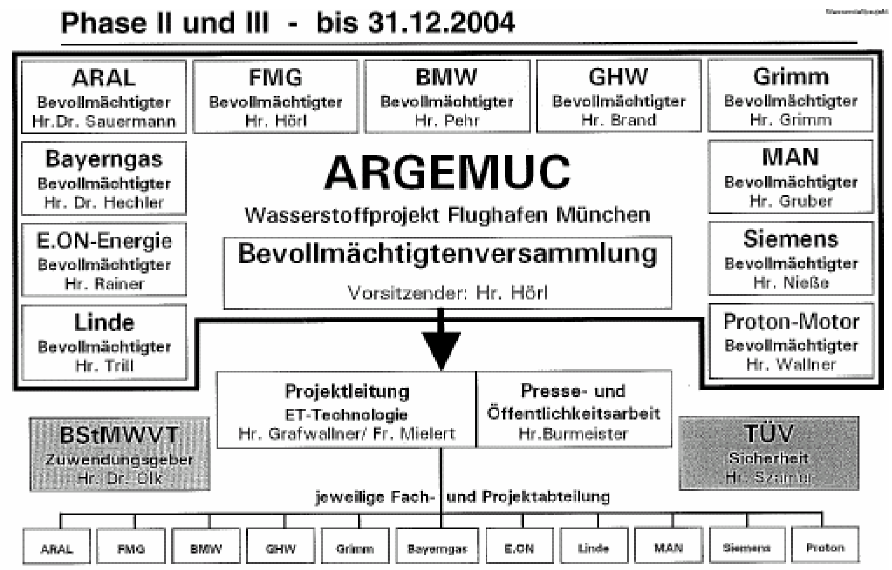
3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

The split between public and private funding is 50-50

In addition funding of DM 1,200,000 approx. EUR 600,000 from 01/97 till 12/00:
ARAL 6.3%
BMW 8.3%
GHW 2.11%
GRIMM 1.2%
HDV 5.9%
Linde 14.9%
MBUM 14.4%
MAN-N 16.1%
MAN-T 4.7%
Neoplan 7.1%

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)



Linear approach.
There is a Partnership Board and Coordination Bodies.
Decision-making process: the Coordinator of the each Body communicates issues to body partners; decision based on ¾ of body member votes, then decision passes to the Coordinator.
For new partners: Association Decision necessary following consultation with all project partners.
TUV participation is an advantage for the permit process – time saving.

4.2 Distribution of project profits - if applicable

No user-fees or other project profit.

4.3 Risk management

The association can claim damages against a partner for damages incurred to the association. A partner can claim damages against other partner for his/her damage. For third parties damages, the association is responsible and then the partners have recourse to responsible party for compensation costs.

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

Low-floor buses with CGH2 refuelling on the apron (until 12/2004 three buses, as of 1/2005 two buses). This shuttle mini-fleet comprises MAN low-floor articulated buses (type Lion's City G), which have been in use since mid-1999 for passenger transportation on the apron. These buses with pressurised hydrogen storage have since covered more than 400,000 kilometers.
Hybrid fuel cell bus. One of the two MAN passenger buses which has been tested since the end of August 2005 on a scheduled service route close to the airport. The electrical driveline draws 68 kilowatts of its energy from a PEM fuel cell system and a further 140 kilowatts from an electrical energy storage unit (ultracap), in which the brake energy is stored.
Hydrogen bus with an ICE. The refuelling of this further development of a MAN bus with hydrogen combustion technology also takes place at the public 350 bar hydrogen pump.
FC Forklift truck. Within the framework of the "Plug & Drive" principle the battery in this environmentally friendly forklift truck is replaced by a PEM fuel cell, without the need for any

major conversion of the vehicle. This high-power fuel cell type is refueled manually with gaseous hydrogen (CGH2) just like the buses at the public filling station.
ICE Hydrogen car 7 series (Clean Energy Fleet of the BMW Group)
Delivery of natural gas for GH2
Bayerngas makes available the necessary natural gas capacities via a pipeline for hydrogen production in the steam reformer.
Optimisation of the electricity capacities for GH2
The electricity for the decentralised generation of the energy source hydrogen is made available by E.ON Bayern.
Delivery of liquid hydrogen (LH2)
Linde Gas delivers supercooled liquid hydrogen (minus 253 degrees Celsius) in tankers from its plant in Ingolstadt and uses this to fill a super-insulated tank with a capacity of 12,000 liters.
Hydrogen production with methane steam reformer (Linde Gas)
With the aid of natural gas and steam, hydrogen is produced in the steam reformer; this serves as fuel for the two shuttle buses on the airport's apron.
Electrolyser (Hydro)
Pressure electrolysis is used to produce gaseous hydrogen with the aid of electricity on site.
LH2 pump and H2 evaporator (Linde Gas)
Using these two components the liquid hydrogen (LH2) can be converted into gaseous hydrogen (GH2): LH2 is compressed to a pressure of 350 bar, vaporised and stored in large pressurised cylinders for the refuelling of the buses.
Hydride storage and high-pressure storage unit (Bayern Gas)
GH2, which is delivered from a hydride storage unit, is compressed to 350 bar and then used to fill the high-pressure storage unit.
Manual refuelling of gaseous hydrogen (Aral/BP, Bayerngas)
Similar to conventional refuelling the refuelling procedure uses (GH2).
Robot filling station with liquid hydrogen (Aral/BP, BMW Group and Linde Gas)
Just stay in your seat! The driver inserts his fuel card at the service terminal and starts the fully automated refuelling process, which takes places with virtually no pressure, at the push of a button.
Extent of the filling station:
Gross surface area of the technology building: 100 m2
Gross surface area of the roofing: 87 m2
Gross surface area of the "Other technology": 180 m2
Total surface area of the filling station: 4,000 m2

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

Normal TUV procedures. Since TUV participated in the project permit process was not lengthy

6.2 Vehicles: authority & timeframe + identified regulatory barriers

Normal TUV procedures. Since TUV participated in the project permit process was not lengthy

7. Safety – Standards & Regulations

7.1 Insurance

Each partner had to prove that had undertaken special insurances before joining the project. In the case of Linde, they consulted their in-house insurance and had to adopt the "conventional", general insurance policy to the needs of a hydrogen project.

8. Intellectual Property

8.1 Ownership
Public partner does not own IP. Each partner is the owner of IP, both project Knowledge as well as Pre-Existing Know How (patents, know-how, documents, etc)..

8.2 Contributing method
The IP is licensed to the other partners on a non-fee basis.

8.3 Handling & dissemination of confidential information
Usual confidentiality and publicity clauses

Higher-level control technology
The higher-level control technology collates all the detailed information from the partial systems, ensures problem-free data transfer, and monitors the overall system
• Partner: Siemens
• Process control system: SIMATIC PCS 7

8.4 IPR stipulations
See above.

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen
N/A.

10. Miscellaneous

10.1 Regions/Municipalities

10.2 “Liaison Body”

10.3 Lessons Learned/Recommendations for the future
Due to highly complex character of the project and customised agreements each partner has to be able to demonstrate commitment and dedicate a lot of time for the participation in the project. Due to the “horizontal partnership structure” of the process and the linear decision making process a lot of discussions take place that last for quite lengthy periods. Maybe it would be better if a “vertical partnership structure” was in place and the public authority would contract private/other entities for the supply of goods or services, as such procedure would be easier to handle due to established procedure and standard documentation.
In addition, the large numbers of project partners implicates many different interests as well. A very good understanding and common goals are essential to avoid conflicts. This leads to complicated forms of partnership contracts as well. Therefore, it would be useful to have an initial consortium agreement before the initiation of the project and then enter into the official project agreement so that goals and roles are clarified beforehand. Furthermore, bilateral agreements between companies should be realised separately and should not be integrated in general project agreement. In ARGEMUC project there exists one general agreement. The disadvantage of this is that each time a new partner joins, this general agreement is enlarged. The result is a highly complex document as additional issues are documented and reflected therein. With such a complex project agreement, it is essential that no conflicts of interest have arisen up to now as it would lead to project failure.
Regarding the dismantling of the project hardware: it is important that when a project ends the infrastructure is not dismantled. It is understandable that it is not economic to maintain

infrastructure that is not operated and without anyone being responsible for its maintenance as it will turn into a conventional refuelling station. If there were a possibility to continue the project and maintain the infrastructure then it would be ideal to do so.
Permit process: Inform responsible authorities beforehand to avoid lengthy procedures. The existence of regulations in Germany covering activities such as the ARGEMUC project´s facilitate the process.

10.4 Useful documents/other information

Two contracts: 1st entered into force with signature of all partners and ended when partners decided to terminate (or no more public funding available); 2nd contract expires in 2006.

CaFCP

1. General Information

1.1 Project Duration

Phase 1: 1999-2003 - Vehicles and stations operated by members
Phase 2: 2004-2007 - Fleet validation phase
Phase 3: 2008 -2012 - Moving toward a commercial market e.g. integration of fueling network, more consumer use of vehicles.

1.2 Background Information

The idea for establishing a voluntary partnership to demonstrate fuel cell technology and prepare for commercialisation began to crystallise in late 1998 among the California Air Resources Board and the California Energy Commission (government) and the Fuel Cell Alliance (DaimlerChrysler, Ford and Ballard. Before the official launch of the partnership the cooperation of fuel providers was recognised as a critical early addition to the core group. At that moment there was an understanding that additional fuel partners and, including other government agencies, would be invited at a later stage.
In January 1999, the two state government agencies joined with six private sector companies to form the California Fuel Cell Partnership with the goal to demonstrate and promote the potential for fuel cell-powered electric vehicles as a clean, safe, and practical alternative to vehicles powered by internal combustion engines.
The California Fuel Cell Partnership (CaFCP) was initiated as a means to accelerate response to the CARB Zero Emission Vehicle (ZEV) regulations, which was a technology-forcing mandate requiring up to 22,000 ZEVs by 2003.
The CaFCP provides a valuable forum for cultivating relationships, discussing projects with potential co-funders, and jointly exploring currently unresolved issues challenging commercial implementation, such as fire marshal permitting and station public accessibility guidelines.

1.3 Brief description of the activities

The original eight Members were Ballard Power Systems, DaimlerChrysler and Ford Motor Company, BP, Shell Hydrogen, and Chevron (formerly ARCO), California Air Resources Board, and California Energy Commission.
In April 1999, the California Fuel Cell Partnership set out to explore and facilitate the path to commercialisation and increase awareness of fuel cells for transportation. Since then, the partnership has made significant progress demonstrating fuel cell vehicle technology and fuel alternatives
Through 2007, the organisation will work together to move fuel cell technology to the next level by accomplishing following goals:
Facilitate members' placement of up to 300 fuel cell cars and buses into fleets

Promote fuel stations to support the vehicle fleets
Ensure 'common-fit' fueling protocols
Prepare communities and train first responders for vehicles and fueling
Promote practical codes and standards
Enhance public awareness
Exchange information and resources worldwide.

1.4 Project Partners

The CaFCP currently consists of 20 full members and 11 associate members

Full Members :
DC, Shell, Hyundai, Shell, UTC, Ford, Nissan, Chevron, NAC, GM, Toyota, Air Resources Board, Honda, VW, Ballard, AQMD,
California Energy Commission, US DOE, US Environmental Protection Agency, US DoT

Associate Members (voluntary partnerships) :
AC Transit, Air Products, Hydrogenics, Sunline Transit Agency, Proton Energy Systems, Pacific Gas & Electric Company, Santa Clara VTA, Praxair, ZTEK, UC Davis, ISE Corporation

1.4 Host Country-ies

USA

2. Contractual Issues

2.1 Type of Entity

The California Fuel Cell Partnership is a collaboration in which several companies and government entities are independent participants. It is not a joint venture, legal partnership, or unincorporated association. It is a voluntary, industry-government collaboration to advance a new vehicle and fueling technology that could move the world toward practical and affordable environmental solutions.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

N/A

2.3 Public procurement procedure (Yes/No-why)

No.

2.4 Existence of agreements between project partners

Statement of Intent: Non-legally binding document signed at the beginning of each Phase.
Safety Plan Statement of Principles
Confidentiality Agreement (signed at the beginning of the project)
Indemnity Agreement (signed at the beginning of the project)
Management services agreements for Bevilaqua Knight – each CaFCP partner enters into an agreement with Bevilaqua-Knight, Inc. (BKI). BKI has been retained by the CaFCP, through a subcontract agreement with Ballard Power Systems, to provide the needed support for the common tasks agreed to by the CaFCP

3. Financing Issues

3.1 Total Budget

At a minimum all partners are expected to equally share the common partnership expenses that vary between the partnership's different realisation phases. These expenses include the public

relations officer, public relation activities and expenses, the services of a financial manager, the project assistant and the contract manager.
The total budget is about $2.2 million per year for common expenses, including CaFCP offices, staff, technical projects and outreach
A trust agreement was created to hold funds for industry members, instead of funds being held by Ballard. This foresees conditions and instructions for dispensation of funds.

3.2 Owner of assets (land, equipment, etc)

Vehicle Fleets are funded and owned by the industry
HRS idem.

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

The US DoE financed the projects that fall under the CaFCP
Each Partner is providing $83,800 or more plus in-kind support for defraying the costs of the CaFCP including:
Several auto manufacturers (General Motors, Toyota, DaimlerChrysler, Ford Motor Company, Honda, Hyundai, Nissan, and Volkswagen);
Three energy companies (BP Amoco, Shell Hydrogen and ChevronTexaco);
Two fuel cell companies (Ballard Power Systems and UTC Fuel Cells); and
Seven government agencies (AQMD, CARB, California Energy Commission, U.S. DOE, U.S. DOT, U.S. EPA, and the National Automotive Center).
The amount $83,800 to cover administrative, technical and program management costs

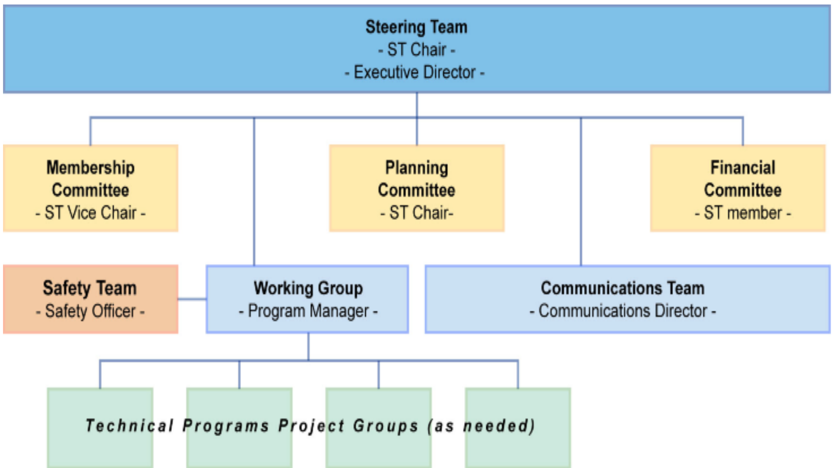
4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

The CaFCP is led by a Steering Team, managed by the Chair. The Chair position is rotated among the 4 sectors (auto, energy, fuel cell technology and government) and is a one-year appointment. A Vice-Chair is selected by a vote of the Steering Team for a two-year commitment – the first year as Vice-Chair and the second year as Chair. The Vice-Chair manages the Steering Team in the absence of the Chair. The Steering Team has three committees, the Planning Committee, the Membership Committee and the Financial Review Committee.

The Executive Director reports to the Chair of the Steering Team. The Technical Program Manager leads the Working Group and reports to the Executive Director. The Communications Director manages the Communications Team, and reports to the Executive Director. Project Groups are established on an ad hoc basis. Leaders are designated to manage the groups and report to the Working Group and Technical Program Manager.

The Steering Team meets 3-4 times per year for about 1.5 days per meeting. The Steering Team makes decisions by consensus, and uses a voting procedure only when it is needed to move a decision forward.



The **Working Group** is the technical component of the CaFCP and is currently comprised of four active teams (Safety, Bus, InterOperability, and DemoNet) which focus on technical and implementation issues critical to the commercialisation success of fuel cell vehicles.
The **Safety Team** is responsible for informing safety best practices for hydrogen stations and vehicle through member presentations and documentation of the safety "learnings" and best operating practices. These learnings inform members about practical issues to improve the safety of hydrogen stations. The Safety Team is also responsible for developing the *Emergency Response Guide* for first responders, which provides emergency procedures related to hydrogen stations and fuel cell vehicles. For example, the *Emergency Response Guide* includes high pressure hydrogen and high voltage line diagrams for the different model fuel cell vehicles so emergency personnel can avoid these when extracting occupants from a vehicle.
The **Bus Team** goals are to support member proposals for federal funding, provide outreach materials, and support transit agencies as buses are placed into revenue service. Transit buses offer an excellent opportunity for fuel cells because they often serve environmental justice areas and would allow the highest population to experience fuel cells.
The **InterOperability Team** (IOT) is focused on identifying and solving issues related to the interface between fuel cell vehicles and the fueling station. The IOT focuses on "common fit" protocols for vehicle refuelling. These protocols help ensure that vehicles and fueling stations can interface in the near term while standards are still being developed. The IOT has developed two pieces of equipment to assist in the performance evaluation of hydrogen stations: the station test apparatus, which simulates a vehicle during fueling to allow testing of the fueling station, and the hydrogen quality sampling apparatus, which allows the sampling of hydrogen at the dispenser nozzle for hydrogen quality analysis. Both apparatus were developed for members to test whether their hydrogen stations are performing within appropriate temperature, pressure, and quality guidelines. Another useful hardware strategy promoted by the CaFCP is the Type I communication fill, which allows fast-fill of hydrogen by monitoring temperature and pressure of the vehicle during the fueling event. The IOT also has established a sub-team to evaluate new fueling and system protocols, and a sub-team that reviews stations in operation and provides information to members interested in developing new hydrogen stations and demonstrating new vehicles, especially to encourage station and vehicle interoperability and station accessibility.
DemoNet is a new user's forum for members operating vehicles and fueling stations to share experiences and ask questions which may or may not be technical or safety related. Questions and learnings that raise technical or safety issues are referred to the appropriate Working Group team for further consideration or to the Steering Team for broader discussion. DemoNet provides a user driven feedback mechanism to improve and optimise vehicle and fueling interaction.

4.2 Distribution of project profits

N/A
The CaFCP is there to facilitate the realisation of HFC demo projects and not to make profit.

4.3 Risk management

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

149 cars and 9 buses.
23 refuelling stations in operation, 14 currently planned
Liquid Hydrogen storage
Liquid compression
Electrolysis
Natural gas reforming

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

6.2 Vehicles: authority & timeframe + identified regulatory barriers

7. Safety – Standards & Regulations

7.1 Insurance

OEMs provide insurance for the vehicles. Many fuel stations are self-insured. Only when events are realised, third party insurance is undertaken.

7.2 Risk management

This is addressed by the Safety Team.

7.3 Liability

The Statement of Intent does not create any legal rights or obligations between the parties. For those projects that a partner chooses to fund, the contract by which funding is transferred provides adequate protection against third-party liability. However, there remains a potential for liability for damages resulting from contracts entered into on behalf of the Partnership, even though the partner is not a signatory to the contract. Since it is not easy or possible to quantify and possible liability, it was recommended in certain cases the Statement of Intent is signed on the condition that the other Partnership members agree to a language which would protect the partner from liability for contract to which they were not signatories.

8. Intellectual Property

8.1 Ownership

The CaFCP does not aim to create IP. Any developments that are realised are placed in the public domain in order to advance the commercialisation of the technology.

8.2 Contributing method

8.3 Handling & dissemination of confidential information

8.4 IPR stipulations

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen
N/A.

10. Miscellaneous

10.1 Regions/Municipalities

10.2 "Liaison Body"

10.3 Lessons Learned/Recommendations for the future
Bevilaqua-Knight, Inc, has provided consultant services and has proven to be very useful as the public cannot participate in a legal entity. Nonetheless, national regulation and project needs will define whether a separate consultancy should be deemed necessary for project management.

10.4 Useful documents/other information

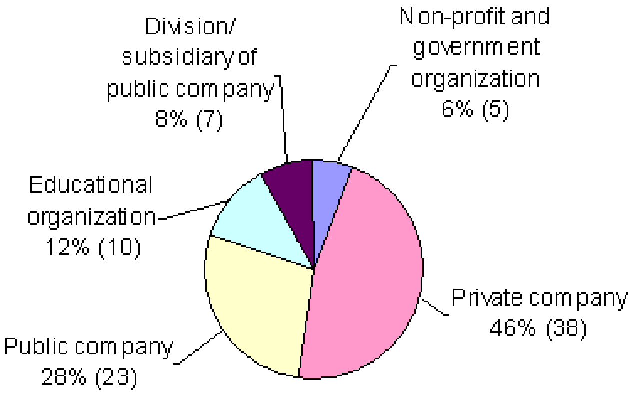
CANADA

1. General Information

1.1 Project Duration
2002-

1.2 Brief Description of Activities & Background Info
Canada is the global industry leader and their hydrogen and fuel cell leadership covers most types of fuel cell technologies, components, systems supply and integration, fuelling systems, fuel storage, and engineering and financial services.
Market focus was split mainly between stationary and mobile applications and fuelling infrastructure, with only 15 percent of Canadian companies focused on portable market applications.
Half of the Canadian hydrogen and fuel cell sector is focused on proton exchange membrane (PEM) technology. PEM is considered one of the most versatile fuel cell technologies, with uses in both mobile and stationary applications. Solid oxide fuel cell (SOFC) technology, which is used mainly in stationary applications, was identified as the next most prominent area of technological focus.
Canadian hydrogen and fuel cell organisations also becoming active outside Canada including the US, Germany, Japan, the UK. South America, India, and China. Such moves toward lower cost manufacturing environments will become more important as the industry approaches commercialisation and together with recent moves toward developing energy infrastructure in developing nations large market opportunity awaits these Canadian actors.

1.3 Project Partners
Cooperation between the Government of Canada, Fuel Cells Canada and the Canadian hydrogen and fuel cell industry.
Chart: Organisation type (Number of respondents)



1.4 Host Country-ies

Canada

2. Contractual Issues

2.1 Type of Entity

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

2.3 Public procurement procedure (Yes/No-why)

2.4 Existence of agreements between project partners

3. Financing Issues

3.1 Total Budget

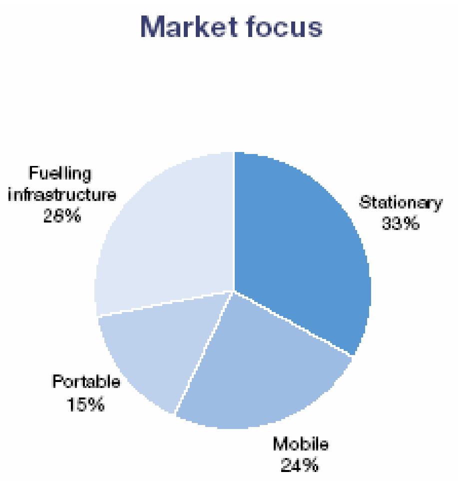
3.2 Owner of assets (land, equipment, etc)

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

The market focus is more focused toward the stationary and fuelling infrastructure than mobility and portable markets.



4.2 Distribution of project profits - if applicable

4.3 Risk management

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

6.2 Vehicles: authority & timeframe + identified regulatory barriers

7. Safety – Standards & Regulations

7.1 Insurance

8. Intellectual Property

8.1 Ownership

8.2 Contributing method

8.3 Handling & dissemination of confidential information

8.4 IPR stipulations

8.5 Patents bought

Innovation remains prevalent in the sector as evidenced by the rise in the total number of hydrogen and fuel cell-related patents reported by the industry, from 433 in 2002 to 581 in 2003.

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

10. Miscellaneous

10.1 Regions/Municipalities

10.2 “Liaison Body”

10.3 Lessons Learned/Recommendations for the future

10.4 Useful documents/other information

Canadian hydrogen and fuel cell-related revenues haves grown 40 percent from $134 million in 2002 to $188 million in 2003.
R&D expenditures have increased 5 percent from $276 million in 2002 to $290 million in 2003.
Employment stands at 2,685, a modest decrease from 2002 levels.
Participation in demonstration projects has increased by 232 percent to 262 in 2003 from 79 in 2002.
Patent holdings are up by 34 percent to 581 in 2003.

CEP

1. General Information

1.1 Project Duration

Phase I: 2003-2007
Phase II: under discussion

1.2 Background Information

Germany has a long-standing R&D history in the field of hydrogen and fuel cells.
A Strategic Council was set up in 1998 to identify the possible solution for future energy strategy.
In 2001 the “Transport Energy Strategy” “Verkehrswirtschaftliche Energiestrategie Initiative” (VES) was launched by BMW and Daimler Chrysler. The German government supports and co-ordinates the activities of this group, whose aim is to establish a nationwide hydrogen technology supply network.
In total seven major German automobile companies (BMW, DaimlerChrysler, MAN heavy duty vehicles and Volkswagen) and energy and fuel companies (ARAL, RWE and Shell) convened to agree on a consensus for one or two alternative fuels of choice. Hydrogen was eventually presented to the Federal German Ministry of Transport on 13 June 2001, both in compressed and liquid form. In its second phase the project will continue to carry the process to a European level and by a hydrogen vehicle fleet and fuelling demonstration in Berlin. The CEP is an offshoot of the VES. While the VES takes a more theoretical approach, the CEP puts the knowledge gained into practice.

1.3 Brief Description of Activities

A federal strategy has been devised to demonstrate future-oriented technologies and thereby indicate the technical and financial prerequisites for the use of alternative fuels in road transportation.
The Berlin hydrogen demonstration project consists of the hydrogen infrastructure of two hydrogen filling stations, the vehicle fleet, a hydrogen information centre and a service station for hydrogen vehicles. CEP is working with a total of three different hydrogen production methods as well as three different hydrogen propulsion systems. With two service stations and a fleet of 17

hydrogen vehicles, the Berlin CEP is the largest and most complex demonstration project for future-oriented H2 technology in the world.
Establishment of the **Hydrogen & Fuel Cell Strategy Council** with key players in **2005** with following mission:
• Development of a national hydrogen and fuel cell roadmap
• Information exchange between industry, science and policy • Temporary working groups for special tasks (e.g. education)
• Communication of results in national and international institutions; public relations
• Interaction with European and international activities (HFP, IEA, IPHE)
The aim is to have 3.000 cars by 2010

1.4 Project Partners
Aral, BMW, Berliner Verkehrsbetriebe (BVG), DaimlerChrysler, Ford, GM/Opel, Hydro, Linde, TOTAL, Vattenfall Europe and Volkswagen AG

1.5 Host Country-ies
Germany

2. Contractual Issues

2.1 Type of Entity
Organised as partnership with defined responsibilities for each partner. No specific legal form assigned to it.

2.2 Existence of agreements between project partners
MoU signed in 2002
Consortium agreement signed in 2003
OEMS sign bilateral leasing agreements with fleet operators (BSR, IKEA, …)
ARAL/BP is the general contractor with the German Government

The industry will have to sign agreements that research will be realised in Germany

3. Financing Issues

3.1 Total Budget
EUR 33,700 million of which EUR 5 million is government funding for hydrogen infrastructure, excluding vehicles

3.2 Owner of assets (land, equipment, etc)
At the end of the contract the project partners are owners of the project hardware that they need to dismantle and retrieve. Each company bears the dismantling costs but public funding of certain percentage contributes to this costs.

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources
Infrastructure part: 50% by Government grant – 50% private
Vehicles: 100% funding by Industry
Each partner contributed his products.
The CEP automotive partners provide a test fleet of 17 hydrogen cars: DaimlerChrysler 10 F-Cell, BMW two hydrogen-fuelled 7-series cars, Ford three Focus FCEV Hybrid, GM/Opel one HydroGen3 and Volkswagen one Touran HyMotion.
Infrastructure:

ARAL/BP is the treasurer of the project. In addition, an external project management company assisted in administrative issues relative to funds

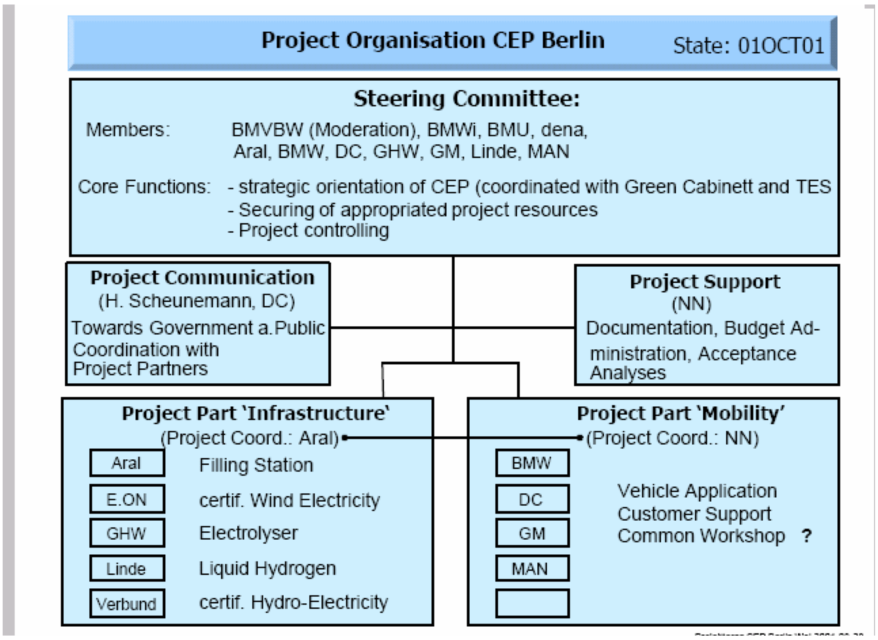
Furthermore: EUR 1 billion 50-50% financed by public and private for 2006-2016

In CEP II funding will be allocated mostly to vehicles than infrastructure (80%-90% of financing). The management of fleets should be subsidised as well.

Another EUR 1 billion has been earmarked for the period 2006-2016 (50%-50% public private) for the "**National Hydrogen & Fuel Cells Program**

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)



The German Ministry of Transport and Ministry of Environment are responsible for the general management, initiation and monitoring of the project

4.2 Distribution of project profits - if applicable

N/A

4.3 Risk management

Each partner is responsible for the project component that they own.

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

10 DaimlerChrysler A-Class F-Cell vehicles FC CGH2 in operation
3 Ford Focus FCEV Hybrid FC CGH2 in operation

2 BMW 7-series ICE LH2 in operation
1 GM/Opel HydroGen3 FC LH2 in operation
1 VW Touran HyMotion FC CGH2 in operation since 01/07/2006
1 VW Caddy FC CGH2 operation start planned for mid 2007
1MAN 12m standard bus ICE LH2 temporarily between May 2004 and June 2006
1Bus converted by BVG FC LH2 operation start planned for end of 2006

2 H2 refuelling stations (Messedamm + Berlin-Spandau)

A service station, specialised in hydrogen-powered propulsion, is also situated at the Aral filling station. The service station is run in cooperation by BMW, DaimlerChrysler, Ford, GM/Opel and Volkswagen and the Berlin public transport company BVG. The CEP's vehicles maintenance takes place here: the required service tasks, routine controls and examinations of the vehicles' technology are carried out in the service station. The data collected in this way provides important findings as to how the vehicle performs for the customer. Along with the operation of the service station, the CEP also helps to develop advanced standards for the hydrogen infrastructure. One particular advantage of the service station is that it allows the visitors insights into hydrogen technology "in action". The demonstration project also provides an opportunity for training in connection with hydrogen technology.

6. Permits – Standards & Regulations

6.1 Stations and Vehicles: authority & timeframe + identified regulatory barriers

The study realised by BMW will be used as the basis for federal and regional legislation
The individual elements of the filling station are safety-tested in accordance with CE certificate norms, while all stations are controlled by the TÜV before going into operation. All of the CEP operated vehicles also meet the German TÜV requirements for hydrogen tanks and technologies.
The vehicles also comply with European safety norms for crash tests
They try to design an approval procedure for H2 infrastructure on the basis of experiences with municipalities and fire departments. Ministry of Environment (bundesemissionschutzgesetz) responsible for vehicles and Burdening implemented for the refuelling stations.

7. Safety – Standards & Regulations

7.1 Insurance

The oil companies providing the refuelling stations are responsible for the security systems.
The OEMs arrange insurance/liability issues bilaterally with the fleet operators. No special insurance for hydrogen vehicles.

8. Intellectual Property

8.1 Ownership

By industry partners.

8.2 Contributing method

With regard to the relationship between the German Ministry of Transport and the industry partners it must be noted that the Ministry does not require that the industry communicate technological details. They only want to know that the project reaches its objectives without any need to control the Intellectual Property arising from the project.

8.3 IPR stipulations

Same as for Industrial Property.

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen
VES

10. Miscellaneous

10.1 Regions/Municipalities
Close cooperation with local authorities facilitates the realisation of the project's objectives.

10.2 "Liaison Body"
A Neutral Party is a good means for project management to ensure that all industry parties are on the same level and to handle aggregate and present data.

10.3 Lessons Learned/Recommendations for the future
The design and the management of the project should be left entirely with the industry
Negotiating the contract between the partners was very time consuming, but it paid off. Better think about possible problems in advance than just adopt a certain legal format and find yourself in deep debates during the runtime of the project. Throughout the project, the above-mentioned organisational structure turned out to be very useful. Particularly the Infrastructure Group and the Mobility Group are meaningful since infrastructure or mobility specific questions can be solved separately without involving everybody.
Absence of Standards & Codes must not necessarily be an obstacle to a project. Good will and close cooperation with the local authorities is much more important.
Local authorities should be involved early on and approve the project plan. All local authorities necessary for the future approvals of vehicles and infrastructure need to be informed well in advance and agree to the project details.
All industry legal departments need to be involved to confirm any regulatory framework.
Homologation: try to get along without homologation and without RCS as far as possible, since we are still dealing with pre-commercial demonstration projects, i.e. technology is still changing.
The price of hydrogen should be subsidised. A good financing mix should be in place to be able to finance vehicles as well.

10.4 Useful documents/other information
The CEP is an outcome of a more theoretical project on transport energy strategy undertaken by private companies together with the federal government and represents a case where it is difficult to separate who originally took initiative to the project

CUTE

1. General Information

1.1 Project Duration
November 2001-May 2006
Work programme: The work programme is divided two phases
Phase 1. Development of the infrastructure (Month 0 to month 24). The nine cities involved in the project developed the hydrogen energy infrastructure necessary to operate the buses. This infrastructure was composed of the hydrogen production facilities and the fuelling station.

Phase 2. Demonstration of the system (Month 24 till the end) During two years the hydrogen buses operated in commercial lines in the nine cities. Each city operated three buses.

1.2 Background information

The public private partnership, established around the ambitious targets of CUTE, started to work by the end of year 2001.

The public transport companies, committed to assume the necessary infrastructure (supply of hydrogen, garages etc.), just as DaimlerChyrsler and EvoBus agreed to guarantee the operation of these vehicles for the whole 2 year period of testing, to train the drivers and technical personnel and to offer technical advice for the creation of the infrastructure.

Apart from the investigation of the central and local hydrogen production via electrolysis installations as well as natural gas steam reformers, the CUTE project also included the preparation of a report for the construction of high pressure refuelling stations at the 9 locations. In addition to that, the situation relating to certification of the vehicles in the 7 European countries was investigated and a safety concept for the operation, maintenance and repair of the vehicles was designed. The greatest interest from the participating public financial backers focused on the publication of the project results.

A major point during the creation of the project was invariably the widest possible involvement of all relevant players, such as politicians, hydrogen and plant manufacturers, suppliers, transport organisations and universities. More than 25 organisations throughout Europe and the rest of the world are now involved in the project.

1.3 Brief Description of Activities

EC FP5 funded demonstration project to support 9 European cities in introducing hydrogen into their public transport system: Amsterdam (Netherlands), Barcelona (Spain), Hamburg (Germany), London (United Kingdom), Luxembourg, Madrid (Spain), Porto (Portugal), Stockholm (Sweden) and Stuttgart (Germany).

The aim of the project was to demonstrate the feasibility of an innovative, highly energy-efficient, clean urban public transport system. Different hydrogen production and refuelling infrastructures were established in each of the cities. The project saw practical applications of renewable energy sources to the transport system.

The project was extended to include the Icelandic capital of Reykjavik (project name: ECTOS - Ecological City TranspOrt System), which was the first one to receive three buses, and Perth in Australia (STEP - Sustainable Transport Energy Perth), which started the demonstration in late 2004. In October 2005, DaimlerChrysler also delivered three Citaro fuel cell bus to Beijing, China.

After the conclusion of the project, CUTE was succeeded by HyFLEET:CUTE ("Hydrogen for CUTE").

After the conclusion of the project, CUTE was succeeded by HyFLEET:CUTE ("Hydrogen for CUTE").

1.4 Project Partners

European Commission
DG TREN
Project Co-ordinator
EvoBus
City Partners
GVB, Amsterdam
DMB, Amsterdam
TMB, Barcelona
Hamburger Hochbahn
First Group, London
London Buses
AVL, Luxembourg
FLEAA, Luxembourg

E.M.T., Madrid
STCP, Porto
Busslink, Stockholm
Miljöförvaltningen,
Storstockholms Lokaltrafik
Stuttgarter Straßenbahnen
Industrial Partners
BP International
DaimlerChrysler
Vattenfall Europe Hamburg
Hydro
Shell Hydrogen
Academic and Consulting Partners
IKP, University of Stuttgart
IST
MVV Verkehr
PE Europe
PLANET
Polis
Statkraft
Sydkraft
Associated Projects
ECTOS
Icelandic New Energy
STEP
Department for Planning & Infrastructure

1.5 Host Country-ies

2. Contractual Issues

2.1 Type of Entity
EC Funded Consortium (FP5).

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project
N/A

2.3 Public procurement procedure (Yes/No-why)
No

2.4 Existence of agreements between project partners
EC Contract & Partners´ Agreement annexed to this (FP5 rules)
Consortium: All project partners of CUTE
Each city has a sub-consortium composed of transport service providers and with energy infrastructure providers.
Confidentiality Agreements: with consultants & academics that analysed the project results

3. Financing Issues

3.1 Total Budget
EUR 52mn

3.2 Owner of assets (land, equipment, etc)

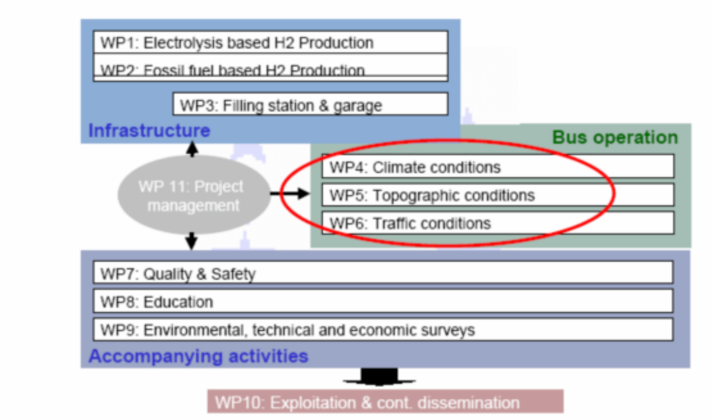
Transit companies bought the buses from the OEMs.
The infrastructure was either leased or bought by the transit companies.

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

EC: EUR 18.5 million

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)



4.2 Distribution of project profits - if applicable

4.3 Risk management

5. Utilisation

5.1 N° and type of vehicles

27 Citaro fuel cell buses - three in each of nine cities in Europe

5.2 N° and type of refuelling stations

Stuttgart: steam reformer
Stockholm: electrolysis
Porto: external
Madrid: steam reformer (ext.)
Luxemburg: external
London: external
Hamburg: electrolysis
Barcelona: electrolysis

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

The vehicles were certified through normal TÜV procedures. Interaction with the TUV begun when buses started to be developed in increase knowledge and experiences in this field for TUV and guarantee a smooth certification process.
Certifications processes from 6 weeks to 8 months depending on location and country.

6.2 Vehicles: authority & timeframe + identified regulatory barriers

The vehicles were certified through normal TÜV procedures. Interaction with the TUV begun when buses started to be developed in increase knowledge and experiences in this field for TUV and guarantee a smooth certification process.

7. Safety – Standards & Regulations

7.1 Insurance

In some cases, i.e. for the EHFP event, bus certificates mentioned "hydrogen" but no special provisions were foreseen.

7.2 Risk management

Risk analysis was realised on the infrastructure only.

7.3 Liability

8. Intellectual Property

8.1 Ownership

N/A.

8.2 Contributing method

N/A.

8.3 Handling & dissemination of confidential information

Data collection & quality check: The coordination of the data collection was one of the responsibilities of the Project Coordinator. The data and information were collected through the project's Mission Profile Planning (MIPP) system, through the Incident Reporting Scheme, through responses to specific questionnaires developed by FLEEA, in project meetings and in individual meetings. MIPP data tables were developed in order to have a common format for the data collection. These tables included all major aspects of the trial . Data were collected on a one-off basis, i.e. training experiences, dissemination activities, cost data. The frequency was defined in accordance with the overall project objective requirements.
Analysis of data using indicators: The submitted data were firstly subjected to a quality check for consistency, reliability and accuracy. They were then analysed focusing in the indicators defined for each key area.
Interpretation of indicators: the findings were then firstly subjected to a quality check for consistency, reliability and accuracy. They were then analysed focusing on the indicators defined for each key area.

8.4 IPR stipulations
N/A.

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen
N/A.

10. Miscellaneous

10.1 Regions/Municipalities

10.2 "Liaison Body"

10.3 Lessons Learned/Recommendations for the future
Data collection (General)
The common data collection and reporting system and the project meetings involving all the sites proved valuable in developing a common appreciation of performance monitoring.

HRS Incidents
Harmonised incident reporting used
• 250 incidents and deviations were reported
• 64 were detailed in incident report forms
• Components were improved
• A reporting culture were developed
Approach
• Safety and security session at each project gathering
• Continuous reporting and feedback on status
•Common attention and corrective actions done e.g. on refuelling system

The establishment of the Safety and Security Task Force in June 2004 turned out to be a major improvement for the communication of incidents and lessons learnt during the operational phase of the project. Experiences from the safety and security related incidents that had been reported were shared and discussed.

Quality Assurance
A quality management methodology for continuous improvement is the PDCA methodology, also known as the Deming methodology3. The methodology comprises four basic steps: Plan what to do – Do what you have planned – Monitor and Check the results of what you have done – Act to correct as needed. The CUTE project implemented the PDCA approach. DaimlerChrysler and Ballard used the PDCA approach efficiently during the planning and the operation of the buses. Deviations, e.g. transmitter failures, were dealt with efficiently, and the overall results have been of a high quality. Customers were satisfied. The PDCA approach was used for the hydrogen stations as well, but not as uniformly as for the buses. This was, however, improved by commencing a common incident and follow-up system introduced by the Task Force for Safety and Security in 2004. The reporting and handling of deviations was done locally. Safety related incidents were discussed and followed up within groups of project partners. More than 60 incidents were reported in this common reporting system.

Experience concerning the evaluation of bus operations

In the beginning of the evaluation, which started in phase 2 of the project, there was a lot of effort put into the defining the data collection sheets as well as negotiating which confidential data should be made available for evaluation. The fact that the evaluation was not included in the phase 1 budget of the project meant that the planning for data collection and specific tests was hindered and that the collection of data only commenced after several of the cities had started operating the buses. This might have influenced the cooperativeness of some of the partner cities. In addition, gathering of important data for evaluation of the bus operations could have been greatly simplified if considered and integrated with the already existing data acquisition system on-board the buses from the start of the project. Data such as road inclination/altitude could have been recorded via altimeter and vehicle weight estimation via passenger counting devices or the monitoring of pressure in the air bellows.

Other
No consistent authorisation procedures
No consistent safety regulations
Security risk – possible higher on public stations
Large-scale demonstration to realise “best practice” solutions
Cluster demonstration activities as “lighthouse projects”
Better availability of vehicles
State of the art vehicles
National and regional policies for support
Stable political framework
Public-Private-Partnerships to join efforts and ensure financing
Information exchange between infrastructure suppliers had to be improved

Recommended Quality and Safety Methodology for Future Hydrogen Stations
The Quality and Safety Methodology recommended to be used for the establishment and operation of future hydrogen stations can be outlined as follows:
Follow the steps for a fixed asset project in the establishment of a hydrogen station.
Identify the main stakeholders, including authorities, and their requirements, goals and expected performance at an early stage.
Address these issues at the design level to develop an inherently safe facility.
Use a risk based safety management approach and industrial safety policy practice to identify hazards and risks. Implement risk-reducing measures, wherever needed, to ensure a facility with tolerable risk.
Apply recognised methods for risk analysis and risk control in all phases of establishment, operation and decommissioning of the hydrogen station.
Apply the ISO standards on quality (ISO 9001:2000), taking the requirements of the customers and interested parties (stakeholders) as a basis for the development of inherent performance characteristics of the station and related systems.

Project Management
CUTE has been a major international cooperative effort – across multiple Governments, across different levels of Government, across diverse industries, organisations and communities. More than 25 major partners and many more secondary and tertiary partners were involved. The organisational complexity and the amount of effort necessary to design, implement and manage such a project is immense and is difficult to under state. Even the time frames to consult the multiple partners, let alone get agreement on issues, are enormous. It is important that future projects of this type are scoped and resourced to commit adequate time and energy and human skills to the project design, operations and maintenance aspects. Without this the success of the project is jeopardised from the outset. The CUTE project has also highlighted the need to give priority to developing evaluation arrangements, and designing operations with evaluation methodologies in mind. This will ensure that appropriate data are collected reliably. Another key

learning from CUTE has been the need to develop and maximise the synergies between similar projects.

10.4 Useful documents/other information

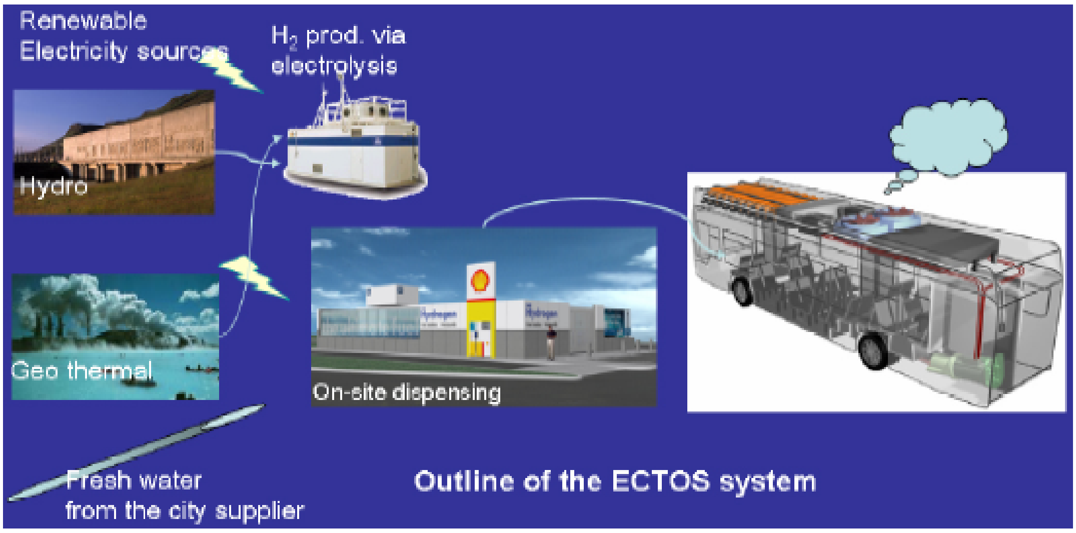
ECTOS

1. General Information

1.1 Project Duration
March 2001 – August 2005

1.2 Brief Description of Activities & Background Info

ECTOS was the first actual step in realising the transition of the remaining fossil fuel use in Iceland over to hydrogen fuel use. The ECTOS project has now been extended in to the HyFleet;CUTE project. A hydrogen fuel station was built in 2003 and operated to fuel the 3 test buses. The three Citaro FC buses from Evo Bus, a daughter-company of DaimlerChrysler, demonstrated in Reykjavik have now fallen into the remit of the HyFleet:CUTE project. The buses use FCs from Ballard. While the onsite hydrogen production compression and dispensing station, using Norsk Hydro electrolyser technology for H2 production, will continue serving consumers as long as it maintains a license to do so. Data was collected on the performance of the buses and the station and issues such as reliability, costs, benefits for the society and learning were compiled and will be used to integrate in the following generations of hydrogen energy technology.



1.3 Project Partners
The partners included industry, academia, municipality, administration, technical research and business organisations, car retailers, bus operators, hydrogen retailers among others. More

specifically the partners were the following (in alphabetic order): DaimlerChrysler, EvoBus, Icelandic New Energy, Icetec, IKP at the University of Stuttgart, Norsk Hydro, Shell Hydrogen, Skeljungur, Straeto bs, University of Iceland, Vinnova. Icelandic New Energy was the promoter, organiser and saw to the project management.

The Institut für Kunststoffprüfung (IKP) at the University of Stuttgart performed a Life Cycle Analysis (LCA) for the equipment and the fuel chain, i.e. a well-to-wheel analysis (WTW), as part of the ECTOS project for benchmarking reasons.

1.4 Host Country

Iceland

2. Contractual Issues

2.1 Type of Entity

The contract used, according to the European Commission was a "Cost-sharing contract". In the US this means that the "government does not fully reimburse a contractor for all allowable costs necessary to accomplish the project under the contract". Such contracts do not include either "usual contractual limitations such as indirect cost ceilings".

The project uses German, Icelandic and Norwegian laws and safety standards concerning all aspects of the fuel and vehicle chain as its legal framework.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

The ECTOS project involved a balance of all necessary partners from Industry, Academia, Municipality, Administration, technical research and Business partners, Car retailers, Bus operators, hydrogen retailers etc. The consortium has been used as a blue print for a well-balanced partnership.

2.3 Public procurement procedure (Yes/No-why)

2.4 Existence of agreements between project partners

3. Financing Issues

On their Total Impact Assessment (page 14) ECTOS say that any "costs, income and prices are not given as concrete figures. The technology is at a very sensitive stage for the competing businesses and this information is neither considered as public domain nor the main outputs of ECTOS."

3.1 Total Budget

The European Commission quotes the total cost of the project at €6.94m. The total construction cost of the hydrogen station alone (including its equipment) was about €1,400,000. The PR and design of the station was undertaken by Icelandic New Energy and therefore did not show up in the ECTOS budget. The owners along with Reykjavík's public transport, the bus manufacturer EvoBus and Shell in Iceland also invested extra resources in ECTOS.

3.2 Owner of assets (land, equipment, etc)

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

The project got a high level political and financial support both from local authorities and from the EU authorities. According to the Impact Assessment of ECTOS the European Commission granted the sum of €3.8 million to the project from the programme Sustainable development, City of tomorrow, DG Research. Yet these funds which were part of the FP5 research budget, on the EU's website are quoted at €2.86m

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

There were discussions, promotion and negotiations which lasted almost 6 years which laid the groundwork before Icelandic New Energy, using international project management procedures, promoted, organised, managed and implemented the project.

For the hydrogen fuel station Norsk Hydro delivered all the components while Shell Hydrogen and Skeljungur in Iceland saw to the external design.

4.2 Distribution of project profits - if applicable

Cost targets were met except for the costs of a partial redesign of the hydrogen station which was in any case covered by the relevant partner. The PR side and design of the station was also covered from external sources helping to meet original cost targets.

4.3 Risk management

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

The project uses German, Icelandic and Norwegian laws and safety standards concerning all aspects of the fuel and vehicle chain as its legal framework.

6.2 Vehicles: authority & timeframe + identified regulatory barriers

The project uses German, Icelandic and Norwegian laws and safety standards concerning all aspects of the fuel and vehicle chain as its legal framework.

7. Safety – Standards & Regulations

The project uses German, Icelandic and Norwegian laws and safety standards concerning all aspects of the fuel and vehicle chain as its legal framework.

7.1 Insurance

8. Intellectual Property

8.1 Ownership

Icelandic New Europe had no IP rights.
The University of Iceland had IPRs on pictures.
DaimlerChrysler had no IP rights.

Norsk Hydro Electrolysees had pre-existing know-how in design elements in Cellpack and Dryer/Deoxo as well as an IPR on their knowledge of a confidential design document.

8.2 Contributing method

8.3 Handling & dissemination of confidential information

8.4 IPR stipulations

8.5 Patents bought

No patents seem to have been bought.

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

10. Miscellaneous

10.1 Regions/Municipalities

Reykjavik, Iceland

10.2 "Liaison Body"

The leading body in the project Icelandic New Energy is owned by four companies: VistOrka, DaimlerChyrsler, Norsk Hydro, and Shell Hydrogen.

Norsk Hydro, following the project, stated that as a future collaboration with other entities they would like to do more R&D, give financial support, exchange information and be available for consultancy.

DaimlerChrysler said that they would also like to exchange information, do more R&D with other entities, and are also interested in PPPs.

10.3 Lessons Learned/Recommendations for the future

An increase in working knowledge was achieved which has helped partners take what they learnt into all levels of the technological and systems development. A monitored test aided in improving this knowledge.

Results

The vehicles' (buses, cars, etc.) performance results can be found below:
Driving range
As expected in city traffic; 180-220km,
Higher that expected in long distance driving up to 280-300km.
Fuel consumption
Confidential information at the moment as the vehicles are not produced for the open marked and will be changed in the next generation
Investment costs
Two three times more expensive as conventional diesel bus, as can be expected for pre-commercial technology
Maintenance costs

Higher than for conventional bus but mainly because of preventive maintenance and tests directly related to the projects goals and monitoring.,
Number of passengers / payload per vehicle
Comparable to conventional diesel bus, 72
Operating time per day
6 -8 hours
Environmental aspects
Totally “clean” technology hydrogen from renewable sources used in fuel cells.
Ease of use / operational restrictions
General enjoyment by the bus drivers, the buses are more enjoyable to drive
Image
Clean and promising technology, fuel of the future

Refuelling infrastructure performance in terms of:
Fuel production
Very clean hydrogen, high quality product reliable operation
Investment costs
High
Maintenance costs
Higher than expected, mainly because of unforeseen incidents in the early stages but dropped to normal after slight redesign in 2004
Refuelling time
Short, less than 10 min.
Number of subsequent refuellings
One per day
Operating time per day
24 hours, 5 days a week
Environmental aspects
Clean technology, renewable energy transformer
Ease of use / operational restrictions
Very ease to use, self-service.
Image
Clean and promising technology, fuel of the future

Recommendations
In order to achieve a sustainable hydrogen refuelling infrastructure the approval framework for H_2 technology is the most important one. Hydrogen needs to the widely approved as fuel worldwide before the hydrogen technology can be widespread. Other issues like codes and standards are also important. Project like HyApproval are therefore very important and will hopefully be successful in bringing us closer to general approval of Hydrogen as fuel. One of most positive incentives to establish the demand for hydrogen as a fuel is by having tax exemptions on hydrogen and hydrogen vehicles, at least until it becomes financially competitive.

10.4 Useful documents/other information
The following document is useful for seeing the IP and wishes of actors for their future participation in the development of the hydrogen sector.
http://www.hydrogen.is/newenergy/upload/files/utgefid_efni/ectos_18_-_finaltip.pdf

Freedom CAR

1. General Information

1.1 Project Duration
Initiated in 2002

1.2 Brief Description of Activities & Background Info
Freedom CAR was launched in 2002 with the initiative of the US DOE and the USCAR. DaimlerChrysler Corporation, Ford Motor Company and General Motors Corporation created the latter as a partnership with legal persona. The Freedom CAR Partnership was expanded in 2003 to include five other companies: BP America, Chevron Corporation, ConocoPhillips, ExxonMobil Corporation and Shell Hydrogen LLC (US) and became the Freedom CAR and Fuel Partnership.

The goals – "Freedoms" of the Partnership are:
Freedom from dependence on imported oil;
Freedom from pollutant emissions
Freedom for US population to choose the kind of vehicle they want to drive, and to drive where they want, when they want, and
Freedom to obtain fuel affordably and conveniently

The partners have jointly identified the technology breakthroughs that could facilitate the development of fuel cell powered vehicles. The Partnership has identified a number of significant barriers that need to be overcome:
Fuel cell stack costs
Satisfactory performance in all types of weather
Durability
Electric drive performance
Hydrogen storage practicality
Hydrogen production issues including primary energy sources
Environmental effects
Hydrogen distribution & refuelling infrastructure

The Partners also identify data gaps related to vehicular and hydrogen infrastructure Codes & Standards. In addition, the Partnership supports R&D in areas that relate to both types of vehicles, such as lightweight materials, power electronics, electric motors and batteries as well as R&D in advanced combustion engines.

The Partnership has pre-defined milestones interpreted into technology specific goals for the years 2010-2015 in order to measure the progress in terms of its long-term vision.

1.3 Project Partners

1.4 Host Country-ies

2. Contractual Issues

2.1 Type of Entity
We leveraged the USCAR structure, including our prior partnership with DOE and other government agencies on the PNGV program (high fuel economy diesel hybrid demonstration vehicle). You need to have a company commitment and VP level engagement, as well as senior government official engagement.

The Freedom CAR and Fuel Partnership is not a legal entity and it is not intended that the "Partners" have the rights and obligations of legal partners (why?). The reference to "Partners" and "Partnership" is used in an informal sense to denote participants of a project that work together towards the stated goal of the project group.

More specifically the Partnership itself is a collaborative effort among the US DOE, energy companies and the USCAR partners. The Partners jointly:
conduct technology road mapping;
determine technical requirements;
suggest R&D priorities and monitor.

Technology road mapping includes identification of existing barriers and challenges, technology-specific R&D goals and milestones needed to progress toward the overall Partnership goals.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

The structure should promote consistent open communications at all levels. Active engagement at the VP level and guidance by company experts on technical teams ensures that technologies developed under the program are relevant to company needs, which improves the chances of technology implementation. The management structure is responsible for yearly progress against specific technical targets.

2.3 Public procurement procedure (Yes/No-why)

2.4 Existence of agreements between project partners

3. Financing Issues

3.1 Total Budget

3.2 Owner of assets (land, equipment, etc)

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

The funding model is mixed, and can be difficult to understand as there are many different "buckets". At one extreme is money that flows directly to the individual OEMs. This can only result from an OEM winning a "competitive solicitation." This is how the US Demonstration program is funded. The OEMs also receive money in a collective sense through USCAR consortia. For example, USABC receives funding from DOE to spend on battery development (with external suppliers) and USAMP receives funds for advanced lightweight material development and processing. DOE spends its money through competitive solicitations, as already mentioned, as well as through funding provided to its extensive network of national labs. The DOE is moving toward also competing the awards to the national labs.

As previously mentioned, the funding was awarded on the basis of a competitive solicitation and 50% cost sharing by recipients. The US OEM team all ended up with about the same amount – which was intentional by DOE.

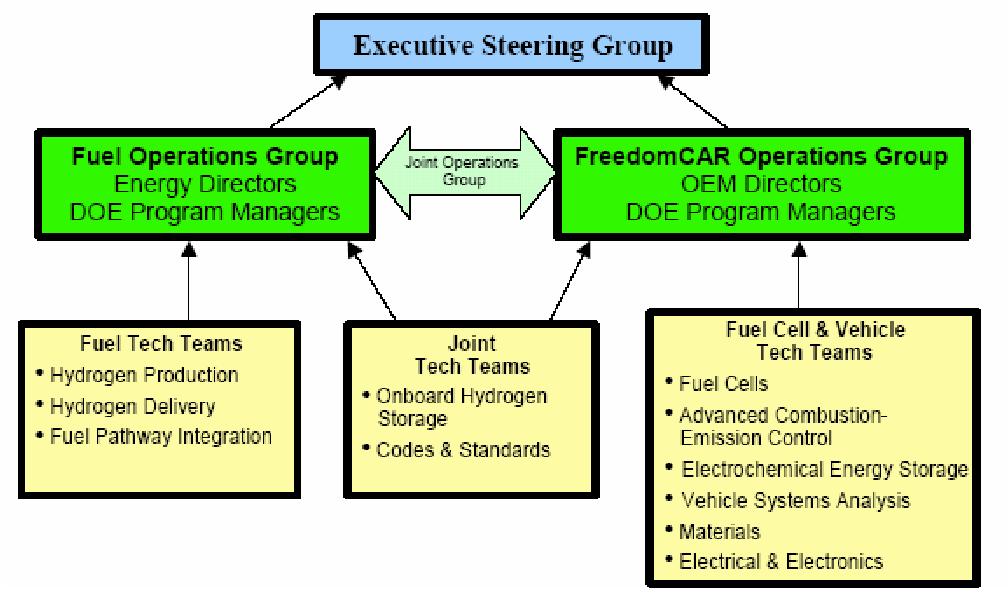
4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

The structure for the Freedom CAR and Fuel Partnership is a loose partnership among the OEMs (USCAR), DOE and, most recently, the Energy Companies. The Partnership is mostly concerned with technology development, and the demonstration project is considered part of the technology development process, both in terms of validation, as well as a learning platform to provide guidance and direction around future research requirements.

Competitive solicitations ensure high quality proposals and the Freedom CAR and Fuel Partnership's Tech Team structure helps direct the research and development towards technologies that have a higher chance of implementation. The Tech Team structure was put in place to recommend technical priorities and specific technical performance targets to DOE in structuring projects with the national labs, universities and other technical experts engaged through competitive solicitations. The overall structure includes industry and government oversight at the VP, Director and technical levels as indicated in the Partnership Plan document.

FreedomCAR and Fuel Partnership Organization



The DOE is in charge of promoting the development and validation of hydrogen infrastructure through R&D programs, government procurements and cooperative demonstration of hydrogen vehicle fleets and refuelling station systems. The USCAR member companies have engaged themselves towards accelerating the migration of energy-efficient technologies to the marketplace and independently demonstrate progress toward real-world reduction of the petroleum consumption of passenger vehicles. The energy partners seek to accelerate the migration of energy-efficient technologies to the marketplace and independently demonstrate technology that may be relevant to a hydrogen-fueling infrastructure.

A very important aspect of the Partnership is the "Research Goals". These are specific goals covering the period 2010-2015 to promote R&D and Innovation. These goals form the criteria against which the Partnership will assess specific research directions and overall progress of the Partnership's efforts.

These goals relate to either individual technologies or hardware-in-the-loop simulated full-system validation1.

These "Goals" are the "criteria" against which the Partnership will assess specific research directions and the overall progress of its efforts.

The DOE, or the DOE and USCAR, are responsible for determining the methodology and other assumptions that will be integrated into the process on the basis of which the Partnership's Research Goals are derived.

4.2 Distribution of project profits - if applicable

4.3 Risk management

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

6.2 Vehicles: authority & timeframe + identified regulatory barriers

7. Safety – Standards & Regulations

7.1 Insurance

To date projects have been largely self-insured by participants. All OEMs have recovery and communications plans in place should there be an incident.

8. Intellectual Property

8.1 Ownership

8.2 Contributing method

8.3 Handling & dissemination of confidential information

Toyota chose not to participate in part because of information disclosure concerns. The DOE is paying for data (at least in GM's case), not hardware. The data is sent to a secure location, and consolidated (averaged) to prevent individual company data from becoming public. Since the DOE is paying for data, GM owns any IP developed.

8.4 IPR stipulations

9. Regulatory Issues

[1] "Hardware-in-the-loop" is considered to be a "full computer simulation (computer model) where one or more components of the model are replaced with actual hardware before a simulation is run.

9.1 Regulations to support the introduction of hydrogen

10. Miscellaneous

10.1 Regions/Municipalities
Are very important to the project. Codes and Standards are critical, as is first responder training. The public is fearful of having a H2 station near where they live or work. Our Partnership is actively engaged in training city/municipality, regional, and national stakeholders in the safe use and response to hydrogen. Their involvement is critical to the success (or failure) of the Partnership.

10.2 "Liaison Body"

10.3 Lessons Learned/Recommendations for the future

10.4 Useful documents/other information
Beyond Freedom CAR, GM is involved in IPHE.
According to your opinion, would the participation of a neutral partner (i.e. a "liaison body") be necessary as part of the demo project?
The National Renewable Energy Laboratory has served as a neutral partner in the DOE learning demonstration program. It serves to coalesce learnings and summaries salient progress metrics which protecting confidential information of individual participants.

HyFLEET:CUTE

1. General Information

1.1 Project Duration
2006-2009

1.2 Brief Description of Activities & Background Info
Goals of this project are to:
Improve FC technology by continuing the operation of the CUTE buses over a period of 12 months in 7 European cities, 2 non-European cities will take part with their ongoing operation
Develop the concept, design and production of a new FC hybrid bus as a pre-prototype with a target of 10 to 20% less consumption than a comparable diesel bus
Build up the infrastructure for operating a fleet of 14 H2-ICE buses in Berlin
Development, design and production of 4 buses with naturally aspirated hydrogen ICE, 150 kW
Development, design and production of 9 buses with turbocharged/direct injection H2-ICE, 200 kW
1 bus with turbocharged/direct injection hydrogen ICE, 200 kW, with energy management/FC-APU
In Berlin the new H2-infrastructure will show special features:
GH2 on site production through reforming LPG, which can be substituted by Bio-DME.
New generations of dispensers and compressors using ionic fluids Two stationary fuel cells will be demonstrated which consume the surplus GH2 produced on-site

1.3 Project Partners
Government Partners
Department for Planning and Infrastructure, Government of Western Australia, Australia

China FCB Demonstration Project Management Office, People's Republic of China
European Commission DG-TREN ??

Transport Companies
Autobus de la Ville de Luxembourg, Luxembourg
BVG, Berlin, Germany
Empresa Municipal de Transportes de Madrid, Spain
GVB, Netherlands
Hamburger Hochbahn AG, Germany
London Bus Services Ltd., United Kingdom
Transports de Barcelona S.A., Spain

Automotive Companies
DaimlerChrysler AG, Germany
EvoBus GmbH, Germany
MAN Nutzfahrzeuge AG, Germany
NEOMAN Bus, Germany

Energy Companies
Air Liquide, Division des Techniques Avancées, France
BP Gas Marketing Ltd., United Kingdom
Islensk NyOrka ehf (Icelandic New Energy Ltd.), Iceland
Norsk Hydro ASA, Norway
Repsol YPF, Spain
Shell Hydrogen B.V., Netherlands
Stuart Energy Europe N.V., Belgium
TOTAL Deutschland GmbH, Germany
Vattenfall

Academic and Consulting Partners
Euro Keys, Belgium
Mechanical Engineering Institute, Instituto Superior Técnico, Technical University of Lisboa, Portugal
MVV Consulting GmbH, Germany
PE Europe GmbH, Germany
PLANET - Planungsgruppe Energie und Technik GbR, Germany
Stuttgart University, Institute for Polymer Testing (IKP), Germany
Technische Universität Berlin, Germany
University of Iceland, Iceland

1.4 Host Country-ies
Iceland, UK, Netherlands, Germany, Luxembourg, Spain, China, Australia

2. Contractual Issues

2.1 Type of Entity
EC FP6 Funded Project.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project
N/A

2.3 Public procurement procedure (Yes/No-why)
N/A

2.4 Existence of agreements between project partners

Consortium Agreement (FP6 rules)

3 Financing Issues.

3.1 Total Budget

EUR 43.16mn

3.2 Owner of assets (land, equipment, etc)

Idem as CUTE + ICE buses purchased by transit companies
Total owns HRS in Berlin and sells hydrogen to German BVG.

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

EC: EUR 19 mn

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

WP 1	**Operation and Optimisation of Innovative Hydrogen Infrastructures** - Optimisation of the existing H2-Infrastructure at the sites - Set-up of a new infrastructure at a new site incl. LPG-reformer and high-power H2-refueling station	DC
WP 2	**Development, construction and operation of a fleet of hydrogen ICE buses** - Construction of 4 H2-nat. asp. ICE buses - Development of a new H2-ICE engine with turbocharger and set up of 9 adv. H2-ICE buses - Integration of an APU into the adv. H2-ICE bus and build-up of one bus	NEOMAN
WP 3	**Development, operation and optimisation of a fleet of fuel cell buses** - Optimisation of the existing FC buses with regard to energy efficiency - Development of a new type of FC-Hybrid bus and built up of one prototype	DC
WP 4	**Quality, Safety and Training** - Analysis of existing H2-safety procedures at the refuelling stations and possible improvements - certification issues - Training in the framework of workshops of e.g. new European member states, Asia, Australia	Hydro
WP 5	**Accompanying studies**	PE
WP 6	**Dissemination through the Global Hydrogen Bus Plattform**	PE
WP 7	**Project Management**	DC

4.2 Distribution of project profits - if applicable

4.3 Risk management

5. Utilisation

5.1 N° and type of vehicles

Operation of 33 hydrogen fuel cell (FC) powered buses in 9 cities around the world - Amsterdam, Barcelona, Beijing, Hamburg, London, Luxembourg, Madrid, Perth, Reykjavik
Operation of 14 hydrogen powered internal combustion engine (ICE) buses in Berlin
One bus in three EU cities (tbd)

5.2 N° and type of refuelling stations

9 HRS in Amsterdam, Barcelona, Beijing, Hamburg, London, Luxembourg, Madrid, Perth, Reykjavik with different technologies to supply gaseous hydrogen

On site GH2-production via
- electrolysis: Amsterdam, Barcelona, Bejing (phase 3) Hamburg, Reykjavik
- Steam-Methane Reforming: Beijing (phase 2), Berlin (LPG), Madrid (CNG)

External supply via
- Delivery of compressed hydrogen: Beijing (phase1), Luxembourg, Madrid
- Delivery of liquefied hydrogen: Berlin (back up), London

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

The recertification of stations took less time due to existing procedures in some locations; however a lengthy procedure was required for new station Berlin mainly due to the fact, that the HRS in Berlin is part of a conventional fueling station

6.2 Vehicles: authority & timeframe + identified regulatory barriers

Vehicle – recertification strategy for FC buses ensure that buses are in good shape as buses have a different design, check if hydrogen pathway still safe
New certification strategy for ICE buses-hydrogen tanks on roof of bus needed to be certified

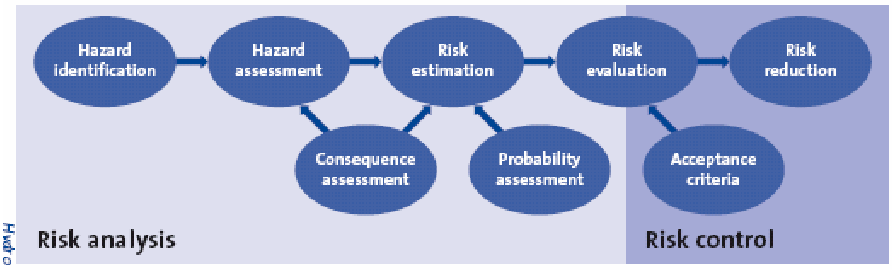
7. Safety – Standards & Regulations

7.1 Insurance

In some cases, i.e. for the EHFP event, bus certificates mentioned “hydrogen” but no special provisions were foreseen.

7.2 Risk management

Risk analysis was realised on the infrastructure only.



8. Intellectual Property

8.1 Ownership

8.2 Contributing method

8.3 Handling & dissemination of confidential information

To increase user comfort for data entry and to reduce the time required for data analysis a commercial software system was implemented. This is fully web-based, clear and easy to handle (compared to the former CUTE MIPP sheets). Tables, graphics, time series, benchmarks and

complete reports are automatically created. The system is configured on the basis of user and user access rights.
The information produced is presented in an anonymous and aggregate manner

8.4 IPR stipulations

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

N/A.

10. Miscellaneous

10.1 Regions/Municipalities

10.2 "Liaison Body"

10.3 Lessons Learned/Recommendations for the future

Integrating the new partners was a difficult task. The need to make all partners feel "comfortable" within the project should not be underestimated.

10.4 Reccomendations

The data management with SoFi has led to a substantial increase of the quality of data produced due to immediate (graphical) feedback

HYNOR & SHHP

1. General Information

1.1 Project Duration

2005-2009

1.2 Background Information

Discussions begun in 2003. Stakeholders from Industry, local government, NGOs and academia were involved in the initial discussions phase. Consumers and central government were not involved at the initial phase. The results of the discussions was
2004-2005: Feasibility studies
2006: Building of the first H2 fueling stations
2006: Vehicles in operation
2009: Corridor completion Oslo – Stavanger. The activities in the nodes will last longer that 2009.

1.2 Brief Description of Activities

HyNor is a Norwegian joint industry initiative to demonstrate real life implementation of hydrogen energy infrastructure along a route of 580 kilometers from Oslo to Stavanger. The goal was/is to operate hydrogen vehicles by 2005 - 2008. The project comprises all steps required to develop a hydrogen infrastructure and includes various hydrogen production technologies and use of hydrogen, in all cases with an adaptation to local conditions. The project covers varying transport means: buses, taxis and private cars, and varying transport systems: urban, inter-city, regional and long national transports. The project aims at connecting various activities and cities in a common network along one of the major national transport corridors. The ultimate goal is to

extend the hydrogen infrastructure network through much of Scandinavia under the **Scandinavian Hydrogen Highway Partnership**, a joint organisation formed by HyNor, Sweden's HyFuture, and Denmark's Hydrogen Link in June 2006. All three countries have different approaches.
It also builds a partnership connecting major industrial and energy companies, transport companies, regional and national public authorities, and R&D institutes.
A project, which first of all will demonstrate the commercial viability of hydrogen energy production and use in the transport sector.

SHHP

Role
Trans-national network and bridging institution
Coordinator of a Scandinavian large scale demonstration project
Body for dissemination of information & marketing
Purpose
Co-operation (B2B, G2G, B2G & B2C)
Co-ordination (standardisation)
Pooling & lifting Scandinavian H2 competences & international impact
Targets
Establish a collaboration during 2006 between networks of actors and demonstration projects in the Scandinavian Regions.
Facilitating the establishment of an hydrogen infrastructure by year 2012 that enables hydrogen fuelled vehicles to operate and refill along the Scandinavian Hydrogen Network.
Ambitions to qualify as a Hydrogen Lighthouse Project in the EU Connect the Scandinavian Hydrogen Network to the rest of Europe.

1.3 Project Manager
Hydro – Ulf Hafseld

1.4 Project Partners
Almost 40 public and private partners
Partners in HyNor
• **Energy companies;**
Hydro, Statoil, Lyse, Vardar,
• **Vehicle users;**
Stor Oslo Lokaltrafikk, Nettbuss, Miljøbil Grenland, Rogaland Taxi, Norgestaxi, Skagerak energi, Choice Hotels, Porsgrunn kommune
• **Research and education institutes;**
Vestlandsforskning, Østfoldsforskning, International Research institute of Stavanger (IRIS), University of Stavanger, Høgskolen I Agder, Høgskolen i Telemark, SINTEF, IFE
• **Environment NGOs;**
ZERO, Bellona
• **Public institutions/City Councils/Regional County;**
Rogaland FK, Telemark FK, Akershus FK, Vest-Agder FK, Buskerud FK, Stavanger kommune, Drammen kommune, Oslo kommune
• **Others;**
Lindum Ressurs og Gjenvinning, GassTEK, Rådet for Drammensregionen, Think Technology, Raufoss Fuel Systems, Entech, Risavika Energipark

1.4 Host Country-ies
Norway

2. Contractual Issues

2.1 Type of Entity

Public-private partnership with six separate legal entities. The “Nodes” are forming partnerships to solve the local challenges

The HyNor partnership includes representatives of all relevant stakeholder groups (industry, NGOs, research institutes, local governments, etc.). The HyNor partnership is open for anyone. Additional partners can be easily included. Authorisation organisations are not included in the partnership in order to remain independent. Not all end-users are partners in the project. In various nodes (where buses will be used) the bus operators are project partners. Other end-users are not partner in the project. For the time being the partnership seems to work properly

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

NA

2.3 Public procurement procedure (Yes/No-why)

Yes for the purchase of buses.

2.4 Existence of agreements between project partners

A consortium agreement based on Norwegian law has to be signed by all partners. Although this Consortium Agreement includes confidentiality clauses, most of the HyNor knowledge will be open to public. The handling of IPR issues is also determined in the Consortium Agreement.

Leasing agreements by Miljøbil Grenland. Duration of lease contracts to end-users, 5 years. The calculatoy cost of the cars will be zero at the end of the lease period. End-users will be local communities, Hydro itself (E Prius vehicles in Hydro´s car pool).

Car companies have ”Cooperation Agreements”

Each node has a “Node Agreement” where cooperation and responsibilities are defined for that particular node

3. Financing Issues

3.1 Total Budget

Approx 30 m €

3.2 Owner of assets (land, equipment, etc)

In Greenland and Stavanger nodes: the owner and operator of RS are the infrastructure provider (Hydro and Statoil)

Land and infrastructure owned by infrastructure providers

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

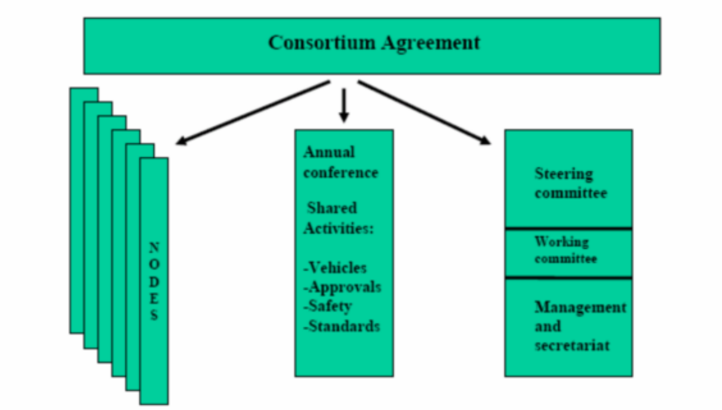
50% - 50% from public and private

NOK 48.6 million (US$7.5 million, €6.0 million) provided by the Research Council of Norway, on behalf of the Ministry of Transport and Communication, granted to a series of projects and the testing of hydrogen and biological fuels. Of that, 62%—NOK 30.2 million (US$4.6 million, €3.7 million)—were allocated to the HyNor project.

Each of the nodes has its own sponsors. Once matured they will apply for their own funding.

4. Managerial Issues

4.1 Management



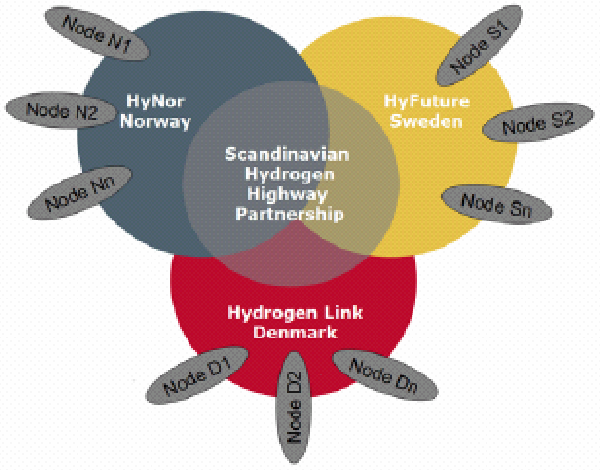
HyNor is structured in two levels:
Level 1: The HyNor Steering Group. It functions as an umbrella for the partnership. Its node leader represents each of the 6 nodes in the Steering Group. The leadership of the Steering Group is organised as a rotating system.
Level 1 currently includes 2 working groups
- working group vehicle acquisition
- working group infrastructure

Further working groups will be established on demand.
Furthermore, the Steering Group is assisted by
- a media coordinator () and a- secretariat

Level 2: Each node is structured in working groups:
- working group vehicles
- working group station
- working group hydrogen competence

All nodes have more or less the same structure. However, they “compete” with each other in terms of performance to be able to receive funding.
It is very important and useful to have this structure (local nodes and overall project management) as the project management provides the framework and rules and the real work has to be done at the nodes level.
The working group on hydrogen competence are also responsible for public awareness. For example an NGO has published an article in a local newspaper answering 10 potential questions related to hydrogen safety (no direct response requested).
There were discussions on installing a permanent project manager. It has been agreed that there is no real need for a permanent project manager in the early phase. This may change during the project duration and there is still the option to install a project manager.
If a project manager were installed from the very beginning it would be preferable to have an internal person in charge. Later in the course of the project an external project manager would be the better option, but also an internal person with certain qualifications and an adequate standing can do this job.
Even if the project has separate financing schemes for the various nodes, there is also a central budget in place

SHHP



4.2 Project revenues

Non existent as they can barely cover the costs.

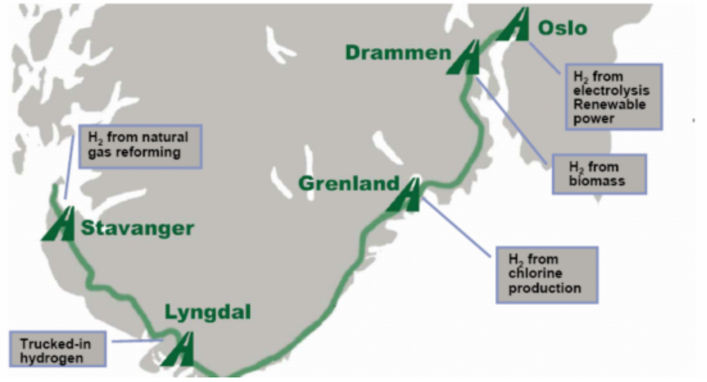
5. Utilisation

5.1 N° and type of vehicles

In total 15 hydrogen-fueled Toyota Prius hybrid vehicles have been scheduled for delivery. Miljøbil Grenland, a Porsgrunn-based professional operator of a fleet of electric cars, has signed an agreement, on behalf of the HyNor project, with the California-based Quantum Technologies and will lease the cars to users in Porsgrunn, Stavanger and Trondheim. The first 4 were delivered by Quantum Fuel Systems Technologies Worldwide, Inc in September.
Nine of the cars will be affiliated with Hydro's hydrogen filling station at Hærøya in Porsgrunn, which is scheduled to start operating by spring 2007
Four cars will be affiliated with the filling station in Stavanger. HyNor's venture partner HyTrec in Trondheim will use two vehicles.
The prerequisite for the project is to have enough local users. A number of parties have expressed interest, but it's still possible to be a hydrogen car user, in connection with the hydrogen filling station in Porsgrunn.
5 Think Hydrogen/Electric cars are planned for in 2007.

5.2 N° and type of refuelling stations

By 2009, HyNor plans to have "enough fuelling stations along the 580-kilometer (360 mile) route to allow hydrogen-powered vehicles to routinely make the trip.



HyNor Stavanger
Norway's first hydrogen station opened August 23, 2006
Offers Hydrogen 350 and 700 bar, Naturalhy (8% H2 + NG) and Natural Gas
Start with trucked-in hydrogen – later reforming of natural gas with CO2 handling
4 Hydrogen Prius in operation

HyNor Grenland
Based on hydrogen byproduct from industry
Transport of H2 in subsea and land pipeline
New underground solution for hydrogen storage
Easy to expand with increasing demand
Will open April 2007
9 Hydrogen Prius will be in operation

Oslo
Plan for on-site hydrogen production from water electrolysis
Vehicle fleet; 4 buses and 10 cars
Will open summer 2008

Drammen
Production of hydrogen from local land-fill with CO2 handling
Planned to open late 2008

Lyngdal
Trucked-in hydrogen
Planned to open early 2009

Romerike just outside Oslo has recently joined as a new node, and plans for a node on the south coast between Lyngdal and Grenland is currently being developed.

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

Authorisation bodies are not partners in HyNor Project. Authorisations granted based on local rules in Norway

6.2 Vehicles: authority & timeframe + identified regulatory barriers

Regarding the refuelling stations each node is responsible for receiving permits from the local building authority and the local fire department.
For passenger vehicles approval is granted according to EIHP2

For the passenger cars: Norwegian law do not allow the purchase of the vehicles after the termination of the leasing contracts as part of the contract.

7. Safety – Standards & Regulations

7.1 Insurance

In-house insurance used by Hydro who is liable for damages. Statoil has a similar set up. Cars have insurance from an ordinary car insurance company.

7.2 Liability

In car companies "Cooperation Agreements" they have stipulations covering damages – if something not foreseen therein, then joint and several liability applies
3-yr warranty for vehicles provided by Quantum, for base car Toyota gives 3 years warranty.

8. Intellectual Property

8.1 Ownership

IP remain with the producer and then they can license these; However, if a partner does not perform its project duties with due diligence the IP produce by this partner passes to the others

8.2 Contributing method

8.3 Handling & dissemination of confidential information

8.4 IPR stipulations

9. Regulatory Issues

10. Miscellaneous

10.1 Regions/Municipalities

10.3 Liaison Body

10.3 Lessons Learned/Recommendations for the future

The kick-off of the project took place at the end of 2003. As it is really difficult to get vehicles, the partnership early realises the need to have a working group on vehicles.
Concerning the financing issues one can say, that one can always do more. Contacting both, Members of Parliaments and local governments turned out to be successful at the end.
What happens if a hydrogen refuelling station does not work has to be determined in the leasing contracts of the vehicles.
If the end-users should be partners in the partnership or not depends on the application and should be decided case by case.
In terms of project management, a rotating role at the driver´s seat is deemed necessary.
Important to have all categories of partners in place

– Local authorities
– Oil/Energy companies
– Vehicle operators and users
– Vehicle suppliers
– Research institutes
– NGO's and other stakeholders

JHFC

1. General Information

1.1 Project Duration
Execution period 2002-2005

1.2 Background
First, the government (Ministry of Economy Trade and Industry “METI”) judged through discussions with key representatives of Japan (industry, energy companies, academia, media, consumer reps etc.) that FC and H2 have an important potential and should be the base for transportation and stationary power generation. Upon that, the FCCJ (Fuel Cell Commercialisation Conference of Japan), a group, representing companies with activities and/or interest in FC, H2 and related, was established to facilitate the positions of the private sector related to FC and H2. Government, FCCJ and academia discussed and agreed on a roadmap, including both technology research and development as well as commercialisation – timelines, needed changes in regulatory framework, education etc. One key execution tool is the JHFC program (Japan Hydrogen and Fuel Cell Project). The generic concept of JHFC was discussed and agreed upon between FCCJ, METI and academia. JHFC Phase1 2002-2006 was a) to demonstrate that FC vehicles in combination of H2 fuel makes sense in respect to energy efficiency and environmental effects, b) to understand the technology status, c) gather experience for discussing C&S, d) try out different H2 pathways, e) promote public relation activities.

1.3 Brief Description of Activities
Hydrogen & Fuel Cell Demonstration Project consists of the fuel cell demonstration program (including in the support project for "empirical and other research on polymer electrolyte fuel cell systems" under the auspices of the Ministry of Economy, Trade and Industry) JHFC is actively engaged in various activities to raise awareness of Fuel Cell Vehicles.
Activities include: seminars to present research results and introduce activities; events for the general public.
In 2003 FCVs from eight car manufacturers and fuel cell buses for commercial routes participated in trial runs on highways. Highway run data and hydrogen station usage data such as environmental characteristics, fuel consumption, etc., were obtained for evaluation.
Will construct Twelve hydrogen stations were organised for desulfurised gasoline reforming, naphtha reforming, LPG reforming, liquid-hydrogen storage, methanol reforming, high-pressure hydrogen storage, alkaline water electrolysis, kerosene reforming, utilising byproducts from iron factory and soda factory, and city gas reforming (2 stations). One liquid hydrogen production facility was also built and operated.

Purposes
Determination of energy saving effects (CO2 emissions reduction and efficiency) achieved by FCVs and hydrogen stations
Determination of environmental (non-CO2) load reduction effects achieved by FCVs and hydrogen stations
Data acquisition for preparing specifications, regulations and standards concerning the safety of FCVs and hydrogen stations
Activities for familiarising the general public with FCVs and hydrogen station
Solving of problems involved in the dissemination of FCVs and hydrogen stations
Efficient recovery of hydrogen from by-product gases, and development and verification of an efficient liquefaction technique

Related Projects
Development of Polymer electrolyte fuel cell system technologies (2002-2004) Run by – NEDO (New Energy Industrial Technology Development Organisation)
Development of basic technologies for the safe use of hydrogen (2003-2007) Run by - NEDO
Demonstration study of stationary polymer electrolyte fuel cell systems (2002-2004) Run by –New Energy Foundation (NEF)
Projects for development of infrastructures for widespread use of polymer electrolyte fuel cell systems (2000-2004)
Run by – NEDO.

1.4 Project Partners

http://www.jhfc.jp/e/project/kigyo.html
Toyota Motor Corporation
Nissan Motor Co., Ltd.
Honda Motor Co., Ltd.
DaimlerChrysler Japan Co., Ltd.
GM Asia Pacific (Japan)
Hino Motors, Ltd.
Suzuki Motor Corporation
Mitsubishi Motor Corporation
Nippon Oil Corporation
Cosmo Oil Co., Ltd.
Showa Shell Sekiyu K.K.
Tokyo Gas Co., Ltd.
Iwatani International Corporation
Japan Air Gases Ltd.
Taiyo Nippon Sanso Corporation
Nippon Steel Corporation
Tsurumi Soda Co., Ltd.
Kurita Water Industries Ltd.
Sinanen Co.,Ltd.
Itochu Enex Co., Ltd.
Idemitsu Kosan Co., Ltd.
Babcock-Hitachi K.K.
Toho Gas Co., Ltd.

1.5 Host Country-ies

Kanto & Aichi region, Honshu Island, Japan.

2. Contractual Issues

2.1 Type of Entity

Trade association
The detailed legal format and management framework for JHFC was drafted under the management of JARI, Japan Automotive Research Institute (vehicles) and ENAA Engineering Advancement Association (stations), both government related organisations, which were assigned by METI to be the project lead and execute the program. All the details around management, legal issues, data exchange, information protection, format of publication etc. is being discussed within several working groups in participation of the private sector companies, government, JARI, ENAA under the participation of academia. Agreement of all participants is necessary.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

In the case of Japan, a too rigid legal structure would be counter-productive, as Japan, culturally, lays less emphasis on contracts. Also, as opposed to the Western approach, companies are looking for consensus with each other, as well as consensus is sought between government and private sector. Academia is playing a facilitating and subject matter expert role. The focus in Japan is therefore on the subject itself, as well as on practical execution, including protecting interests of the participants.

2.3 Public procurement procedure (Yes/No-why)

No.

2.4 Existence of agreements between project partners

JARI makes agreements with automakers, and ENAA makes agreements with infrastructure companies. Details of agreements are confidential.

3. Financing Issues

3.1 Total Budget

2002 - ¥2.0billion
2003 - ¥2.5billion
2004 - ¥2.0billion
2005 - ¥1.8billion

3.2 Owner of assets (land, equipment, etc)

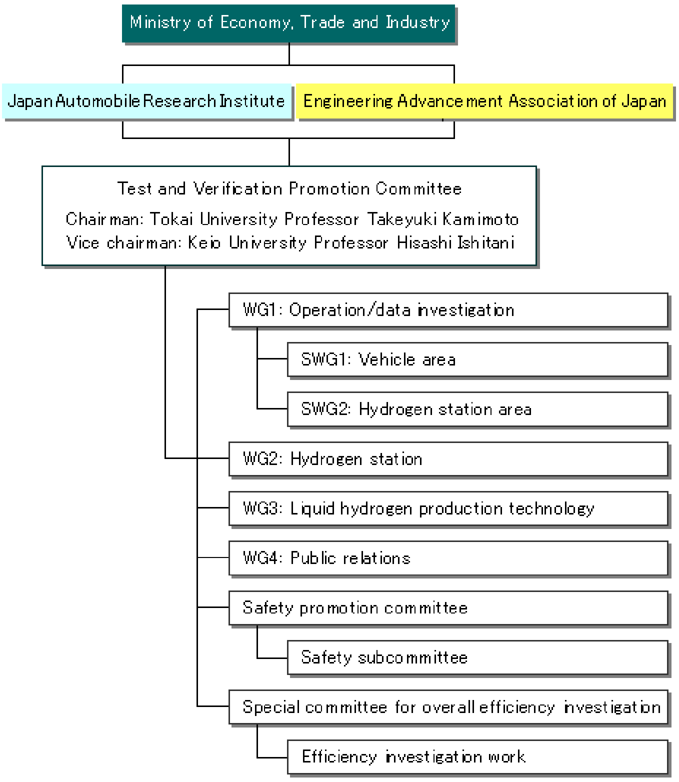
3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

Subsidised by Japan's METI
In JHFC 1, vehicle manufacturers received from JARI small funds in exchange of agreed data, as well as garage facilities and H2 fuel free of charge. Energy companies received from ENAA full funding for station build, maintenance and operation. In JHFC 2, less funds available for stations, vehicle funding in exchange of tbd data unclear.

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

Chairman: Prof. Takeyuki Kamimoto, Tokai University
Vice Chairman: Prof. Hisashi Ishitani, Keio Univeristy
Organised and funded by the Japanese Ministry of Economy, Trade and Industry deals with the whole Demonstration Project and supported by:
Japan Automobile Research Institute (JARI) does empirical research on solid high-polymer fuel cell systems, and;
Engineering Advancement Association (ENAA) of Japan looks at hydrogen fueling facilities for FCVs.



http://www.jhfc.jp/e/project/jhfc.html

Each company has contact with JARI (auto companies) and ENAA (energy companies). Different layers and types of Working Groups exist to work on the details. Working groups are chaired usually by academia. The concept, however, of the activities (including setting key priorities, timelines etc) are agreed upon between FCCJ, government and academia.
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4.2 Distribution of project profits - if applicable

If project output can be regarded as one of profits, it was reported in JHEC Seminar annually (held every March), and disclosed on our website to public

4.3 Risk management

There was no particular risk management.

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

Number of FCVs registered to JHFC: 21(2005FY)
Number of FC Buses registered to JHFC: 11(2005FY)
Number of hydrogen stations operated by JHFC: 12(2005FY)
Number of liquid hydrogen production facility by JHFC: 1 (2005FY)

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

Regulations, codes and standards are not discussed directly in JHFC project. JHFC supply data for discussion of the RCS for hydrogen infrastructure.

6.2 Vehicles: authority & timeframe + identified regulatory barriers

Regulations, codes and standards are not discussed directly in JHFC project. JHFC supply data for discussion of the RCS for FCV.

7. Safety – Standards & Regulations

7.1 Insurance

Insurance only given for other parties and injuries of people, but not for own vehicles. Important to address how to cope with this subject, would depend probably on the countries.

8. Intellectual Property

8.1 Ownership

Intellectual properties belong to each partner.

8.2 Contributing method

No contributing method (not necessary).

8.3 Handling & dissemination of confidential information and IPR stipulations

Working groups discuss and agree first, what data is providing value in context of the objectives of the JHFC. Then, it is discussed on how the data is taken, and how it is protected and processed. JARI serves as a neutral entity, with whom the OEMs have confidentiality agreements; JARI compiles data as such, that individual OEMs cannot be traced.

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

These activities were taken in another group or project, and some regulation modifications for promoting spread of FCV and hydrogen station were made on March 2005.

10. Miscellaneous

10.1 Regions/Municipalities

Industry is not interested in local/regional governments in Japan working on regulatory issues. It is expected that this is handled by the central government for harmonisation reasons. However, local governments still play a key role when it comes especially to refuelling stations.

10.2 “Liaison Body”

Makes sense in Japan, and that process is used.

10.3 Lessons Learned/Recommendations for the future

Keywords for future:
Demonstration in more actual use
Expansion of demonstration area
Inclusion of more partners (hydrogen ICE vehicle, mini-transportations, etc.)
Unification of hydrogen refuelling specifications.

LONDON HYDROGEN PARTNERSHIP

1. General Information

1.1 Project Duration

The Deputy Mayor of London launched the LHP at the "Clean Fuel for London: Towards a Hydrogen Future" event in April 2002.

1.2 Brief Description of Activities & Background Info

The Mayor established the London Hydrogen Partnership to drive forwards London's hydrogen economy. In addition, he is keen to adopt the technology, where feasible, in the buildings and vehicles owned and operated by the GLA Group (Greater London Authority, the London Development Agency (LDA), Transport for London (TfL), London Fire and Emergency Planning Authority, Metropolitan Police Authority)). Transport for London (TfL) controls London's buses, taxis and licensed minicabs, and London Underground Ltd.
LHP aims to:
Produce and implement the "**London Hydrogen Action Plan"** as a route map for clean energy
Establish and maintain dialogue among all sectors/actors relevant to the hydrogen economy
Disseminate relevant materials
Provide a platform for funding bids and initiation of projects
The Partnership functions on the basis of a "**Business Plan 2004-2007**" (attached to this report).

The "**London Hydrogen Action Plan**"
The Mayor followed up his commitment with policy in his Energy Strategy, London Plan and other strategies to support a hydrogen economy for London. The Clean Fuel for London event generated a draft "Hydrogen Action Plan", which was approved in November 2004. This is the Partnership's route map and statement of intent, containing specific objectives and actions required to establish hydrogen and fuel cell technologies in London. TfL is the lead body to implement the "London Hydrogen Action Plan".
Targets (indicative):
• 5 year transport programme operating 70 vehicles by 2010/11
• 20% public sector fleet hydrogen by 2020
• 2% all London vehicles hydrogen fuelled by 2020
• 600-1500 micro-CHP units by 2012
• 15-40MW large/medium fuel cell capacity by 2012

TfL role
TfL is managing a project to procure, deliver and operate a hydrogen-fuelled fleet in London by 2010. This phased project will deploy up to 60 hydrogen cars, vans, motorbikes and other vehicle types (the procurement of 9 buses is already subject to a separate procurement exercise) from a range of suppliers. Both hydrogen ICE and fuel cell technology will be considered. London's public sector fleets will operate the vehicles, with a focus on Central London operation. Dedicated hydrogen refuelling facilities will be constructed within the city to support this project. This high profile project is an opportunity to showcase new hydrogen vehicle technologies and to prepare London for the wider deployment of hydrogen vehicles as the technology approaches commercial maturity.

1.3 Project Partners

Partners include local, regional and national government, education institutions, funding bodies, companies involved in fuel cell development, gas supply, the energy industry, systems and component manufacture.

1.4 Host Country-ies
UK – Greater London area

2. Type of Entity

2.1 Partnership
A Parnership Agreement was signed between the members. The Agreement formalises the partnership, giving a common statement of aims and was a GLA audit requirement. The document had gone through the GLA legal process, however it is not a legal binding document. The process is for individual copies of the agreement to be signed by each party, and co-signed by the Partnership Chair

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

2.3 Public procurement procedure (Yes/No-why)
Yes

Cars/Vans:

A 'Competitive Dialogue' was used to procure and then allocate vehicles. Deadline for responses was September 22, 06. The objective is to have the first contractor by end of February 07.
It was agreed that it is necessary to formally approach the market (under OJEU) prior to a decision on which vehicles can be procured and operated in London. The TfL procurement team proposed a 'Competitive Dialogue' process. This open process allows for an initial OJEU with loose specifications, followed by concurrent discussions with a range of suppliers towards very different contracts. This allows for an initial approach to the market, followed by allocation of vehicles within the functional bodies.

Buses:

A notice published in European Journal on 1 February 2006 inviting companies to join a Pre-Qualified supplier list for the provision of:9 to 11 hydrogen buses
Infrastructure to refuel the buses
The notice was also sent to all major bus, fuel cell and hydrogen refuelling infrastructure suppliers in Europe
The replies were received in mid-April 06 and London Buses have prepared a final Pre-Qualified list of suppliers.
A formal invitation to tender against a detailed specification was issued to the Pre-Qualified Suppliers at the end of June 06.
Successful contractor(s) to be selected in early autumn 06, with contracts finalised late autumn 06.

2.4 Existence of agreements between project partners
For the LHP: Partnership Agreement and Terms of Reference

3. Financing Issues

3.1 Total Budget
LHTP: GBP 16.1 mn for 2005-2010
LHP: GBP 200.000 => operational costs

3.2 Owner of assets (land, equipment, etc)
The bus operators will own the buses. No leasing agreements with the OEMs.
The infrastructure provider on the basis of leasing agreements will use the land. The public sector is the owner of the land.

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

At the beginning of the project the initiators of the LHTP sought "seed" funding and built up some "Strohmen". The Mayor of London was initially to contribute only 15-20% of the project budget. However, subsequently he decided to fully underwrite the programme budget.
The LHP overhead expenses are of GBP 200.000 (annual project budget that covers overheads, project consulting, etc). The Greater London Authority (GLA), Mayor of London finances 1/3 and the London Development Agency (LDA) 2/3of 50% of the abovementioned expenses and the private parties the remaining 50%.
The Mayor of London finances entirely the "London Hydrogen Transport Programme".
TfL covers entirely the expenses of the purchase & maintenance and HR of buses.
Minutes from the Transport Applications Task Force demonstrate a willingness to obtain funding from FP6 (EU) and Dti (Department of Trade and Industry in the UK) and favour the MAN built hydrogen-powered hybrid internal combustion engines (H2 ICE).
For the **CUTE** project the "Energy Saving Trust" is supporting the project through grant funding from its New Vehicle Technology Fund programme. The Energy Saving Trust (EST) was set up by the government after the 1992 Earth Summit in Rio de Janeiro and is the UK's leading organisation addressing the damaging effects of climate change. It aims to cut carbon dioxide emissions by promoting the sustainable and efficient use of energy. EST is a non-profit organisation funded by government and the private sector.

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

The Partnership consists of a Steering Group, Task Groups, Secretariat, and a Forum.

Steering Group
The Partnership is co-ordinated by a Steering Group chaired by a representative of the Mayor of London, and including Air Products, Association of London, Government, Baxi Technologies, BP, BMW, BOC, Carbon Trust, DTI, Energy Saving Trust, Fuel Cell Europe, Greater London Authority, Health and Safety Executive, Imperial College, Intelligent Energy, Johnson Matthey, London Development Agency, London First, Rolls-Royce, Thames Water and Transport for London. The SG is an unincorporated body.
The SG decisions go to the GLA (Mr. James Farell) and subsequently to the Mayor of London.

Steering Group Role and Remit
Provide the overall steer for the Partnership's activities
Coordinate the Hydrogen Action Plan
Set up and oversee Task Groups
Discuss strategic issues and work towards solutions, resolving conflict between key decisions made by the Task Groups if necessary
Oversee a review at the end of Year 1 and decide whether to continue and on what basis
Establish a vision for a hydrogen economy in London
Promote the vision
Ensure proper representation on Task Groups, Forum etc.
Ratify membership of the Partnership
Co-ordinate funding and investment

Task Groups

The Steering Group co-ordinates a number of Task Groups which work to identify and enable projects under the Action Plan, and define how the Partnership can enable its members to deliver further work towards the goals of the Partnership.

Transportation Applications. Identifying priority transport projects including hydrogen-natural gas vehicle conversions and fuel cells for water transport, linking to the **London Fuel Cell Bus Project**. From the budget of GBP 200.000, GBP 25.000 is dedicated for the development of the Hydrogen Transport Strategy.
The thrust of the transport group strategy is to establish partners and funding for projects in four specific areas. **The focus is on achievability.**
SME type projects – where an innovative approach from a smaller enterprise is demonstrated in London (often for the first time).
'Affordable' type vehicle project – where reliable and credible vehicles can be imported into London at a cost that can be afforded by London based operators. **Bus project** – working with TfL to seek an order of 9-11 buses for operation in the London bus fleet.**OEM agreements** – seeking to engage at high level with large automotive manufacturers to encourage an agreement over large-scale deployment of vehicles in London. Requires higher H2 profile for London.
All discussions will be conducted with a view to both a major (>€10 million) bid for EC funding and the prospect of a London Olympics.
Members
Greater London Authority (Chair), Air Products, Association of London Government (ALG), Auriga Energy, Baxi, BMW, BOC, BP, Bristol Electric Railbus, British Airports Authority, Brunel University, DTI, Element Energy, Energy Conservation and Solar Centre (ECSC), Energy Savings Trust, Enertech, Fiat, Ford, Fuel Cell Markets, Imperial college of Science, Technology and Medicine, Institution of Mechanical Engineers, Intelligent Energy, Lawrence Bryce, London Borough of Croydon, London Buses, London Development Agency, London Fire Brigade, Metropolitan Police, North London Transport Forum, Rolls-Royce, Thames Water, The Carbon Trust, Toyota, Transport for London, UCL

Stationary Applications. Identifying priority projects in portable, and small to large scale stationary applications such as combined heat and power (CHP).
Members:
Independent Fuel Cell Consultant (Chair), Adelan, Advantica Technologies, Air Products & Chemicals, BAA Sustainability, Baxi Group, Berkeley Group, BOC, Cenergie, Ceramic Fuel Cells Ltd, Ceres Power, CIBSE Group, Croydon Council, Element Energy, Enertech Solutions Ltd (ChevronTexaco Consultant), GLA, Hydrogenics, Land Securities, London South Bank University / CIBSE CHP Group, MTU CFC Solutions, Plug Power Consultant, PZERO Limited, Rolls-Royce Fuel Cells, Scottish & Southern Electric, Thames Water, Voller Energy

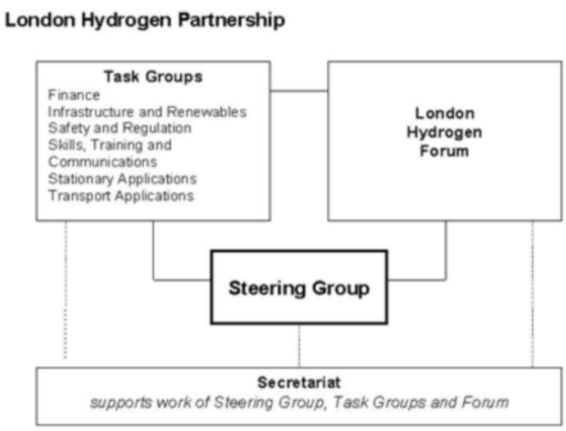
Infrastructure & Renewables. Integrated with Imperial College's London Hydrogen Infrastructure study. Advisory group for other Task Groups.
Members:
Imperial College London (Chair), Advantica, Air Products, BMW, BOC, BP, Brent Energy Network, Camden Council, Croydon Borough Council, Element Energy, Enertech Solutions (representing ChevronTexaco), Fuel Cell Markets, Fuel Cell Power, GLA, Heatric, Hydrogen Solar, Imperial College London / RAC Foundation, Independent Energy, Independent Fuel Cell Advisor, Intelligent Energy, LB Waltham Forest, London Development Agency (LDA), Loughborough University, Rutherford Appleton Laboratory, Sepco, South Bank University, Stuart Energy Systems – Europe, Thames Water
(**Renewable Hydrogen Projects** is a **subgroup** of Infras. & Renew.)

Safety & Regulation. Advisory group for other Task Groups, managing the safety and regulatory issues of Partnership projects and advising on safety aspects of communications work.
Members:

The Health and Safety Executive (Chair), Air Products, BMW (GB) Ltd, BOC Group, BP, Energy Conservation and Solar Centre, Greater London Authority, LB Croydon, LB Hammersmith and Fulham, London Fire Brigade, Metropolitan Police, National Hydrogen Association/TTC Ltd, Transport for London TfL

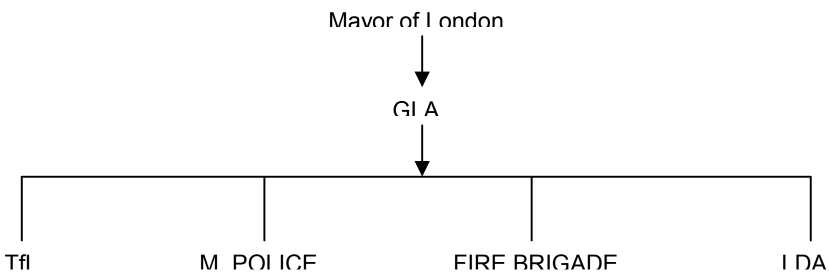
Skills, Training & Communications. Facilitating new skills and training to support the hydrogen economy. Producing and managing Partnership Communication Strategy. To find out more, or contact the Secretariat.
Members:
Johnson Matthey plc (Chair), Fuel Cell Markets (Deputy Chair), ALG, BMW, College of North West London, Fuel Cell Today, Fuel Cells Bulletin, Imperial College, LDA, London South Bank University, Policy Studies Institute, Pzero, Scientific Advances in Fuel Cells Exhibition Organiser, The Clean Energy Educational Trust

Secretariat
The Partnership is supported by a Secretariat, which is working to drive the development of priority, high-profile demonstration projects and increase awareness of the Partnership's activities, and hydrogen and fuel cell technology in general.



London Hydrogen Forum
The Forum is the networking and consultation platform for the Partnership, encouraging discussion and debate and bringing in experience from elsewhere in the UK, Europe and the World. It met for the first time at the Clean Fuel for London event and it is intended that it will meet again in autumn 2004.

In addition, TfL is the lead partner in the LHTP and guarantees a balanced representation of activities in the programme through its different departments (legal, financing, health & safety, etc). Other programme partners are the Metropolitan Police Authority as well as the London Fire and Emergency Planning Authority.
Below the management structure of LHTP .



The **London Hydrogen Forum** was established at the launch of the Partnership in April 2002. The Forum's role is to provide a pool of members for the Task Groups and Steering Group, share good practice including from outside London and the UK, and act as a consultation mechanism for the Steering Group.

In addition, a formal **project board** has been established with **GLA** and **LHP** representation. Sub-groups have been established for: bus project, non-bus project and external communication.

4.2 Distribution of project profits - if applicable

The revenues from the buses´ fares will go to the TfL as it pays for all the costs.

4.3 Risk management

Liability is partially borne by the TfL. The bus & infrastructure providers bear part of the liability as well.

5. Utilisation

5.1 N° and type of vehicles

Cars/vans:
The non-bus aspect of the Action Plan represents the procurement of 60 hydrogen vehicles to be operated in London by 2010. In order to deliver a project of this type, TfL required a new governance structure, as this does not naturally fit with their day-to-day operations. Also the expected budget is sufficiently large to require a formal 'Project Initiation' process. The non-bus aspects of the project have been delayed whilst the governance structure is established. At the start of May 06, a project manager was appointed to resolve governance issues.
In the first instance the Functional Bodies are requested to incorporate the hydrogen vehicles into their fleets. All Functional Bodies are requested to allocate budgets (the Mayor has written to the heads of the bodies). If the full compliment of vehicles cannot be achieved within the functional bodies, it may be possible to allocate vehicles to appropriate borough level hydrogen activity within London.Discussions were held with the relevant fleet managers of all functional bodies. There is clear willingness to participate in a first round trial of hydrogen vehicles in London. Fleets for up to 20 vehicles were identified for the first phase. A second phase larger rollout (up to 40 vehicles) may require buy-in from other public agencies in London (e.g. boroughs). All operators requested larger van/estate type vehicles than the vehicles currently available in London. All bodies agreed that the fleets would need to be Central London fleets and would therefore need Central London fuelling infrastructure.
Buses:
London Buses is taking steps now towards a hydrogen bus programme to build on the success of the CUTE project. The bus programme forms part of the LHP transport programme. A fleet of 9-11 hydrogen-fuelled buses will be operated on one London route, starting between 2008 and 2010. Technology will be either hydrogen ICE or fuel cell.

5.2 N° & type of refuelling stations

Two types of refuelling infrastructure will be required. The first will involve the bus refuelling facility, which has been specified to allow the refuelling of non-bus vehicles in addition to the 9-11 buses.
A dedicated hydrogen refuelling facility will be built at the bus operator's depot – main objective will be reliability, but consideration will be given to reducing well to wheel emissions where possible.
The project aims to trial the technology as close as possible to conventional diesel bus operation
18 hour days (370km range specified)
364 days per year

five years of service with an option to extend to seven
fast refuelling of 11 buses in quick succession
The second will require depot based refuelling in central London. These will all require a safety audit from trained safety experts, as well as a practicality audit for the project.
This infrastructure will need to be:
• of a flexible low cost design
• suitable for limited volume hydrogen refuelling
• located at one or more (most likely two) central London public sector fleet depots
• capable of dispensing hydrogen at reasonable cost (£/kg)
• well located to avoid excessive planning difficulties
Over the summer, potential sites were surveyed, to establish appropriate locations.
Once the vehicle hydrogen requirements are better understood, a procurement process for infrastructure equipment and associated operation will be imitated.

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

The Local Planning authority is responsible for the permits with consultation from the HSE, the Fire Brigade & other actors.

6.2 Vehicles: authority & timeframe + identified regulatory barriers

The Department for Transport (DfT) will be responsible for the certification and permits of the vehicles. This will be realised together with the bus operators.

7. Safety – Standards & Regulations

7.1 Insurance

TfL will have commercial insurance. However, when it comes to accidents and damages caused on civilians TfL will not adopt a corporate view; they will adopt a “conductive claim” process. At the beginning of the project a budget for “conductive claims” is allocated. In the future when the technology will have evolved and public awareness will be sufficiently increased, maybe the claims´ conduct will be transferred.

8. Intellectual Property

8.1 Ownership

TfL will own IP and subsequently will license this to different providers.

8.2 Contributing method

8.3 Handling & dissemination of confidential information

8.4 IPR stipulations

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

10. Miscellaneous

10.1 Regions/Municipalities

10.2 "Liaison Body"

10.3 Lessons Learned/Recommendations for the future

A solid project management structure is necessary.
Regarding the public procurement and the PQQ process the qualifications lists should be developed based on the Utilities Directive as this is simpler than the Public Sector one.
Bilateral agreements are not functional, as they cannot prepare the market from a competition point of view.
Public procurement process is more efficient to facilitate large-scale commercialisation.
For the realisation of the selection following the PQQ three issues were crucial: costs, reliability-availability of buses and C02 emissions.
3-yr warranty would be necessary to cover technology evolution.
The issue is not to design the best set-up structure but to design a "viable" structure for the long term.
A public consultation process should take place in order to increase public awareness in terms of health & safety. In London the TfL undertook such a consultation.
The responsibility for incidents should be borne by the public to increase their confidence.
The warranty and reliability requirements should be clear right at the specification phase in a public procurement process.
Procurement is necessary as it will "force" some marriages and encourage bilateral discussions between the different parties => procuring partnerships.
Pay attention to timing to ensure and right balance between the vehicles and the H2 available.

Refuelling Infrastructure
Establishing the correct solution to infrastructure requires an understanding of which hydrogen vehicles can be operated and where. Filling solutions exist on a number of scales and with different configurations. Scale and location of filling infrastructure will be determined based on grouping fleets prepared to operate H2 vehicles.

10.4 Useful documents/other information

London is in discussion with other cities interested in procuring hydrogen buses on a similar timescale
The group currently includes: Hamburg, Berlin, Amsterdam, Barcelona, British Columbia (Canada) and Perth (Australia)
The intention is to form a core grouping of interested cities, with a view to:
Sharing of procurement documentation and methodologies
Sharing of market information
Sending a large signal to the market of the intent to procure hydrogen buses – assisting suppliers in their decision making for manufacturing scale-up etc
Achieving equipment cost reduction through increased orders from suppliers
Sharing data on vehicle performance etc
Attracting new cities to purchase hydrogen buses so helping to increase the size of the market

Stationary Power meeting minutes (latest)
http://www.lhp.org.uk/content/images/articles/Stationary%20Power%20TG%20Minutes%20050606%20(JH&SG).doc
Transport Task group minutes (latest)
http://www.lhp.org.uk/content/images/articles/Notes 6th meeting 08 11 2004.doc

STEP

1. General Information

1.1 Project Duration
Approx. 4 yrs
http://www.dpi.wa.gov.au/mediaFiles/ecobus_projecttimeline0308.pdf

1.2 Brief Description of Activities & Background Info
The purpose of the Perth Fuel Cell Bus Trial is to evaluate the potential for the future operation of hydrogen powered fuel cell bus public transport system. Of particular interest is consideration of the possible future roles for Government, the private sector and the community in any introduction of hydrogen and fuel cells into static and mobile energy generation in Western Australia and Australia.
The hydrogen for the Perth Trial is being produced from the BP Oil Refinery at Kwinana. The hydrogen is made during the process of refining crude oil and is a byproduct, some of which is used to produce low sulphur fuel. BP is also building the hydrogen refuelling station at Path Transit's bus depot in Morley. As hydrogen is not a dense fuel, it needs to be compressed for transport. The hydrogen will be piped from BP to the BOC purification plant in Kwinana alongside the refinery, purified to 99.999% purity, compressed and then transported in a tube trailer by road to a storage facility at the refuelling station some 30 km away at the Morley bus depot. The hydrogen will then be compressed to the pressure needed to fill the buses and piped to a dispenser that will fill the buses with hydrogen. The buses will carry approximately 44 kg of hydrogen at 350 atmospheres of pressure. The buses will have a Range of more than 200km.
Since September 2004, Perth has been participating in one of the first major trials of hydrogen fuel cell buses in the world. Three Daimler Chrysler hydrogen fuel cell buses will be trialed on normal Perth service routes for two years.

1.3 Project Promoter
Government of W. Australia - As part of the Government's commitment to working towards sustainable transport energy solutions in Western Australia

1.4 Project Partners
Government of Western Australia, Commonwealth Government (Dpt of Environment & Heritage and Australian Greenhouse office)
BP
DaimlerChrysler
Murdoch University

1.5 Host Country-ies
Western Australia

2. Contractual Issues

2.1 Type of Entity
No specific legal entity created. The Govt of W. Australia entered into bilateral agreements with the private & public entities participating in the project:
-Contracts for services
-Contracts for supply of goods

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project
N/A

2.3 Public procurement procedure (Yes/No-why)

No public procurement procedures applied as the private entities esp. were considered as "sole providers" of the technology and services and qualified for project partners without needing to enter in a "competitive dialogue" process as there was no competition.

2.4 Existence of agreements between project partners

One-off, bilateral cooperation agreements with public & private partner.
The general project agreement was set up with the underlined principle that the project functions more as a partnership rather than a vertical services-supply of goods agreement.

3. Financing Issues

3.1 Total Budget

The total cost of the trial is nearly $15 mill
Most of this cost will be met by the Western Australian Government. There are also contributions from the Commonwealth Government, BP, Murdoch University and DaimlerChrysler

3.2 Owner of assets (land, equipment, etc)

Govt of W. Australia: 1,200 busses x? refuelling stations

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

Govt of W. Australia covered the project budget in cash as well as contributed land for the construction . The other partners covered the cash as well as in kind contributions
BP will be supplying hydrogen fuel and constructing a hydrogen refuelling station for the purposes of the bus trial. They needed to purchase the refuelling stations .
Path Transit will be responsible for housing the fuel cell buses. Path Transit employees will be trained to carry out maintenance and operation of the buses provided by DaimlerChrysler through its subsidiary EvoBus

3.4 Distribution of Costs/Benefits

Cost/Benefit Analysis to be realised as part of the project

Objectives
To analyse the full economic costs and benefits to the Western Australian community of the implementation of a hydrogen powered fuel cell bus fleet in Perth.

Anticipated outcomes
Data on the full economic costs and benefits, including both quantified and non-quantified factors;
Data on the distribution of the costs and benefits, ie 'who pays and who benefits';
An analysis of the key items that will need to, and those that are likely to, change in the next five to ten years in order to increase the benefits and reduce the costs;
Recommendations as to what future actions that the Western Australian Government should consider taking, if any, in order to progress the implementation of fuel cells and a hydrogen economy; and
Extrapolation of the data and findings to the extent possible to other Australian and overseas situations.

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

The Department of Infrastructure and Planning from the Govt of W; Australia is coordinating the demo project on a day-to-day basis.
A top down approach was adopted in project contracts however in practice the project functions more as a horizontal partnership. There exists a Steering Committee but its role is mostly political rather than decision-making. There was one project coordinator appointed by the Govt. of W. Australia taking decisions following consultation with other project partners
DaimlerChrysler is responsible for coordinating a series of workpackages aimed at capturing all learning from the European trials
Murdoch University, will realise the majority of an independent evaluation programme comprising seven sub-programmes to capture all learning from the Perth trial.
Public perception
Bus operation
Cost/benefits analysis
Government system analysis
Industry development opportunities
The evaluation programme will be used to further the development of hydrogen and fuel cell technology. It will also identify opportunities for industry development within the state of Western Australia and investigate government and private sector systems that will facilitate the future introduction of associated technologies. (http://www.dpi.wa.gov.au/ecobus/1718.asp)

4.2 Distribution of project profits - if applicable

No project profits foreseen. However, reg. the ticket price, used to auto-finance the project after a point, this was agreed upon between the Govt of W. Australia and the other participants – info confidential.

4.3 Risk management

The risk sourcing from the operation & maintenance of the buses was borne by the Govt of W. Australia. The one related to the production of H2 and the operation of the refuelling station was borne by the respective companies

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

1,200 buses operated by Path Transit one of three private companies that are under contract to the Western Australian Government (through the Department for Planning and Infrastructure - Transperth) to provide Perth urban bus services

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers and
6.2 Vehicles: authority & timeframe + identified regulatory barriers

In Australia there are different levels of governments that provide different permits – procedure too complicated to explain in few lines. The permit allocation procedure lasted around 1 year; mainly due to the learning effect of the project and not to the hydrogen technology and the lack of standards and regulations per se. The timeframes are prolonged due to the complicated nature of the project itself as well as the fact that the project promoters “learn by doing” and simultaneously need to “educate” regulators on the new technology

7. Safety – Standards & Regulations

7.1 Insurance

No additional insurance costs incurred due to hydrogen technology.
The government owns the busses as well as the land where the refuelling stations were installed. With regard to these the insurance undertaken by the Govt of Perth was a semi-commercial arrangement, and it did not need to incur any additional insurance costs due to the hydrogen technology; however, they approached a private insurance company for consultation purposes. The Govt chose to act as a private project promoter in order to comply with the technology standards & regulations and manage the risk as a private entity.

8. Intellectual Property

8.1 Ownership

All intellectual property generated by the project will be passed on to the Govt of W. Australia

8.2 Contributing method

N/A

8.3 IPR stipulations

N/A

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

A trial evaluation programme is being conducted to inform the Western Australian and Australian Governments, regulators, and the community about the operation of hydrogen powered fuel cell buses.
At the conclusion of the trial it is anticipated that the evaluation programme will have provided information to (among others) enable the Government to make informed judgments on:
the possible future costs and benefits of operating hydrogen powered fuel cell buses;
the changes needed in Government statutes and other systems to remove obstacles from and/or facilitate any move to a hydrogen economy;
options for the role that Government might take in facilitating any move to hydrogen powered fuel cell buses and/or a hydrogen economy

Government Systems Analysis
Project objectives:
To record the process of implementing the Perth Trial
To recommend changes required to regulations and procedures so that the Government statutory and systemic impediments to implementation can be identified and overcome.

Anticipated outcomes
A record of the process of implementing the Perth Trial and the Government statutory and systemic impediments, as well as other non-Government systemic impediments to implementation that were encountered and;
Recommendations on what changes need to be made to non-Government systemic arrangements in order to facilitate the introduction of hydrogen powered fuel cell vehicles and a hydrogen economy.

Lead Researcher:
This project is being conducted by staff within the Department for Planning and Infrastructure.
For more information contact Mr. Jeff Major
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10. Miscellaneous

10.1 Regions/Municipalities

10.2 "Liaison Body"
A proposal was submitted to the Australian Greenhouse office to establish a body centralising all hydrogen activities and knowledge – decision for creation pending.

10.3 Useful documents/other information
http://www.dpi.wa.gov.au/mediaFiles/ecobus_infobrochure.pdf

ZERO REGIO

1. General Information

1.1 Project Duration
2004 –2009 (started Nov. 04)

1.2 Brief Description of Activities & Backrground Info
Overall objective:
Developing low emission transport systems for European cities – contribute to EC s&m term goal of 5% substitution by Hydrogen in road transport by 2020. Construct and demonstrate hydrogen infrastructure in two European regions (Lombardia, Italy and Rhein-Main, Germany) for supplying fuel cell passenger cars
Specific objectives:
Use of Hydrogen from different sources as an alternative transport fuel
Development and demonstration of 700 bar refuelling technology
Integration of Hydrogen fillers in conventional service stations
Demonstration of reliability of fuel-cell cars in different applications
Socio-economic and environmental assessment of using Hydrogen as a motor-fuel
Development of tools for faster market penetration of Hydrogen

Execution in two phases:
Phase I - Construction phase (0-24 months)
Phase II - Demonstration phase (25-60 months)

1.3 Project Partners
16 partners from 4 member states
7 industrial partners, 4 universities/research institutes, 3 public authorities and 2 consultants

1.4 Host Country-ies
Lombardia, Italy & Rhein-Main Germany

2. Contractual Issues

2.1 Type of Entity
Joint venture. Designed as a demonstration project with defined responsibilities.

2.2 Advantages/Disadvantages of Legal Form – Impact on successful implementation of project

2.3 Public procurement procedure (Yes/No-why)

2.4 Existence of agreements between project partners
Consortium Agreement
Leasing Agreement
Confidentiality Agreements

List of partners:
1. Infraserv GmbH & Co. Hoechst KG Germany, Industry, Coordinator
2. Linde AG, Linde Gas & Engineering Germany, Industry
3. DaimlerChrysler AG Germany, Industry
4. Fraport AG, Frankfurt Airport Services Worldwide Germany, Public Admin.
5. TÜV Technische Überwachung Hessen GmbH Germany, Industry
6. Agip Deutschland GmbH Germany, Industry
7. Lunds Universitet Sweden, University
8. Roskilde University Denmark, University
9. Saviko Consultants Ltd. Denmark, Industry-SME
10. European Commission-DG Joint Research Centre Italy, EC
11. EniTecnologie S.p.A. Italy, Industry
12. Regione Lombardia Italy, Public Admin.
13. Sapio Produzione Idrogeno Ossigeno S.r.l. Italy, Industry
14. Comune di Mantova Italy, Public Admin.
15. Università commerciale Luigi Bocconi Italy, University
16. C.R.F. Società Consortile per Azioni Italy, Industry-Research Centre

3. Financing Issues

3.1 Total Budget
The project is financed by the Consortium participants and by the European Commission "DG Transport and Energy" within the FP6. The budget of the whole project will be about 18 million €.

Activities	Costs	EU- grant
RTD and innovation related activities	3.974 M€	2.161 M€
Demonstration activities	15.409 M€	4.688 M€
training activities	79.63 T€	79.63 T€
consortium management	531 T€	531 T€
total	19.995 M€	7.461 M€

3.2 Owner of assets (land, equipment, etc)
Refuelling stations, land, vehicles, etc

3.3 Percentage & type of financial Contributions for each partner: in-kind, cash and other resources

4. Managerial Issues

4.1 Management (please attach project organigram/chart if available)

The management structure of the project is designed to assure a successful progress of work according to the time plan. Basic control of all activities is in the hands of the work package leaders.
They report to the local co-ordinators. In case of difficulties, corrective actions will first be undertaken by the local co-ordinator. If necessary, the problem is communicated to the global co-ordinator Infraserv Hoechst, who will activate any available resources within the project to overcome the problem, or will determine alternatives to reach a solution, by suitable consulting with all the involved project partners. Work packages are structured so as to promote communication and integration of activities at the two sites.

European scale via. 4 EU partners in the consortium
_ Cooperation with the European Hydrogen Technology platform especially with the following projects:
_ CUTE (focus on public busses)
_ CH2IP (700 bar)
_ Hyways (Development of a European hydrogen roadmap)
_ DWV-Roadmap (Project of German hydrogen association)
_ Hynet

Top-down, bottom-up, Steering Committees, Assembly, Partnership Board, Coordination Bodies, Working Groups, etc

4.2 Distribution of project profits - if applicable
N/A.

4.3 Risk management
Identified strategy, risk allocation between public-private partners and liability concerns.

5. Utilisation

5.1 N° and type of vehicles and N° and type of refuelling stations

<u>Business associations</u>
Use of Hydrogen as an alternative motor fuel from existing
Hydrogen sources in Europe
(Infraserv Höchst, D; Sapio, I)
• Employing European technological and development capabilities (Uni Lund, S; JRC-Ispra, I; Roskilde Univ., DK)
• Collaborating with key players in hydrogen powered vehicle development (Daimler-Chrysler, Fiat)
• Collaborating with universities, research institutes, SME's and other projects developing a European hydrogen economy
(CRF, I; Becker Technologies, D; Eni-Technologies, I)

Once the infrastructure is ready for operation, it is planned to perform field tests with automobile fleets for a period of over 2 years. In the Frankfurt area, DaimlerChrysler will take part in the project with fuel cell powered vehicles (F-Cell, class A, Fig. 2). The specific conditions of operation of these vehicles will be specified between DaimlerChrysler and the vehicle operators (availability, duration of operation, application mission profile, data acquisition, etc.). In Italy a fleet of 3 fuel-cell cars is planned. The Italian fleet will be based on Fiat Pandas

6. Permits – Standards & Regulations

6.1 Stations: authority & timeframe + identified regulatory barriers

6.2 Vehicles: authority & timeframe + identified regulatory barriers

7. Safety – Standards & Regulations

7.1 Insurance

Commercial insurance, in-house, etc.

8. Intellectual Property

8.1 Ownership

By NewCompany, jointly by shareholders, by one shareholder, etc.

8.2 Contributing method

8.3 Handling & dissemination of confidential information

8.4 IPR stipulations

9. Regulatory Issues

9.1 Regulations to support the introduction of hydrogen

Existing/under preparation?

10. Miscellaneous

10.1 Regions/Municipalities

10.2 "Liaison Body"

10.3 Lessons Learned/Recommendations for the future

10.4 Useful documents/other information

The Zero Regio started out as two separate ideas fostered by the Hessian Initiative for Fuel Cells and Hydrogen and the regional government of Lombardy and later developed into a joint project under the auspices of the EU

The expected results of the project in short keywords are the following:
- Building up safe & functional infrastructure for Hydrogen as an alternative motor fuels to serve future road traffic in urban areas
- Promoting car fleet development for alternative fuels
- Promoting public acceptance for alternative fuels particularly Hydrogen
- Developing suggestions and models for faster penetration of alternative fuels over larger urban areas in the EU
- Contributing to the EC's political objective of 20% substitution by alternative fuels in the road transport sector by year 2020