Hamburg Initiative for Fuel Cell and Hydrogen Technology

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Commitment to Fuel-Cell Technology

The Mission of the City of Hamburg according to decision in Parliament

The Senate is called upon

1.) to initiate a cluster of competence in fuel cells and hydrogen technology

2.) (...)

3.) to realize „lighthouse-projects“ for this sustainable technology

4.) in the context of a sustainable development (..) to develop modules for educational purposes

5.) to co-ordinate (...) activities in order to foster the economic potential of the fuel cell technology

6.) to report to the respective state department once a year

Bürgerschaft der Freien und Hansestadt Hamburg; Drucksache Nr. 18/787

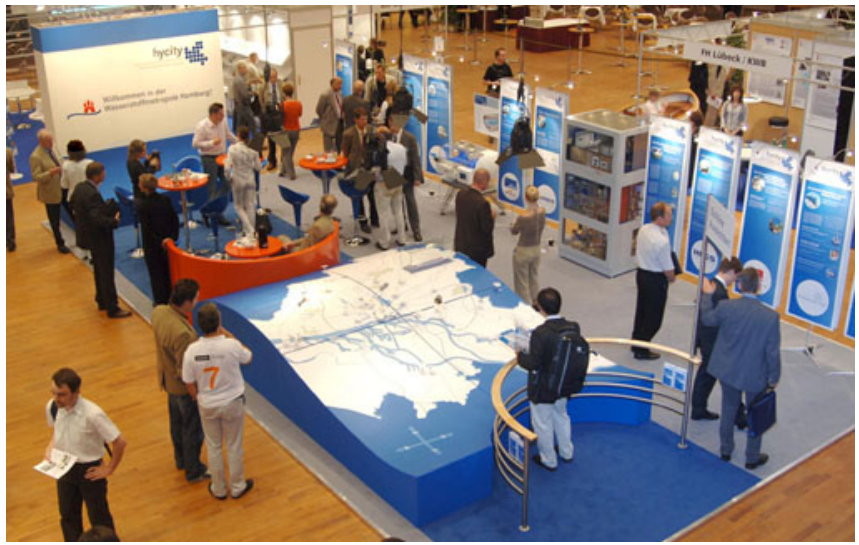
Commitment to Fuel-Cell Technology

- Innovation funds in municipal budget
- Previous high quality fuel cell projects
- Support of future lighthouse projects

Fuel-Cell Technology Network

Hamburg fuel Cell and Hydrogen Technology Initiative

- Established in 2005
- More than 40 partners
- Network of representatives of
  - industry
  - universities
  - chambers & associations



German Federal Funding Program

- 500 Mio. Euro German funding budget for hydrogen and fuel-cell demonstrations and research (2007 – 2015)
- 50/50 share with industry
- Applications will be bundled in „lighthouses“

Projects (1)

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Hamburgs Antrieb Wasserstoff

Hamburg ferry first to use hydrogen power

THE world's first fuel-cell technology ship that is powered by hydrogen will enter service in the summer of 2008, writes *Mike Hood*.

The 100 passenger ferry will operate on Lake Alster in the centre of Hamburg and will be a prototype for hydrogen-powered deepsea ships.

The 'green' ferry is spearheading the 45.2m ($67m) Zemship project, which began at the end of last year, partly funded with €2.4m from the EU's LIFE programme.

Nine German and Czech partners are involved in the project, led by Hamburg's State Ministry for Urban Development and the Environment. They others are Alster Touristik, the Czech ETC Consultancy Group in Prague, classification society Germanischer Lloyd, public transport company Hamburg Hochbahn, the Hamburg University of Applied Science, fuel cell company Linde, the Czech Nuclear Research Institute in Rez and Germany's Proton Motor Fuel Cell.

Hamburg's Senator for the Environment, Michael Freytag, said: "Hamburg aims to be the forerunner for hydrogen and fuel-cell technology. This is equally true for research and applications. Our partners are developing a computer model of the propulsion system and making data and results available other interested parties.

A major challenge for ... signers in developing a fu... cell deepsea vessel is the st... age of fuel-cell capacity.

Such ships have to ... close to the hydrogen supp... so that they can easily be ... fuelled. While this is not ... problem in ferry operations ... is a major obstacle for deep... ships.

Projects in Hamburg (2)

- Growing number of Fuel Cell buses and Filing station
- Fuel Cell cars for politicians and decision makers
- Operation of Minibus with fuel cells
- Use of Hydrogen produced from gas from purification plant for Elbe ferry (PURShip)
- Supply of APUs with fuel cells on seegoing vessels
- Deployment of fuel cells in aviation sector
- Fork lifters etc. in logistic companies
- Operation of Fuel Cell Heating Devices of BAXI Innotech
- Combined Heating and Power Station with Fuel Cells in HafenCity
- Fuel Cell Lab
- Active Fire Protection with Fuel Cells
- Concept for hydrogen pipeline

Fuel Cell buses

- Expected end of operation of the first generation: Summer 2008
- Lighthouseprojects in Hamburg and Berlin (NIP)
- Next Generation: Hybrid version with relevant economy of fuel
- Test of Prototype of EvoBus beginning in autumn 2008
- Currently negotiations concerning procuration of new buses (van Hool/UTC bzw. EvoBus/Ballard)
- purchase by 2011: circa 10, constant purchase from 2012 on

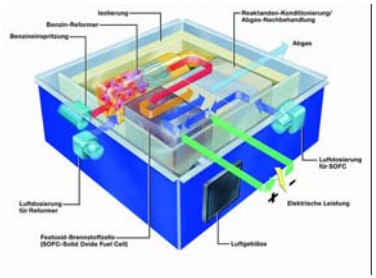



Fuelling station HafenCity

- Local Energy supplier as project leader
- Cooperation with other industrial partners
- Base for future infrastructure
- Max. refuelling of 50 Buses a day, refuelling of passenger cars also possible

Car Sharing

- Business model with partners
- Vehicles from DaimlerChrysler (open for other automotive partners)
  - ➢ from spring 2008 two fuel cell cars
- BMW provides hydrogen-cars for decision makers as well as the City Mayor
- Hamburg will become part of the „Clean Energy Partnership“ CEPII (2009)

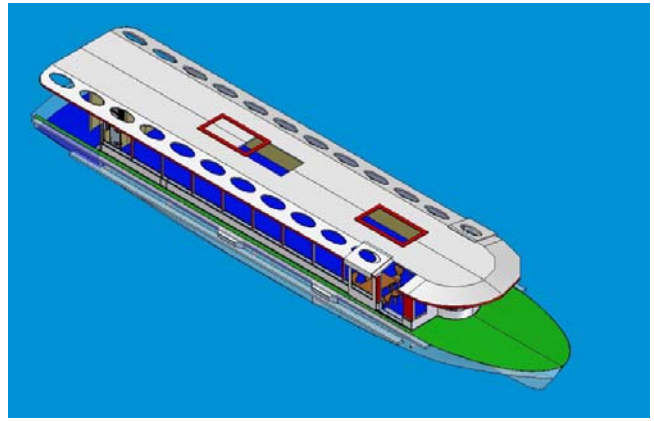


Minibus

- Operation on the area of the University Medical Center Hamburg-Eppendorf
- Substitution of existing minibus by fuel cell hybrid bus
- Optimal orientation on demand, integration in local traffic concept
- Demonstration project for five years

Zero Emission Ships

- World's first passenger ship with fuel cell propulsion on Alster lake
- Capacity: 100 passengers
- Allows zero emissions solutions in lakes, rivers, nature and water protection areas
- Two Proton Motor Fuel Cell Systems with 50 kW peak each
- Start of service: Spring 2008

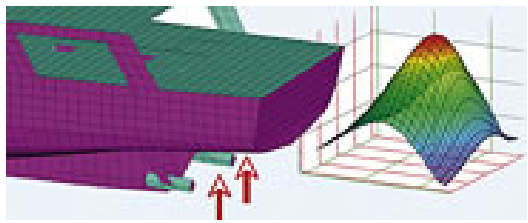


PURShip

- Use of Hydrogen produced from gas from purification for APUs of Elbe ferry
- For APU´s and partly main engine
- Partners: Hamburg Storage company, HADAG – ferry company, German Lloyd, Fuel Cell manufacterer, developer of motors

Supply of APUs on seegoing vessels

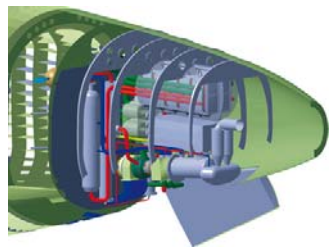
- Integrated project - objectives: definition, evaluation and demonstration of the supply of APUs on seegoing vessels
- Test application ashore and at sea
- use of synthetic fuel (BtL)
- Partners: TKMS, Shell, CFC-Solutions, HDW-Hagenuk, German Lloyd, N_2telligence

APUs in aviation sector

- Technical definition and test of fuel cell for deployment of APUs in aircrafts
- Successive extension of activities (target: operation of fuel cell for Grounding)
- Partners: Airbus, DLR, EADS, Fuel Cell manufacterer
- First test apparat already in operation (Flying test bed)
- Focus: Reforming and fuel



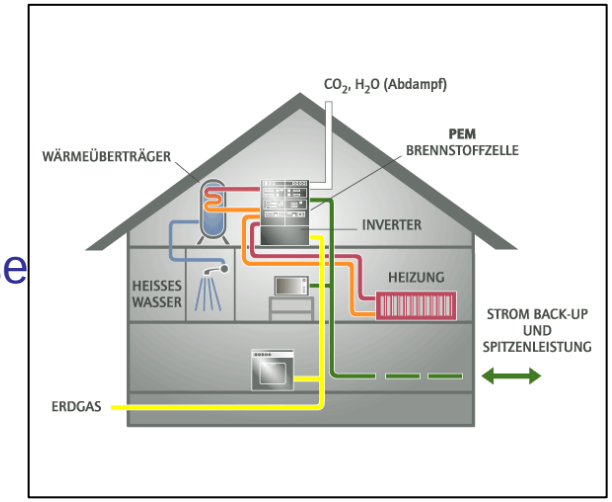



Luggage truck

- Cooperation project with North Rhine-Westphalia, Hessen and Hamburg
- Focus on logistic companies and logistic partners in harbour area
- Flottila of about 100 vehicles for demonstration of suitability for daily use
- Partners: STILL, Linde, Hoppecke, logistic partners in harbour area (Unikai, Oceangate etc.)

Small Fuel Cell CHP

- Cooperation project with Baden-Wuerttemberg, and North Rhine-Westphalia
- Partners in Hamburg: Baxi Innotech and E.ON Hanse
- Range of 1 – 4 kW
- Testing of up to 100 units
- Continous quality improvement
- Regional application with Lighthouse relevance - superior cooperation for monitoring and public relation

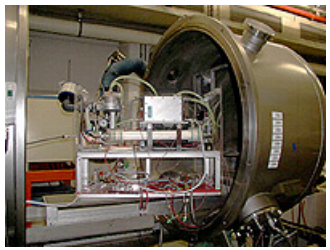


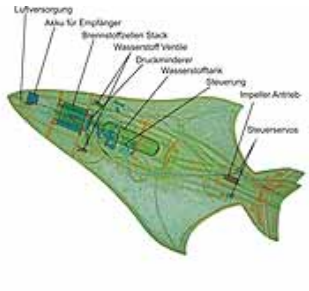
Combined Heating and Power stations with Fuel Cells

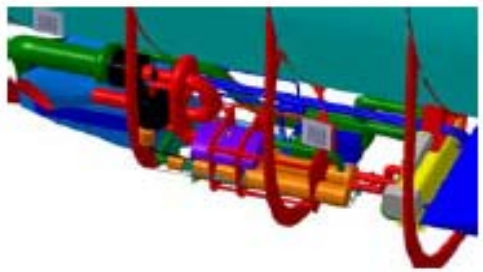
- Range of 250 kW – 1 MW
- Currently circa 10 projects, within different phases of concept and planning
- Direct comprehension with climate change concept of City of Hamburg
- Partners: CFC Solutions, energy supplier, potential user (real estate and service sector)

Fuel Cell Lab

- Buildup of a Fuel Cell Innovation Center with focus on Fuel Cell application
- Cooperation of industry partners and universities/institutes
- Partners: Airbus, City of Hamburg, DLR
- Further partners are interested and welcome





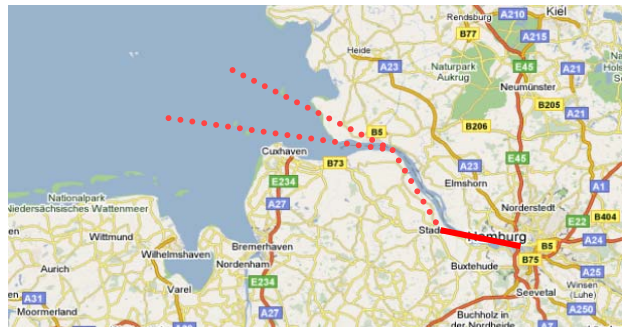


Fire Protection

- Additional value supplemental to engery supply
- Defintion and integration of system + demonstration of capability
- Spin-Off uses Patent of Airbus
- Partners: N_2telligence, Kidde, Fuel Cell manufacterer, user

Hydrogen-pipeline

- Use of industrial hydrogen to ensure a reasonable supply
- Cooperation with industry partners to guarantee sufficient demand
- Close cooperation with Lower Saxony



Strategic Hydrogen Bus Alliance

- Bundling of Demand
- 9 public transit agencies from: London, Berlin, Hamburg, Western Australia, British Columbia, Amsterdam, Barcelona, Cologne and South Tyrol
- The Alliance represents a cumulative fleet of over 12.000 buses (*diesel, diesel-hybrid and fuel cell)*
- Average yearly purchase of over 1.200 buses
- Target: genuinely commercial hydrogen bus operation from approx 2015
- More partners welcome

Memorandum of Understanding

On October 5, 2006, the undersigned representatives from public transport companies in Europe and Canada convened at the General Assembly of the European Hydrogen and Fuel Cell Technology Platform in Brussels to agree to co-operate and work together with regards to the procurement of hydrogen powered buses for public transport. The purpose of this memorandum of understanding is to initiate and promote the co-operation between the undersigned cities and regions as well as their public transport operators through the establishment of a working group which will:

Share information and knowledge on hydrogen powered bus technologies and refuelling infrastructure
Share information and knowledge on planned procurement programmes
Share information and knowledge on tender procedures, documentation and evaluation

The aim of the working group will be to:

- Demonstrate to potential suppliers of hydrogen buses and refuelling infrastructure that potential markets exist for these technologies
- Achieve economies of scale where possible through demonstrating joint demand to suppliers
- Encourage suppliers to move towards the commercialisation of hydrogen buses as soon as possible
- Procure and operate hydrogen buses in public transport operation from 2008 onwards
- Share information and experiences with other cities and regions and welcome the addition of new partners to the working group

GVB Amsterdam, City of Amsterdam, J. Gertjan Kroon, General Manager

Transports de Barcelona S.A., City of Barcelona, Francisco Gonzalez Balmas, General Manager

Berliner Verkehrsbetriebe BVG, City of Berlin, Thomas Necker, Member of the Board

British Columbia Transit, Province of British Columbia, Ron Hamer, Vicepresident Technical Services

City of Hamburg, Senator Dr. Michael Freytag, Minister for Urban Development and the Environment

Hamburger Hochbahn AG, City of Hamburg, Jost Knebel, Member of the Board

London Bus Services Ltd., City of London, Mike Weston, Director of Operations

Government of Western Australia, Hon Alannah MacTiernan, MLA, Minister for Planning and Infrastructure

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Thank you very much !