

FUEL CELL POWER

The magazine for the power source of the future



HEADLINE NEWS

At a meeting in Birmingham the Royal Mail announced plans to take the lead in the change towards clean hydrogen and efficient fuel cells, in order to meet CO₂ reduction targets for its transport fleet and the 2019 aim for zero carbon commercial buildings.

Hydrogen fuel cell projects in several UK regions as well as in Hamburg and Aragon, Spain, were outlined. Measures were proposed to replicate successful regional programmes with hydrogen and fuel cells in the UK, Europe and around the world.

The important role of fuel cells in a new distributed energy infrastructure was explained.

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BUILDING THE HYDROGEN AND FUEL CELLS FUTURE

Birmingham, UK

At an international conference in Birmingham, organised by Climate Change Solutions, several regions of Europe showed how they are starting to change their energy systems to hydrogen and fuel cell power. Hydrogen and fuel cell use is growing in early markets and speakers outlined the action being taken to bring these technologies into the mainstream. Several speakers proposed that more co-ordinated action by central Government would enable hydrogen and fuel cell technologies to contribute to climate change targets and provide future energy security.

NEW ENERGY FUTURE

Prof Angelika Heinzl of the University of Duisburg explained how they are starting to build the new energy future. Hydrogen will become an important fuel and fuel cells will ensure that it is utilised most efficiently. We have to deal with climate change and we have reached peak oil so prices are rising. Renewable energy is starting to replace fossil fuels and we can produce enough electricity for the entire world on a very small area of the Earth's surface.

Fuel cell technology is becoming more and more mature, with a variety of manufacturers bringing different types of fuel cell to market. Stationary fuel cells are used for back up power, where battery storage is insufficient, as well as for traffic signals. Smart Fuel Cells provides Direct Methanol Fuel Cells (DMFC) for the leisure markets and work is continuing to replace batteries with fuel cells. There are already over 800 fuel cell combined heat and power (CHP) units operating in Germany and further development is under way by manufacturers around the world. The lifetime needed for stationary fuel cells to compete with established technologies is 40,000

hours. The Phosphoric Acid Fuel Cell (PAFC) is demonstrating long lifetime and there are many installations of Molten Carbonate Fuel Cells (MCFC) operating successfully. Several companies are bringing to market solid oxide fuel cells (SOFC).

HYDROGEN FUEL CELL TRANSPORT

The first fuel cell powered vehicles are being successfully evaluated in niche markets, with several thousand powering fork lift trucks in the USA. The first hydrogen fuel cell powered buses supported by the European CUTE programme will be succeeded by the next generation of advanced fuel cell buses next year. Most of the world's fuel cell cars on the road are in California, where they have been encouraged by the emissions legislation.

The market for fuel cell cars has been held back while manufacturers improve upon the long term reliability of the fuel cell systems, reduce costs and start to build the hydrogen infrastructure, but in the meantime Daimler and Honda are building small fleets of fuel cell cars. Manufacturers are now aiming for 2015 for the mass production of hydrogen fuel cell cars.

FRONT PAGE : Delegates at the meeting were impressed by the first hydrogen fuel cell hybrid vehicles which deliver mail at the University of Birmingham

AVAILABILITY OF HYDROGEN

California has taken the lead in building the first 'Hydrogen Highway' and in Germany there are several filling stations said Prof Heinzl. A 700 bar storage system has been developed for the cars of the future which has passed safety certification, but the cost is still a problem for the automotive industry. Hydrogen is widely used in industrial applications and in Germany a 150 km pipeline transports surplus hydrogen to sites where it can be utilised. The hydrogen would otherwise be vented off. Filling stations are being built alongside the pipeline so that the hydrogen can be used to fuel road vehicles.

It is estimated that about 20% of hydrogen could be produced from biomass compared with 80% from wind and solar power. Rather than replace the entire natural gas infrastructure, local pipelines could connect users with new energy sources. It would be possible to generate hydrogen at home, so long as there is sufficient wind and solar power and an electrolyser is available.

UNIVERSITY OF BIRMINGHAM HYDROGEN FUEL CELL HYBRID VEHICLES

Dr Bruno G. Pollet of the University of Birmingham's Fuel Cells Group stated that climate change is a global issue needing to be swiftly solved as time is running out. Two billion tonnes of fuel is used worldwide per annum, fossil fuel supply is peaking while the number of road vehicles is increasing and therefore CO₂ and particulate emissions are increasing. In the UK alone, one third of CO₂ originates from transportation and about 8,500 people per annum die due to particulate emissions from vehicles.

'Green' vehicles are therefore needed, such as Electric Vehicles (EV), Hydrogen Fuel Cell Vehicles (HFCV) and Hydrogen Fuel Cell Hybrid Vehicles (HFCHV) like the five running on the University Campus.

The University of Birmingham's Fuel Cells Group is working with companies in the West Midlands Region to overcome the issues with the hydrogen economy: availability, production, distribution and cost.



John Jostins of Microcab showed an HFCHV to Jean Aldous of Fuel Cell Power at the meeting.

The University of Birmingham has five HFCHVs powered by a 1.2kW Proton Exchange Membrane (PEM) fuel cell and a series of lead acid batteries. The campus is also starting to build a 'local' hydrogen infrastructure, with a hydrogen filling station. The hydrogen is stored at 350bar and gives a range of 60 miles per filling at a cost of 20p/mile.

The overall energy efficiency is 1km/MJ which is much higher than that of a diesel Internal Combustion Engine (ICE) of 0.3km/MJ.

By 2010 The University of Birmingham's Fuel Cells Group is planning to have a further twenty HFCHVs running on the campus and in Birmingham City Centre. This project is enabling them to build up strong engineering expertise, involving fifty local SMEs, which will create sustainable jobs, wealth and growth.

Based on a projected 40 million hydrogen fuel cell vehicles in Europe by 2030, with 19,000 hydrogen filling stations, the infrastructure costs would not be prohibitive, but would be similar to the cost of the mobile phone and broadband infrastructure.

HAMBURG CHANGING TO HYDROGEN POWER

Karim-Tarik Hammou of HySOLUTIONS said that the City of Hamburg is taking the initiative in dealing with climate change, with the aim of cutting CO₂ emissions by 40% by 2020, which is double the German average. Hamburg will be the European Green Capital of 2011. They want local emissions-free transport, and less dependence on fossil fuels. Wind will be a major source of clean power and hydrogen is a very important energy vector.

The prototype Daimler hydrogen fuel cell buses operated satisfactorily under the HyFLEET CUTE programme, with availability of 90 - 95%. The fuel cell stacks operated for 5,000 hours and they are aiming for 12,000 hours with the next generation of hybrid fuel cell buses in 2010. At present, the buses have 100 km range on 20kg hydrogen. The next generation of hybrid fuel cell buses will incorporate a lithium-ion battery. They will have more passenger capacity and will have a 100 km range on about 10-13 kg hydrogen. The target for fully commercial hydrogen bus operation is from approximately 2015. The present refuelling stations for the buses produce 120 kg hydrogen per day and have 400kg storage capacity. They do not use hydrogen in internal combustion engines because the hydrogen consumption would be high, as the engine efficiency is much lower than that of a fuel cell. Hamburg is a member of the Hydrogen Bus Alliance which works with bus operators in ten cities around the world.

A hydrogen fuel cell powered ship (Zemship), with capacity for 100 passengers, is operating on Lake Alster. This provides a zero emission solution for rivers, lakes and environmentally sensitive areas and it is planned to develop the technology for mass production. For larger ships, a fuel cell auxiliary power unit (APU) is being developed.

Hamburg is also planning to establish a glider project for the evaluation of APUs for aviation.

For stationary hydrogen fuel cell applications, Hamburg is participating in the German Government's Callux programme and plans to install up to a hundred hydrogen fuel cell combined heat and power (CHP) units in family homes this year. The Mayor of Hamburg has announced that up to 1,000 hydrogen fuel cell cars will be introduced in the City by 2015. Four new publicly accessible hydrogen filling stations are planned for the cars.

HYDROGEN FUEL CELLS IN THE BUILT ENVIRONMENT

Prof Saffa Riffat of the University of Nottingham outlined the global problems associated with ever growing cities and how they can be countered by the construction of low energy buildings and eco-cities. In particular, the University is investigating energy systems and the possibility of using hydrogen fuel cells. China is building an eco-city at Dongtan and the UAE is building Masdar City with low carbon buildings incorporating efficient and renewable energy technologies. The University of Nottingham has five 'Creative Energy Homes' designed to meet future Government requirements for low carbon homes.

ARAGON LEADING REGIONAL HYDROGEN INITIATIVE

Ms Leire Romero Elu, Research and Development Manager, Foundation for the Development of new Hydrogen Technologies in Spain said that Aragon is taking the initiative with regional support for green hydrogen from renewable sources. The electricity generating capacity of the region is nearly 6GW, 55% of which comes from renewable sources, mainly wind and hydro, with a small amount of solar power.



The IHER project in Aragon, Spain is helping to balance the load on the grid. Part of the hydrogen generated powers fuel cells or engines for transport applications.

Sixty stakeholders are working together in the IHER programme to develop a variety of hydrogen technologies. They have three wind turbines of differing sizes, as well as 40kW of solar photovoltaic panels on buildings and 60kW on the roof of a parking area to refuel cars. They are testing the durability and efficiency of components of the hydrogen production systems and optimizing control systems. The efficiency of both polymer and alkaline electrolyzers, together with the balance of plant (BOP) is being assessed. They are ensuring the most efficient use of hydrogen for electricity generation, combined heat and power (CHP) and tri-generation (power, heating or cooling) and developing guidelines for the operation and maintenance of the system.

LOCAL ENERGY GENERATION

Jeremy Harrison of E.ON outlined their work with CFCL and Gledhill Thermal Storage, to bring solid oxide fuel cells (SOFC) to the UK domestic CHP market. They believe that it can help them to meet Government targets for reducing CO₂ emissions, ensure future energy security and eliminate fuel poverty, all of which must be achieved within a competitive energy market!

The closure of nuclear, oil and coal fired plants, together with rising electricity demand, will lead to a shortfall in electricity supply over the next decade. E.ON Energy Company believes that local distributed energy will be a fundamental part of the new energy infrastructure. Micro CHP (mCHP) meets all the four criteria for new power generation: CO₂ reduction, energy security, good performance and competitive cost. Local investment is also less risky. They can install one kilowatt tomorrow and then scale up according to the conditions.

It is estimated that micro-generation, with perhaps more wind power, could save up to £1bn by 2020 in network investment. At present the UK market for natural gas boilers is 1.5 million per year and eighteen million homes would be suitable for CHP installations, including six or seven million natural gas powered fuel cells. Condensing boilers provide heat at 90% efficiency and Stirling engines provide electricity at 10% efficiency, with about 80% of the input energy converted into useable heat. Fuel cells can achieve 50% electrical efficiency plus 40% useable heat. It is important to note that SOFC can generate electricity continuously without needing to waste heat. Every kWh of energy can be used with the fuel cell operating for 8,000 hours per annum as opposed to the Stirling engine operating efficiently for only 3,000 hours.

GOVERNMENT ACTION REQUIRED

Eventually carbon pricing will make the use of fossil fuels for the grid obsolete. Mr Harrison does not envisage the development of a hydrogen grid but possibly biofuels will be used, although these will go to the highest value markets, which will probably be transport. Prompt Government action is needed to help exploit the potential for SOFC mCHP. Feed-in-tariffs are not helpful and nor is the tax regime. While there is capital relief for investment in coal and other centrally generated power, mCHP is paid for out of taxed income.

YORKSHIRE HYDROGEN MINI-GRID

Jason Stoyel of TNEI outlined progress with the new hydrogen mini-grid, which will supply entirely renewable energy to the Environmental Energy Technology Centre (EETC) in Yorkshire. The Vestas wind turbine has been installed and a 30kW electrolyser has been specially designed by the Pure Energy Centre to cope with fluctuating electricity supplies.

The combined compressor/dispenser provides hydrogen at 350 bar for transport. Hydrogen storage is in composite cylinders. Costs and other operational data will be made available later on www.hydrogen-yorkshire.co.uk. The project is supported by Yorkshire Forward, which is leading the way for the UK regions to develop a renewable and sustainable energy industry.

STIMULATING THE UK HYDROGEN MARKET

Dr Martin Blake said that the Royal Mail is interested in buying hydrogen fuel cell technology and they are big enough to stimulate the market as they have 33,000 vehicles on the road. 40% of their emissions are from road transport, which must be decoupled from fossil fuels. They are interested in green hydrogen and don't want the hydrogen price linked to that of oil or gas. They are aiming to cut their CO₂e emissions by 50% by 2015.

The Royal Mail is interested in converting their fleet to hydrogen fuel cell power and is proposing a UK wide hydrogen and fuel cell project. This will link up regional hydrogen facilities and establish a national 'Hydrogen Highway'. The project will co-ordinate action, develop universal design specifications, enable joint procurement and lead to mass production. As the Royal Mail is Government-owned, they cannot receive grants, but if grants for the procurement of hydrogen fuel cell vehicles were allocated to other transport users, it would contribute to bringing down the cost for them all. The concessions on road tax and fuel duty help to make operating costs competitive.

For stationary applications the Royal Mail is also interested in the Molten Carbonate Fuel Cell (MCFC). Fuel cells will help them to meet the requirements for commercial buildings to be zero carbon by 2019.

The Royal Mail launched the first hydrogen postal fleet in Europe at the meeting.



ADVANCES WITH HYDROGEN FILLING STATIONS

There are 70 hydrogen fuelling stations operating around the world said Andrew Winship of the Linde Group. Hydrogen fuel cells can already be competitive in fork lift trucks where they displace batteries. There is no need for battery stores as the fuel cells can be easily refuelled in 2 minutes and give a long, consistent run time. The hydrogen is compressed to 350 or 750 bar. At present, almost all the hydrogen is obtained from natural gas, but in the future it must be green hydrogen, which will become cost effective.

FIRST MARKETS FOR PEM AND DMFC

David Hart of E4tech explained that the delays in introducing fuel cell powered cars were caused by the cost and the need to improve lifetime performance. The PEM functioned well in buses and fork lift trucks because the performance requirements are not as arduous as they are in cars. There would be early markets for a few tens of thousands of fuel cell cars, but the automotive parts suppliers are not interested in such volumes. A better initial market is the recreation sector which does not require high performance and the lower volume manufacturing enables fuel cells to compete. In order to make the PEM more competitive, manufacturers are working to reduce the catalyst loading and to reduce platinum degradation. The lifetime can be increased if the fuel cell is used in operations which are not so demanding.

Fuel cells are operating successfully in several early markets. Smart Fuel Cells has sold over 10,000 DMFC portable fuel cells, PEM fuel cells are becoming more widely used to provide back up power for telecoms and larger PAFC and MCFC are in operation around the world. The Japanese Government supports 1kW fuel cells with the aim of reducing costs and developing

common specifications for all the balance of plant.

If we get the technology out there, market pull will lead to larger scale production. Governments could do more. The ZEV mandate in California pulled forward an enormous amount and so did the Japanese action. Feed-in-Tariffs give a strong advantage in Germany. The prospects in the UK are not so good - it is difficult to understand the policy trade-offs between CO2 reduction and the Treasury wanting to keep existing jobs. Regional development is more promising.

Peter Gray of Johnson Matthey said that they have capacity for manufacturing hundreds of thousands of membranes for portable fuel cells, the PEM and the DMFC. They have achieved a fourfold increase in watts generated, which compensates for the increased price of platinum in recent years. The first markets are leisure, remote and military power, auxiliary power units (APUs), notebook computers, cell phones, security, monitoring and disaster recovery. Fuel cell systems are much lighter than batteries and can be left for months or years without discharging. The market for consumer electronics is fairly close. In response to a question about a child holding a methanol canister, Mr Gray explained that the canister cannot be opened or damaged - it has been certified as completely safe.

UK GOAL FOR HYDROGEN IMPLEMENTATION

Dr Mary Gillie of EA Technology said that the UK urgently needs a clear goal if we are to get hydrogen into the main stream and help innovative companies to get to market. Dr Gillie outlined progress with several excellent regional projects in the UK but said that better Government programmes and co-ordination of ministries is needed. In countries where such programmes exist, progress is greater. For example, In Germany there are over 300 hydrogen powered vehicles

on the road and Japan has over 2000 micro fuel cell CHP units in homes.

Dr Gillie works with the IEA's HIA Task 18 which provides information about hydrogen integration into society around the world. There are several areas of expertise in the UK and we have strong skills in designing, integrating and replicating systems, which should be expanded.

INTEGRATED FUEL CELLS FOR TRANSPORT AND BUILDINGS

It is now time to start deploying hydrogen fuel cell vehicle fleets and the requisite infrastructure, said Dr Chris Jackson of Intelligent Energy. His company has been developing fuel cells for automotive, aviation, domestic and portable power applications. Intelligent Energy also has reforming technology which produces hydrogen from hydrocarbon sources and has been integrated with fuel cell systems for the CHP market.



Intelligent Energy's fuel cell systems range from 50 watts up to 75 kilowatts and have fewer components, are highly power dense and are more compact than conventional PEM fuel cells. Their fuel cell systems were employed in the world's first fuel cell powered manned flight, in a programme with Boeing. They were integrated into PSA Peugeot Citroen's H2Origin fuel cell hybrid delivery vehicle, extending the range from 78km to 308km with no loss of load capacity and having a refuelling time of 3 minutes. They are now developing fuel cell powered London

Black Cabs with Lotus Engineering and London Taxis International (LTI) in time for 2012, as part of a programme part-funded by the Technology Strategy Board.

Intelligent Energy is focussed upon four target markets encompassing: two and four wheel automotive applications, powering their ENV, the world's first hydrogen fuel cell motorbike, the Suzuki Crosscage motor bike, taxis and H2 Origin: Stationary power, APUs for terrestrial applications and clean hydrogen generation for residential and commercial applications and CHP, in joint venture IECHP with Scottish & Southern Energy: in aerospace applications with Boeing and others: and in distributed and portable power.

AUSTRALIAN MATERIALS AND SOFC DEVELOPMENT

Dr Andrew Dicks, Director of the CSIRO funded National Hydrogen Materials Alliance, discussed the work being carried out by 12 Australian universities to develop hydrogen generation, storage, and end use technologies. New catalyst materials are being developed for hydrogen generation from hydrocarbons. Materials are being developed for electrolysis systems and photocatalytic materials for hydrogen production from water. Hydrogen storage projects are based on lithium, magnesium, carbon and porous materials. Materials for advanced fuel cells are also being developed, focussing on SOFC which is being developed by CFCL. Australia has established projects with PAFC and PEM fuel cells and there is also interest in MCFC products.

Brendan Bilton, CEO of CFCL said that their solid oxide fuel cell (SOFC) reforms methane within the cell. It has high electrical efficiency and produces a small amount of useable heat, so it is ideal as a base load generator. Including heat, overall efficiency is over 80% and this saves 2.5 tonnes CO2 per year. SOFC are designed to last for 15 to 20 years. The stack life is now 4

to 5 years but this should be up to 8 years in future and it can be replaced at low cost. CFCL have engaged partners who can deal with sales, installation and maintenance. Households benefit from reduced fuel costs and the energy supplier benefits even more. In the UK they are working with E.ON and Gledhill. In Beta 1 trials they will supply 10 to 30 units to each partner and in Beta 2 trials this will increase to 100 units per partner. The first commercial trials will be in 2011 to 2012. It is a competitive battle with established industries for innovative companies to take market share, so established industrial partners are essential.

KEEPING UP WITH ASIA AND THE USA!

Jonathan Lewis of Rolls-Royce Fuel Cell Systems represented the EU JTI for Hydrogen and Fuel Cells. This is one of only five Joint Technology Initiatives (JTI) the other four are with established industries.

The EU has allocated €450m over 6 years so that Europe should remain competitive vis-a-vis Japan, the USA, Korea and China. We must bring the developments of the last 20 years to market. The four markets are: early markets, power generation and CHP, sustainable hydrogen production and vehicles with refuelling stations. Green economy jobs will provide much of our wealth in future.

The JTI's next call for funding of €78m is being prepared for later this summer. This is the first time that funds have been earmarked for hydrogen and fuels cells and if we do not use it we will lose it. Germany has €700m available for hydrogen and fuel cells. We need to go from proof of concept, to validation to deployment with the end user. The ideal partnership is industry, university and users.

<http://www.climate-change-solutions.co.uk>

NEWS

70% BETTER FUEL ECONOMY

Oakland, California



AC Transit of Oakland, California, has ordered a total of 12 new buses, incorporating UTC Power PureMotion® fuel cell systems, which will be delivered by Van Hool from late 2009 through 2010. AC Transit is currently operating three Van Hool hybrid-electric buses with UTC Power fuel cell systems. These first-generation fuel cell buses have demonstrated on average 70% better fuel economy than a control fleet of diesel buses. Fuel cell buses have a significant effect on reducing greenhouse gases, ranging from a 43% reduction over diesel buses if hydrogen is supplied from the reformation of natural gas, up to a 100% reduction when hydrogen is generated on-site from renewable sources like solar and wind power.

According to Rick Fernandez, AC Transit's General Manager, "In addition to fuel efficiency, these UTC Power fuel cell systems produce no harmful tailpipe emissions and have an immediate, positive impact on street-level emissions. They also provide a smooth, quiet ride for our passengers. We've been quite pleased with the performance of our first-generation fleet and we look forward to expanding operations and testing with our next-generation fleet of 12 advanced technology buses." www.utcpower.com

FUELCELL ENERGY CUTS ENERGY USE AND EMISSIONS

Danbury, Connecticut

FUEL CELLS WITH 60% ELECTRICAL EFFICIENCY

The Connecticut Department of Public Utility Control (DPUC) has approved funding for nine of FuelCell Energy's 2.8MW DFC 3000 power plants, including three of their highest efficiency products, the DFC-ERG units that achieve approximately 60% electrical efficiency. These units are designed for use where natural gas is transferred from long distance pipelines to lower pressure local networks. The integration of the fuel cell enables waste energy to be converted to electricity for the grid and the heat obviates the need for a boiler to maintain the natural gas at the right temperature.

DEPLOYMENT OF MORE LOCAL GENERATORS

FuelCell Energy and the Connecticut Clean Energy Fund (CCEF) have inaugurated a 1.2 megawatt (MW) fuel cell at Pepperidge Farm in Bloomfield, Connecticut. The new DFC1500B™ fuel cell power plant provides a major share of the power required to bake premium breads and rolls. This fuel cell initiative is supported in part by the Connecticut Clean Energy Fund (CCEF), a ratepayer fund administered by Connecticut Innovations Inc., which provided a grant of \$3.5 million to Pepperidge Farm to offset part of the cost of construction last year. This is the second fuel cell power plant installation at Pepperidge Farm. A smaller, FuelCell Energy 250-kilowatt fuel cell was commissioned for the site in January 2006, also with assistance from CCEF. Combined with the smaller fuel cell, this installation provides clean power for 70% of the plant's electricity needs. Both fuel cells operate 24/7

and greatly improve the reliability of electricity at the site - a key issue for a plant that operates three shifts, six days a week. Additionally, excess heat from the new fuel cell is being used to support bakery processes, which helps reduce fuel needs for plant boilers. DFC power plants are an ideal part of the clean energy solution because they provide reliable base load power 24 hours a day with near-zero emissions and low CO₂. They can be deployed in approximately one year and require no new transmission and distribution investment.

"Pepperidge Farm is making excellent use of all the attributes of the fuel cell," said Lise Dondy, President of CCEF. "Not only are they deriving a significant portion of their required electricity, but they are also effectively utilizing the fuel cell's thermal output to enjoy the added benefit of being able to operate with a decreased dependence on less efficient resources." www.fce.com

SOFC POWERED BY COAL SYNGAS WITH CO₂ SEQUESTRATION

Coal currently supplies more than half the United States' electricity and globally coal-fuelled generation is responsible for more than 40% of the world's current CO₂ emissions, the leading contributor to greenhouse gases in the atmosphere.

FuelCell Energy Inc. has been awarded a contract for Phase II of the program of the U.S. Department of Energy (DOE) to develop a solid oxide fuel cell (SOFC) system powered by coal and employing carbon capture and storage. FuelCell Energy utilizes the cell and stack designs of its technology partner, Versa Power Systems Inc., for SOFC development

programs. Today's average U.S. coal-based power plants have an electrical efficiency of approximately 35%, but in contrast the DOE program aims for an overall efficiency of at least 50% in converting energy contained in coal to grid electricity. In addition, it calls for SOFC-based systems to separate at least 90% of the carbon dioxide emissions for capture and environmentally safe disposal, while being cost competitive with other base load power generating technologies.

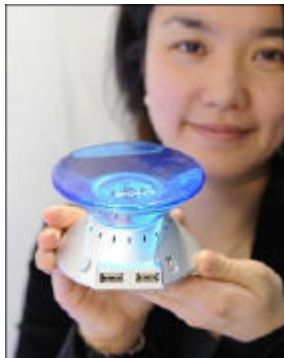
In Phase I, Versa Power's SOFC prototype successfully met all DOE-specified goals, including power output level, system efficiency, system

availability and overall system endurance. Phase II extends to September 2010 and seeks to build a 25kW SOFC stack that meets DOE requirements for performance and manufacturing cost. The new stack is to be integrated with a larger fuel cell power module and a 5 MW proof-of-concept system that will operate on coal-based syngas, which is fuel created by reacting coal at high temperatures. The program's overall goal is to develop megawatt-class coal syngas-based SOFC power plants for use as high efficiency central generation facilities that address the need to reduce greenhouse gas emissions and for increased energy independence. www.fce.com

NEWS

FUEL CELLS FOR PORTABLE POWER

Tokyo, Japan



Masayo Endo, an employee of Sony Japan, displays a prototype model of a direct methanol fuel cell (DMFC) which has two USB ports to charge small electronic devices such as mobile phones or digital music players (the blue part is the methanol cartridge). Although current DMFCs are limited in the power they can produce, they can store a high energy content in a small space, so they produce a small amount of power over a long period of time. This makes them ideal for consumer goods such as mobile phones, digital cameras or laptops.

CENERGIE PREPARING FOR PRODUCTION

County Donegal, Ireland

Cenergie Corporation seeks Joint Venture Partners in the USA, Asia and the UK. Interested parties will join in producing mobile fuel cell generators rated from 100kW up to 250kW for the UK market. The company is looking for balance of plant engineering partners who can assemble, package and service generators.

Other partners would be hydrogen producers in the waste to energy field, sustainable gas producers using renewable fuels and ammonia producers. The Joint Venture will be a UK registered enterprise with partners sharing costs and revenues. The participants will be SME's with dedication and drive to support sustainable energy solutions. Similar Joint Ventures have been founded in the United States and are under negotiation in India and Korea. www.cenergie.com

MORPHIC EXPEDITING FUEL CELL COMMERCIALISATION

Karlskoga, Sweden

EXERGY TO SUPPLY FUEL CELLS FOR RECREATION VEHICLES

Exergy Fuel Cells, a subsidiary of Morphic Technologies AB, has made an agreement with Narbonne Accessoires for the exclusive sale of their fuel cells through the distribution network of Narbonne Accessoires in France and Spain. Following the verification and approval of the products, Narbonne Accessoires will collaborate on the introduction of Exergy's Fuel Cell systems, with the following marketing activities:

- Install a display in each store to demonstrate the product and its technology
- Train its salesmen on fuel cell power advantages compared to traditional systems
- Deliver fuel cartridges in all stores, as available stock
- Communicate the Exergy brand in the Narbonne catalogue and in the French and Spanish press
- Introduce the power system on Recreation Vehicles fairs in Paris and Barcelona this autumn

"This co-operation agreement follows our strategy" said Martin Valfridsson, CEO of Morphic Technologies. "The modular design of the fuel cell system means that only very minor modifications are necessary to transfer the generic fuel cell system into this customized recreation vehicles product. Furthermore, for a consumer product such as this, Narbonne is ideal since all the infrastructure is already present including the important after sales activities."

FUEL CELLS FOR THE MICRO CHP MARKET

Exergy Fuel Cells, in partnership with ICI Caldaie and several other Companies and Research Institutes has won the Italian "Selection Industria 2015" with their project MICROGEN 30. The value of the grant for Exergy is 1,960,000 euros.

Industria 2015 is the new plan in Italy for carrying out the EU Directive of April 2006, under which Member States will have to hit energy saving targets. Industria 2015 will financially support projects that aim to improve energy management and the industrialization process of sustainable energy technologies with related R & D, up to 2015. The MICROGEN 30 is a medium size combined heat and power (CHP) energy system based on a PEM fuel cell for stationary applications, in this case for residential units. The goal for the system is to generate 30 kW electricity and 50kW heat.

The project team leader is ICI Caldaie S.p.A., the leading Italian company in the heating and boiler industry. Exergy is responsible for the fuel cell, with the goal of refining the technology for a low cost fuel cell stack. Exergy's sister companies will be involved, with Cell Impact supplying bipolar plates and Helbio developing a catalyst based on carbon nanotubes. Other important partners are the Italian National Agency for New Technologies Energy and Environment (ENEA), Politecnico di Milano, and the Public Institute of Study and Research (CNR).

Many studies have highlighted the fact that micro-cogeneration based on fuel cells is one of the most promising technologies in terms of energy efficiency, but there are still no cogeneration systems of this size available on the market. Angelo

D'Anzi, Managing Director of Exergy Fuel Cells said: "The potential for improvement of fuel cell technology for residential applications is strongly increased by the fact that our sister companies, Helbio and Cell Impact, can support us with first class technologies for bipolar plates, electrodes and catalysts, thereby enabling us to develop high temperature fuel cell stacks for higher efficiency and reduced cost. This project will enable us to gain all the technical knowledge necessary to proceed further on the way to industrialization of fuel cells for the consumer market".

FUEL CELL BIO-ETHANOL SYSTEM

Helbio S.A. is supplying the University of Milano with a fuel cell power system operating on bio-ethanol. Helbio's GH2-5000 Energy System has been designed to operate in remote locations, without the need for external power input and can be monitored and controlled remotely. A group of Italian investors has subcontracted the University to evaluate the unique power system, and after this evaluation Helbio has agreed to discuss volume deliveries and/or license cooperation.

The integrated fuel cell is manufactured by Exergy Fuel Cells. The system delivers 5 kW electrical energy and at least 5 kW thermal energy. It consists of a fuel processor which converts bio-ethanol and water into a hydrogen rich stream, suitable to be fed into a PEM fuel cell. The fuel processor and the fuel cell are highly integrated and controlled so that the overall efficiency of the system exceeds 90%. Professor Xenophon Verykios, Managing Director of Helbio S.A., said "Helbio and Exergy are the only companies worldwide which can provide integrated fuel cell energy systems based on renewable raw materials such as bio-ethanol."

MORPHIC PATENT FOR CO2 CAPTURE AND LIQUID FUEL PRODUCTION

Morphic has been conducting intensive research and development into energy conversion, with the aim of finding ways to convert and store renewable energy in various forms, and to adapt it for later use in fuel cells for a range of different applications. They have been granted a patent on a method for absorbing atmospheric carbon dioxide using enzyme coated wind turbine blades, and then combining the CO2 with water and excess electricity to produce liquid biofuels. They are now looking for partners in the research community and industry to find the most cost-effective way to evaluate and optimize the technology. www.morphic.se

NEWS

EUROPEAN ELECTRICITY CHIEFS PLEDGE CARBON-NEUTRAL POWER

Brussels, Belgium

A Declaration by 61 Chief Executives of European power companies, which jointly produce over 70% of European electricity, has been handed to the EU Energy Commissioner, Andris Piebalgs, in Brussels. The Declaration recognises that climate change is a serious global environmental, economic and social challenge which requires urgent action and acknowledges that the power sector, as a significant emitter of greenhouse gases, needs to achieve a carbon-neutral power supply by the middle of this century. To achieve this means engaging with customers and regulators to ensure the take-up of energy-efficient electro-technologies, including combined heat & power and new renewable energies. www.eurelectric.org

ISLINGTON COUNCIL DEMONSTRATES FUEL CELL BENEFITS

London, UK

UPS Systems plc is supplying a methanol fuel cell to Islington Borough Council in London for use in its demonstration projects promoting the benefits of clean energy technology. The unit will be on display in the Council's foyer and at several events across London from spring 2009. Islington Borough Council is one of London's leading borough councils for reducing carbon emissions and using and promoting green and clean power.

UPS Systems is supplying an EFOY 1600 methanol fuel cell as well as an inverter and additional methanol canister. The benefits of using the EFOY 1600 fuel cell include delivering clean energy and guaranteed power. At just 7kg it is lightweight and compact, making it easy to transport between several locations and it is virtually silent when running. EFOY 1600 fuel cells provide 1600 watt hours per day for recreation and leisure purposes, as well as for powering household and office appliances.

Zoë Hatherly, Sustainability Officer at Islington Borough Council said, "We are keen to use fuel cells instead of conventional power because they offer a clean energy solution. The fuel cell will be on display in several locations across London and will be made available to anyone in the Council to use so they can benefit from its clean credentials to reduce their carbon emissions and improve air quality. It will also be an educational tool so we can all learn about the benefits of implementing fuel cell technology.

UPS Systems has been very helpful in giving us advice on the available options and demonstrating the unit to us. If the project is a success, we may go on to invest in other fuel cell technology."

CHAMPIONS OF ENTERPRISE CHOOSE FUEL CELL!

West Berkshire, UK



A group of students were crowned champions when they selected UPS Systems as the best company to invest in at the 'Champions of Enterprise' competition, which is organized by the Education Business Partnership, West Berkshire. The winning students from the Willink School chose UPS Systems because of its dedication to promoting fuel cells and the value they would add to future energy provision.

Karen Sperrey, Operations Director at UPS Systems said, "Obviously we are extremely happy that the students chose UPS Systems to invest in. They fully understood the potential of fuel cell technology to provide clean and reliable energy, and even simulated a power cut in the middle of their presentation to reinforce the benefits of using this technology!"
www.upssystem.com

BALLARD AND BAXI CONTRIBUTE TO GERMAN MICRO CHP PROGRAMME

Burnaby, Canada



Ballard Power Systems Inc. has entered into a three-year supply agreement with Baxi Innotech GmbH, the leading European developer and manufacturer of fuel cell micro combined heat and power (mCHP) units. Under the agreement, Baxi Innotech agrees to exclusively purchase Ballard fuel cells until the end of Phase 2 of the German Callux Project, which is scheduled to conclude in 2012. The Callux Project was launched last September as part of Germany's national innovation program for hydrogen and fuel cell technology.

The Callux Project is Germany's largest demonstration of combined heat and power fuel cell systems for domestic use. These systems provide decentralized power to the home at a high level of energy efficiency, and the project is a preparation for their market launch.

Ballard brings its extensive experience in the Japanese residential cogeneration market to the European market with its FCgen™1030 fuel cell, which Baxi Innotech, will integrate into its 1 kW GAMMA 1.0 natural gas pilot production series.

The performance and durability which Ballard's products have demonstrated in Japan will prove invaluable, particularly when partnered with Baxi's broad experience in supplying heating equipment in Europe. www.ballard.com

CLIMATE CHANGE COMMITTEE SETS OUT CO2 BUDGETS FOR UK

London, UK

The UK Climate Change Committee recommends statutory CO2 budgets to ensure that the target set out in the Climate Change Act for an 80% reduction by 2050 is met in several stages. The first three Intended budgets for the UK should reduce emissions by 42%, subject to a global agreement being reached, probably at Copenhagen in December. Until such agreement is reached, Interim budgets require 34% reduction in CO2 equivalent emissions.

Intended Budgets: Million tonnes CO2 equivalent (MtCO2e)

	Budget 1 2008-2012	Budget 2 2013-2017	Budget 3 2018-2022
Traded sector	1233	1009	800
Non-traded sector	1785	1670	1445
Total	3018	2679	2245

The Budgets indicate allowed greenhouse gases in the UK in million tonnes CO2 equivalent for each five year period. The traded sector comprises energy-intensive firms in the E U Emissions Trading Scheme (ETS). The non-traded sector comprises the UK's residential, commercial, small industrial and transport sectors. For comparative purposes, 1 tonne of carbon is equivalent to approximately 3.7 tonnes CO2. www.theccc.org.uk

CERES AND CALOR AIM FOR 2 MILLION UK FUEL CELL MARKET

Crawley, UK

Ceres Power has signed a major new agreement with Calor Gas Limited for residential combined heat and power (CHP) products operating on liquefied petroleum gas (LPG). This Agreement builds upon Ceres Power's existing mains natural gas CHP programme with British Gas, and will use the same core fuel cell technology, allowing the Company to exploit economies of scale.

The new LPG CHP product variant, generating electricity and all of the home's heating and hot water, will address the needs of residential customers and small businesses in the many areas of the world that are not connected to the mains natural gas grid. There are more than 2 million off-gas-grid homes and small businesses in the UK alone and over 100 million across Europe.

Calor will contribute £2.5 million to Ceres during the development and trialing of the LPG CHP product and has placed a conditional call-off order for 20,000 LPG CHP products over a five-year period for the UK market, which is expected to begin in 2012. Ceres and Calor intend to maximise sales of the LPG CHP product by addressing not only the existing LPG customer base but also the two million UK homes and small businesses using oil, solid fuel or conventional electrical heating. These customers will be able to enjoy convenient, low carbon, cost-competitive energy with this environmentally friendly product.

Stephen Rennie, Managing Director of Calor, commented: "Working with Ceres on this revolutionary technology further highlights Calor's position as the UK's off-gas-grid market leader. The Ceres Power CHP product will help accelerate a transition from dirty domestic fuels like heating oil, to cleaner convenient fuels like LPG." www.cerespower.com

EVENTS

20th - 21st May 2009, ALL-ENERGY 2009, Aberdeen, Scotland International conference and exhibition on renewable energy, hydrogen and fuel cells. www.all-energy.co.uk

31st May - 3rd June 2009, HFC2009, International Conference and Exhibition Canada. Key issues will include investment, trading pollution credits, hydrogen production, distribution and storage, integrated systems, codes and standards, fuel cell materials, components and distributed power www.hfc2009.com

22nd - 24th September 2009, 11th Grove Fuel Cell Symposium, Building on Fuel Cells, Queen Elizabeth II Conference Centre, London, UK. In order to meet their carbon emission commitments, governments are now beginning to introduce legislation to stimulate a market for clean and renewable technologies. This has the potential to dramatically change the nature of fuel cell markets. The Symposium will address this changing world and its potential impact upon the fuel cell industry. www.grovetfuelcell.com

Fuel Cell Power provides information about all types of fuel cells. It has been set up by the family and friends of the late Dr. F. T. Bacon, OBE, FRS, the fuel cell pioneer who was concerned about the effects of discharging the by-products of combustion into the atmosphere.

Information can be obtained from:

Fuel Cell Power, The Gallery, The Street, Woolpit, Suffolk, IP30 9QG.
Telephone : 01359 245073

www.hydrogen.co.uk www.futureenergies.com www.fuelcellpower.co.uk