

FUEL CELL POWER

The magazine for the power source of the future



HEADLINE NEWS

As the world is changing to low carbon vehicles, there is a growing role for hydrogen fuel cells to power transport. A new car was unveiled at Somerset House in London by Riversimple. Their concept car employs a small hydrogen fuel cell in a unique hybrid car design. Riversimple is working systematically to eliminate the environmental impact of personal mobility. In order to expedite the introduction of clean, efficient vehicles, the technology will be shared with similar ventures around the world. Small factories will be set up to build the cars, upgrade them in mid-life and recycle the materials to use for the next generation.

CONTENTS

Hydrogen fuel cells power the car of the future	p. 2
US and UK government proposals for future transport	p. 5
News	p. 7
Launching the Hydrogen economy in Spain	p. 8
Australian fuel cells for residential markets	p. 10
News	p. 11
Plug Power leads the transition to hydrogen fuel cells	p. 12
News	p. 13
Events	p. 16

HYDROGEN FUEL CELLS POWER THE CAR OF THE FUTURE

London, UK

Riversimple unveiled their urban car technology demonstrator in London this summer. The lightweight car is powered by hydrogen fuel cells. Their Chairman, John Constable, said that this is the car of the future and that they are closer to commercialization than the automotive industry. They are not held back by investment in gigantic plants rolling out heavy steel chassis, but they started with a clean sheet of paper and can make bigger changes more quickly and cheaply.

THE RIVERSIMPLE DESIGN



Hugo Spowers is the engineer who designed the Riversimple car because he was concerned about the impact of vehicles on the environment. He and his colleagues have been working on the development for nine years. In 2004 Hugo teamed up with Morgan Cars, Oxford University, Cranfield University, BOC and Qinetiq and received Government funding to build the LIFECar concept car.

The Riversimple vehicle embodies five key features:

- hydrogen fuel cells
- no gearbox or transmission
- four electric motors, one on each wheel
- regeneration of electricity by these motors when the car is braking - known as regenerative braking

- a body made of lightweight composite materials

There are two new principles in the Riversimple design, which were originally conceived by Amory Lovins and the Rocky Mountain Institute. The first is to decouple the power required for acceleration and cruise demands. In a conventional car, acceleration has to be provided by the engine, but as a car is only accelerating for about 5% of the time, and the power needed then is five times what it is when cruising, it means that for 95% of the time the car is carrying around an engine and transmission that is five times larger than necessary. Decoupling acceleration and cruise means that the fuel cell needs only to be large enough to meet the maximum steady demand when cruising, which is usually only about 20% of the maximum power required for acceleration.

SMALL FUEL CELL

The two seater Riversimple car uses a 6kW fuel cell, which compares with the 100kW fuel cell which Honda is using in its new FCX Clarity model currently being trialed in California - admittedly in a four seater car. In the Riversimple car less hydrogen needs to be carried and less held at filling stations and the cost of the fuel cell drops dramatically.

Riversimple is working with Horizon Fuel Cell Technologies of Singapore, who have developed a highly efficient yet simple fuel cell system for the urban car. As the output required of the fuel cell is less than in most fuel cell prototypes, Horizon has been able to prioritise cost reduction in the development of the system.

This has been the focus of their research since they were founded and so there is a natural synergy between their technology and Riversimple's

approach to commercialising hydrogen fuel cell vehicles. Together they are pursuing a combined development programme on the next generation for the production prototype vehicle.

Horizon pioneered the sales of next-generation fuel cell power systems in small consumer products, while developing larger-scale clean power solutions for practical applications in portable power, stationary back-up power and transportation. With comprehensive technological developments focused on enabling fuel cell commercialisation, Horizon is the first company to bring advanced fuel cell technology out of the laboratories and into the mass market.

The ultracapacitors which store electricity can also be smaller: Riversimple urban cars have just 21 kg of ultracapacitors, capable of absorbing over 30kW of power from regenerative braking, and of delivering 15 kW for bursts of acceleration of up to ten seconds, enough time to reach maximum cruising speed.

CAPTURING ENERGY OF THE CAR IN MOTION



In the Riversimple network electric vehicle, almost all braking is done by the electric motors, capturing the energy of the car in motion, rather than using conventional brakes that just waste the energy as heat. This energy is stored in the bank of ultracapacitors which can provide 80% of the power required for acceleration. This enables the use of a fuel cell with a fifth of the power that would be required in a conventional car.

The second new principle is mass decompounding, that is designing the car as a whole system rather than attempting to squeeze a fuel cell into a car architecture that is designed for a combustion engine.

WEIGHT REDUCTION AND FAR LESS FUEL

The reduced size of the fuel cell and elimination of a gearbox and driveshafts, result in weight reduction. This leads directly to a lighter chassis, which in a conventional vehicle is designed to hold on to the heavy engine and gearbox in accidents. This in turn means less power is needed, which means lighter components, which means a lighter chassis, meaning less power and so on, and this effect is magnified by using lighter composite materials for the chassis as well. These weight reductions make power-assisted systems for brakes and steering redundant, which leads to further improvements in weight and efficiency.

The hydrogen fuel cell is about 50% efficient, double that of a petrol engine. The combination of this efficiency and the new, and much more efficient architecture, allows for a vehicle which is more sustainable because it needs far less hydrogen energy. 240 miles can be travelled on one small tank of hydrogen weighing only 1kg. Further fuel and emissions savings are gained because, unlike an internal combustion engine, the electric motor is not running when the car is stationary in traffic.

GOOD, EFFICIENT PERFORMANCE



The result is a car with an expected fuel consumption equivalent to 300 miles per gallon, a range in excess of 200 miles, a top speed of 50mph, and greenhouse gas emissions at 30 gms per km (well to wheel), less than a quarter of the emissions of the most efficient petrol-engined cars currently available. If this hydrogen were generated from electricity from wind, this figure would drop to 3g/km.

BOC, part of the Linde Group, is supplying the hydrogen and are impressed by Riversimple's efficient use of the fuel. BOC is developing processes that will produce hydrogen from renewable sources, which will make hydrogen vehicles a truly 'green' transport option.

ELIMINATING THE CAR'S ENVIRONMENTAL IMPACT

Riversimple is working systematically towards the elimination of the environmental impact of personal mobility. They are working with the 40 Fires Foundation which is a forum to develop energy-efficient cars using an open source approach. Designs will be made available under a Creative Commons license for viewing and download, and information will be given about participation in projects. Fuel efficient vehicles are urgently needed and by sharing ideas and designs, they aim to speed up

development times, produce more robust, reliable products, drive the adoption of common standards and drive down component costs. They are not concerned about competition from others making use of their designs, because there are such vast markets for hydrogen fuel cell powered vehicles. Their business model differs from that of mainstream car companies which rely on finding more car owners, persuading them to use the car for every journey and encouraging them to replace the car at regular intervals. This is not a tenable strategy for the future. Climate change, peak oil, congestion, noise, resource consumption, break up of communities caused by traffic: all mean that this business model will have to change.

A NEW BUSINESS MODEL

Riversimple's cars are designed to last for twenty years and to be completely recyclable. They will be leased rather than sold, and the onus will be upon Riversimple to maintain the vehicles and provide the hydrogen. The projected cost is in the region of £200 per month.

The next phase is to build ten of the cars and test them rigorously. The experience gained will enable Riversimple to build 50 prototypes to be field tested in a small city by a mixture of fleet, business and individual users. They are currently in discussions to select the city to undertake this phase and with hydrogen suppliers to install the refuelling stations and ensure that there is urgent and tangible progress towards 'green' hydrogen from renewable sources. It is planned to start manufacture in small plants producing about 5,000 vehicles per year in 3 to 4 years time. www.riversimple.com
www.40fires.org

US AND UK GOVERNMENT PROPOSALS FOR FUTURE TRANSPORT

OBAMA TO END DEPENDENCE ON OIL WITH INVESTMENT IN CARS OF THE FUTURE

Ten of the world's largest auto manufacturers joined President Barack Obama at the White House when he announced an historic agreement to help America break its dependence on oil, to reduce harmful pollution and begin the transition to a clean energy economy. "Everyone here believes that the status quo is no longer acceptable" said Barack Obama. "While the United States makes up less than 5% of the world's population, we create roughly a quarter of the world's demand for oil. This comes at a tremendous price - a price measured by our vulnerability to volatile oil markets which send gas prices soaring, by a trade deficit where as much as 20% of what we spend on imports is spent on oil and it's measured in a changing climate, as sea levels rise, and droughts spread, forest burns, and storms rage."

The President deplored the lack of action over past decades which had made America so dependent upon fossil fuels to power its transport, but congratulated environmental advocates present at the meeting, in particular the extraordinary leadership of the State of California. "This announcement is so important" he said "for it represents not only a change in policy in Washington but the harbinger of a change in the way business is done in Washington."

"At a time of historic crisis in our auto industry" continued President Obama "when domestic auto manufacturers are making painful choices and restructuring their businesses to be viable in the future, this rule provides the clear certainty that will allow these companies to plan for a future in

which they are building the cars of the 21st century. The fact is that everyone

wins. Consumers pay less for fuel, the economy as a whole runs more efficiently by using less oil and producing less pollution and auto companies have new incentives to create the technologies and the jobs that will provide smarter ways to power our vehicles."

"I also want to note that the agreement we have announced today is part of a far larger effort. We are working on an historic energy bill that will not only reduce our dependence on foreign oil, prevent the worst consequences of climate change and build a clean energy economy, but will provide more than \$15 billion to help build the cars of the future here in America. Ending our dependence on fossil fuels, represents perhaps the most difficult challenge we have ever faced as a people. It will take time and an incredible effort. It will take a historic investment in innovation. But more than anything, it will take a willingness to look past our differences, to act in good faith, to refuse to continue the failures of the past, and to take on this challenge together for the benefit not just of this generation, but generations to come." www.whitehouse.gov

RECOMMENDATIONS FOR LOW CARBON VEHICLES

The New Automotive Innovation Growth Team (NAIGT) which is sponsored by the UK Government, has issued its proposals for reducing CO2 emissions from cars over the coming decade. NAIGT's report finds that the climate change agenda is accelerating technological change at an unprecedented rate, and that industry in Europe and the UK has

embraced the CO₂ challenge and is investing heavily in people and technology to provide innovative solutions. The EU is adopting targets for new passenger cars to reduce CO₂ emissions by 2020. There will be increasing penalties for non-compliance but low-carbon vehicles with emissions under 50g/km will gain 'super credits' which will favour electric vehicles.

NAIGT considers that internal combustion engine/electric hybrid cars will be widely produced by 2015 and that the fuel cell and hydrogen infrastructure will start to be built up during the latter part of the decade. So far, the UK is poorly placed to make any significant contribution to the challenges of a technology shift towards low-carbon power trains because the relevant R & D is being conducted in other countries. Overseas Original Equipment Manufacturers (OEMs) now own much of the British automotive industry and carry out their R & D in their home markets.

The EU's regulatory framework for CO₂ reduction is the basis for most manufacturers' forward technology planning. The framework is based on regulations affecting manufacture. NAIGT recommends that the UK could take the lead with measures affecting demand, to assist with the additional purchase price of low carbon technologies. It is recommended that a joint industry/UK Government Automotive Council should be set up to provide cash based as well as tax based incentives to facilitate the introduction of low carbon vehicles. The Government is already funding university R & D and it is proposed that 'Test Bed UK' should be set up to provide facilities for the development and evaluation of innovative technologies. www.berr.gov.uk

INNOVATION IN CLEAN TECHNOLOGY IN THE UK

At the launch at Loughborough University of the Government's

initiative "Building Britain's Future –New Industry, New Jobs", Government ministers pointed to the success of Intelligent Energy as an example of how innovation in clean technology can be one of the pillars of economic recovery in the UK. The policy statement identifies areas in which the UK government intends to invest in order to increase British competitiveness. Low carbon technologies are one of the areas in which existing leadership can be built upon to generate new jobs and economic growth.



Dr Jon Moore explained the advantages of fuel cell hybrids to Prime Minister Gordon Brown, John Denham (Secretary of State, DIUS), Andy Reed MP and Lord Mandelson, Business Secretary. "Intelligent Energy is a prime example of innovation being driven by excellence in technology, enabling a growing private sector, and receiving support from the Government's Technology Strategy Board," said Lord Mandelson.

Earlier, on a visit to Intelligent Energy's facilities at the Innovation Centre in Loughborough, the Prime Minister was told of the Company's breakthrough role with Boeing in providing the power system for the world's first manned fuel cell aircraft in 2008. He also learnt of the company's leadership of a consortium, part-funded by the Government's Technology Strategy Board, which aims to put a fleet of hydrogen-powered taxis on the streets of London for the 2012 Olympics. Gordon Brown praised the manner in which Intelligent Energy had broken new ground in low carbon innovation.

The company started life as a spin-off from Loughborough University, and now employs over 100 staff in the UK and the US.

"It's fantastic to have senior Government figures come here and see what progress we've made towards making this low-carbon technology a reality for consumers," said Henri Winand, chief executive officer of Intelligent Energy. "Fuel cells are a tremendously versatile option for providing clean power in numerous markets, including transport. What we have achieved here is testament to the forces of innovation and technical expertise that exist in the UK's universities. However, we must draw upon support from a number of sources, including the Government, to ensure that clean technology like ours becomes a driver of real economic growth. The time to roll it out into commercial markets is now, and with the Government's backing we can make this a sector of genuine competitive advantage for the UK." www.intelligent-energy.com

LOW CARBON VEHICLES

Fuel Cell Power is concerned that the Technology Strategy Board's latest funding competition for low carbon vehicles is not open to fuel cell powered vehicles because the New Automotive Innovation Growth Team (NAIGT) envisages that the hydrogen and fuel cell infrastructure will only start to be built up at end of the next decade. If the large automotive companies want to mass produce fuel cell powered vehicles in the future, we will have to start now to build up this infrastructure. There are several first class innovative companies in the UK which are taking the lead in this field and need Government support now. The regional development of the hydrogen infrastructure, with vehicles designed initially for niche markets and fleet applications, will enable UK industry to take a world lead with hydrogen and fuel cell technologies. However, it is encouraging that the

West Midlands Consortium will be demonstrating one of Microcab's hydrogen fuel cell powered cars in the trials of low carbon vehicles recently announced by the Technology Strategy Board. www.innovateuk.org

NEWS

CERES POWER MOVES TOWARDS MASS MANUFACTURE

West Sussex, UK

Ceres Power has announced that it has secured a facility in Horsham, UK for the volume manufacturing of its solid oxide fuel cells for the domestic CHP market. In accordance with the Company's published roadmap, an initial manufacturing line will be commissioned later this year.

Low volume 'beta units', which will be evaluated and modified prior to mass production, will be used in sheltered field trials in 2009 and 2010 under their contract with British Gas. During 2010 additional equipment will be installed to deliver the higher volumes required for commercial field trials and in preparation for volume launch with British Gas in 2011. The site is intended to provide the potential for expansion beyond the previously indicated one million fuel cells per annum. Ceres' strategy is to manufacture in-house their fuel cell core technology, for which they hold considerable intellectual property rights.

Peter Bance, Chief Executive Officer commented: "Securing the site where we will establish our fuel cell mass manufacturing is a key step forward in the commercialization of our technology and underpins our roadmap to the volume launch of our CHP products in the UK. This plant will also provide the template for further expansion internationally and will help support Ceres Power's growth plans into other markets". www.cerespower.com

LAUNCHING THE HYDROGEN ECONOMY IN SPAIN

Aragon, Spain

The mission of the Aragon Hydrogen Foundation in Spain is to carry out a wide range of activities with the purpose of generating, storing and transporting hydrogen for use in fuel cells in transport applications and the generation of distributed energy. It aims to stimulate research, technological development, cogeneration and industrial adaptation, contributing to industrial modernization and improved competitiveness.



Research and development covers all aspects, from the production of hydrogen from renewable sources, mainly wind and photovoltaic energy, to the integration of fuel cells for automotive, portable and stationary applications. Methods of hydrogen storage and management are also tested and evaluated.

The Aragon Hydrogen Foundation aims to become a leader in the emerging hydrogen economy. They are assisting small and medium-sized enterprises to become the hub of their economy and to place them at the forefront of innovation in the new hydrogen technologies. They incorporate different forms of renewable energy in new products and industrial processes, as a driving force for growth and modernization. They inform businesses and the general public of the technical and economic

results of using hydrogen as an energy vector.



They are working on a project called IHER to develop the technological infrastructure for hydrogen and renewable energies. They provide solutions to meet the specific requirements of companies and to balance the load on the grid. The University of Zaragoza is working with them to optimize renewable energy systems. Aragon is developing complete hydrogen storage systems including energy management, and instrumentation for the measurement of hydrogen stored in hydrides.

The balance of plant, such as pumps and control systems, is just as important as the fuel cells themselves and they are developing this for both alkaline electrolyzers and for polymer fuel cells. Work is continuing to integrate solid oxide and solid polymer fuel cells for portable, automotive and stationary applications. They designed and built a hydrogen fuel cell vehicle which competed in last year's Formula Zero International Championship and they are working on a remote-controlled multi-purpose vehicle with four wheel drive.

In conjunction with the Spanish Association for Standardisation and Certification, they are assisting in the preparation of regulations on hydrogen technologies and to

establish international standards in this area.

LAUNCHING HYDROGEN AND FUEL CELL PRODUCTS

The Foundation for the Development of New Hydrogen Technologies in Aragon is a private not-for-profit entity. It is supported by the Government of Aragon and its sixty members which are of key importance for the Aragonese economy. They advise SMEs on the opportunities for hydrogen in Aragon and assist with the preparation of bids for European projects.

The Foundation is putting into practice its experience with new hydrogen technologies and is launching onto the market fuel cells, metal hydride storage systems, electrolyzers and related products. They have created the trademark HIDRAVIA for the commercial division of the Foundation and the distribution of products. HIDRAVIA offers services with the guarantee of quality in both sales, with appropriate advisory services, and after-sales with personal attention.

They are working with others in Europe to prepare a manual for training teachers of hydrogen technologies and providing a training course for employees. They are also working with universities and research centres on the development of professional technical training.

INTERNATIONAL ACTION

The Aragon Hydrogen Foundation takes part in the European Joint Technology Initiative (JTI) for hydrogen and fuel cells. They are a member of HyRaMP, the European regions and municipalities partnership for hydrogen and fuel cells. Within the International Energy Agency, they lead the working group on Integration of Wind Energy and Hydrogen, Task 24, and take part in Task 18 for the Evaluation of Integrated Systems.

At the Hannover Fair in April, the Vice-President of the Aragon Hydrogen Foundation, Javier Navarro, discussed the future for hydrogen with Marieka Reijalt, Managing Director of the European Hydrogen Association.



Mr Navarro is also Vice President of HyRaMP and gave a presentation on their behalf at the recent conference organised by the European Hydrogen Association entitled 'Hydrogen and Fuel Cells as Strong Partners of Local Energy Systems'. Mr Navarro explained that hydrogen produced by renewable energy and used in fuel cells makes it possible to develop zero emission local energy chains.

INVOLVING THE PUBLIC



The Aragon Hydrogen Foundation celebrated its 5th anniversary this summer. They organized public events with their hydrogen kart, as well as a hydrogen bike race. People were shown how the hydrogen kart operated and were given an opportunity to drive it themselves. www.hidrogenoaragon.org

AUSTRALIAN FUEL CELLS FOR RESIDENTIAL MARKETS

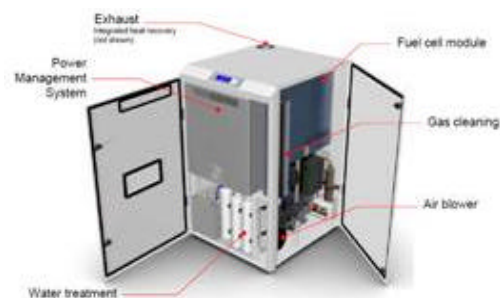
Victoria, Australia

Ceramic Fuel Cells Limited has officially launched BlueGen a 'mini power station' for homes and other buildings. It produces low emission electricity and hot water, reducing greenhouse gas emissions and saving on home energy bills. About the size of a dishwasher, the BlueGen unit converts natural gas to electricity and heat via ceramic fuel cells. The Company plans to make the BlueGen mini power station available in Victoria, Australia from early 2010 and they are in discussions with potential local manufacturing partners. They are also in discussions with potential purchasers of the BlueGen product in other markets including Europe and North America. Compared to Victoria's current brown coal electricity generators, each BlueGen unit can reduce carbon dioxide emissions by up to 75% or 18 tonnes per year.

The BlueGen mini power station was officially launched by the Premier of Victoria, John Brumby, who said: "Innovation is vital to Victoria's response to climate change and local innovations like Ceramic Fuel Cells' technology will help to play an important part in reducing the carbon intensity of Victorian homes and businesses. Ceramic Fuel Cells' technology is a great example of local business delivering sustainable, 'green' jobs and exports for our State." During the event, Ceramic Fuel Cells' Managing Director Brendan Dow demonstrated a working BlueGen unit, connected to a hot water unit producing electricity and hot water. "Our units are far more efficient and produce far less carbon dioxide and other emissions than traditional electricity generators like coal-fired power stations," said Brendan Dow. "If our units replaced just 7% of Victoria's electricity from brown coal, the State would achieve the Federal

Government's target of a 5% reduction in carbon dioxide emissions, well before 2020. Currently, coal-fired power stations produce 95% of Victoria's electricity."

EFFICIENT ELECTRICITY AND HOT WATER ON SITE



Ceramic Fuel Cells Limited (CFCL) have agreed with VicUrban, the Victorian Government's sustainable urban development agency, to showcase their BlueGen units in VicUrban's housing developments. Subject to final agreement, CFCL will install the first BlueGen unit in VicUrban's Sustainable and Affordable Living Centre in Dandenong to be opened towards the end of 2009, and will install up to three more demonstration units in other VicUrban developments next year.

Pru Sanderson, CEO of VicUrban explained their longstanding commitment to sustainable energy and said that they were delighted to help promote a product which could become the next generation of sustainable energy technology in Australian homes. The Company's modelling of the Victorian market shows that widespread deployment of the BlueGen product has significant potential benefits:

- BlueGen units can generate electricity more than twice as efficiently as the current Victorian power grid, at a cost of up to 40%

cheaper than the current average retail electricity price. This could save up to \$1,100 off the average home's annual energy bill.

- When mass produced, BlueGen products are forecast to cost around \$8,000 each with a payback period of seven years and a product lifetime of 15 years.
- Energy is produced by the BlueGen unit with up to 75% less carbon dioxide emissions than Victoria's current coal-fired generators – saving up to 18 tonnes per unit per year.
- Over the course of a year each 2kW BlueGen unit can produce up to 17,000 kilowatt hours of power – more than twice the electricity needed to power an average Victorian home.
- The unit also produces heat, which can make up to 200 litres of hot water a day, enough to meet the hot water needs of the average Victorian home.
- The unit has an overall efficiency of up to 85%, compared to about 25% efficiency of Victoria's current coal-fired power stations.
- The BlueGen unit also uses up to 95% less water than Victoria's current coal-fired power stations to generate the same amount of electricity.

Rupert Posner, Director of The Climate Group, said: "Ceramic Fuel Cell's clean domestic power station is proof of the new jobs that can be created by a low carbon economy. There is a whole host of existing and emerging technologies that will enable us to make substantial cuts in greenhouse gas emissions at low cost and maintain, indeed enhance, our quality of life. In addition to its modular BlueGen product, Ceramic Fuel Cells continues to develop fully integrated micro-CHP products with some of the world's leading utility and appliance partners in Europe and Japan. BlueGen units have been produced for market segments that may not require a fully integrated product. www.cfcl.com.au

NEWS

ELECTROPHEN BIPOLAR PLATES RATED UP TO 200°C

Southampton, UK

Bac2 the fuel cell materials and components company, announced an extended family of products made from its ElectroPhen™ conductive polymer at the Hannover Fair in Germany. They include high temperature bipolar plates which are mechanically and electrically stable at over 200°C. High temperature operation, typically between 180° and 200°C, is required to achieve good efficiency in polymer electrolyte membrane (PEM) fuel cells.



Traditional bipolar plates for fuel cells have to be machined to create the channels through which fuel, air and water vapour flow. ElectroPhen is an electrically conductive thermoset material, made from readily available bulk constituents, which can be compression moulded and cured at room temperature.

Bipolar plates based upon ElectroPhen do not need further machining, so they can be produced quickly and economically in any quantity. High temperature versions are subject to a proprietary conditioning process but this does not add significant cost or production time. ElectroPhen is a unique, patented conductive polymer that requires relatively little loading with graphite to achieve the required conductivity for fuel cell plate applications. In addition to offering customised plates in high volume, Bac2 markets blank plates that customers can machine for prototyping work before committing to mould tooling expense. www.bac2.co.uk

PLUG POWER LEADS THE TRANSITION TO HYDROGEN FUEL CELLS

New York, USA

Rising fuel costs coupled with large greenhouse gas emissions are making companies search for alternative solutions to internal combustion engines. Electric lift trucks powered by Plug Power's GenDrive units provide a cost effective alternative to traditional power sources. "The first quarter of 2009 was an important transitional period for our Company as we continued to drive fuel cells toward commercialization," said Andy Marsh, Plug Power's CEO. "Plug Power shipped 186 GenDrive units as customers across the country adopted fuel cell power units into their operations. Most notably, 140 class 3 GenDrive fuel cell units were shipped to Central Grocers for the grand opening of its state-of-the-art facility near Chicago. Operators at the \$90 million Central Grocers facility will handle all goods with PEM fuel cell powered lift trucks. Plug Power has adjusted its expectations upward to 1,000 unit orders and remains committed to meeting this by the year end.

Nestlé-Waters North America has installed 32 GenDrive™ hydrogen fuel cells at their Dallas, Texas bottling facility. Their entire fleet of sit down counterbalanced lift trucks has now been converted from internal combustion (IC) engines powered by liquid petroleum gas to electric lift trucks powered by GenDrive power units. "Nestlé-Waters assessed all their IC engine replacement options and found that the GenDrive fuel cell solution was less expensive than investing in lead acid batteries and costly battery equipment," said Tony Troutt, Director of Sales at Plug Power. "Fuel cells were also found to be more efficient. Most importantly, converting their fleet to hydrogen fuel cells allows Nestlé-Waters to eliminate exhaust emission issues, ultimately creating an

improved working environment for their employees as well as a reduced carbon footprint."

HYDROGEN REFUELLING BY AIR PRODUCTS

Air Products provides the hydrogen and infrastructure to power the GenDrive units. The fuelling infrastructure consists of an outdoor liquid hydrogen storage and compression system, as well as multiple indoor fuelling dispensers for operator refuelling. The GenDrive power units can be refuelled by the lift truck operator in less than 5 minutes, completely eliminating lead acid batteries and the related charging and storing infrastructure.

DOE AWARDS FOR MARKET TRANSFORMATION

Plug Power has received over \$6M in awards from the United States Department of Energy (DOE) for fuel cell market transformation programs. The funding will be used to integrate Plug Power's fuel cell solutions into materials handling, residential and stationary power applications. Successful completion of these projects will strengthen the product portfolios for Plug Power's GenDrive as well as their combined heat and power GenSys products. Gensys will replace traditional furnaces and boilers, creating electricity and high-quality heat for the consumer. "These awards move commercial customers beyond field trials to full fleet conversions," said Tony Troutt. "Strong support from large customers in diverse industries will drive rapid market adoption." "We appreciate the DOE's investment and commitment to fuel cell technology," said Katrina Fritz Intwala of Plug Power. "Their vision and

leadership has facilitated expansion and growth within the industry. This will allow companies like Plug Power and its customers to deploy exciting alternative energy products and accelerate the growth of green jobs.”
www.plugpower.com

NEWS

UK REGIONAL HYDROGEN PROJECTS

Aberdeen, UK

At the All-Energy'09 conference and exhibition in Aberdeen, several presentations were given on hydrogen and fuel cell projects. Dave McGrath of ReGenTech outlined developments for small communities which could be powered by wind, solar, hydro or energy from waste, with hydrogen used as an energy store. From the Shetland Islands, John McClatchey explained that hydrogen provides a means of storing their intermittent wind power. It is extremely flexible and can be used in internal combustion engines, fuel cells, gas turbines and domestic gas boilers and CHP. Ruairi MacIver gave a progress report on the Hebridean Hydrogen Park. They are developing solutions for remote communities and social housing clusters. They also envisage great potential for hydrogen powered vehicles. They have built a hydrogen refuelling station and the Royal Mail is their first customer.

Tom Read, CEO of the Scottish Hydrogen and Fuel Cell Association said that the future for wind is hydrogen. He outlined plans for building a Scottish hydrogen highway and linking it to other parts of the UK. Dermot Roddy, Director of the UK Hydrogen Association (UKHA), said that analysis revealed a large functional gap in low-carbon energy systems that can only be filled by hydrogen. This means that there will be a large domestic market as well as the potential to exploit the huge export market. There is significant

interest from the regions. Wales has published its vision for the hydrogen future and Scotland and the Midlands are working towards one. The UKHA welcomes participants in developing a UK-wide low carbon strategy. Dr Rupert Gammon, Chair of the British Midlands Hydrogen Forum, outlined progress with a variety of hydrogen and fuel cell projects in his region. They are also collaborating with other regions, notably in the extension of the Midlands Hydrogen Ring of refuelling stations to other parts of the UK. In Europe, they are working with the European Partnership of Regions and Municipalities for Hydrogen and Fuel Cells (HyRaMP).

Daniel Aklil, MD of the Pure Energy Centre, explained the difficulties in commercializing hydrogen from renewable energy sources. It is much cheaper to obtain hydrogen from fossil fuels and they have no financial or policy incentives, unlike other sustainable technologies. The benefits could be huge. They can cancel the intermittency of renewable energies and increase their penetration. They could provide energy security and have the potential to eradicate fuel poverty. www.all-energy.co.uk

BRIGHTON TO LONDON ON HYDROGEN POWER

London, UK

Forty-five low carbon vehicles were on display outside London's City Hall at the Revolve Eco-Rally 2009 in June. The hydrogen and fuel cell powered vehicles included the Nissan FCV and MicroCab's fuel cell car, as well as ITM Power's bi-fuel hydrogen Ford Focus. ITM Power completed the 53 mile route from Brighton to London powered only by hydrogen.

Zac Goldsmith, who took the wheel of ITM's car on the first leg to Greenwich, commented "I think it's a magnificent car. I like it because it's so simple. I couldn't tell the difference, driving with gas or hydrogen, it's the same vehicle, same motion, very uncomplicated.

I like the fact that it's a fairly straightforward retrofit so we're not talking of hundreds or thousands extra. If it became mainstream, you're talking about something quite affordable. We could have a clean, national car fleet within 4 or 5 years



with the right policies in place, in a way that would benefit consumers as well as the environment. There is also energy security, which is a massive issue. I fail to see the real obstacles. I don't think they exist, except in politicians' minds. I'd like to see them showing a bit of clarity and the courage to take action."

ITM modified the factory standard Ford Focus in order to show that hydrogen as a fuel is compatible with today's engines and infrastructure. The bi-fuel Ford Focus is refuelled using hydrogen generated using ITM's patented electrolyser technology that is being developed to make hydrogen affordable. Using only water and renewable energy, electrolyzers can generate "green hydrogen", providing refuelling infrastructure for vehicles at the point of use. Charles Purkess of ITM said that they wanted to show the clean green motoring spirit that the public could one day enjoy if car manufacturers undertook simple modifications to their production lines. "We need an alternative clean fuel to replace fossil fuel; a fuel is a store of energy" he said. "Existing sources of renewable energy are intermittent and variable; when the wind blows at 3am we waste the electricity generated because it isn't used or stored. If however, electrolyzers were deployed we could store the energy as a clean fuel for whenever we need it. We need

pragmatic thinking to allow our car industry to evolve, to achieve long term zero carbon goals; we have to consider where our power is coming from, make better use of renewable energy, and reduce our dependency on oil". www.eco-rally.org
www.itm-power.com

AFC ENERGY'S FUEL CELL SUCCESSFULLY OPERATING ON INDUSTRIAL HYDROGEN

Bitterfeld, Germany

AFC Energy, the low cost fuel cell company, has announced the demonstration of its fuel cell system successfully operating on industrially produced hydrogen at AkzoNobel's chlor-alkali plant in Bitterfeld, Germany. The company has completed its practical review of the installation of the fuel cell and system integration. They have repeated start up, thermal and load cycling tests and demonstrated electricity generation using industrially produced hydrogen taken directly from a chlor-alkali plant without pre-treatment. They have tested the inverter technology by feeding electricity produced from the fuel cell system into AkzoNobel's electricity grid.

The next phase will be to bring the fuel cell system to full commercial operation at Bitterfeld, by installing AFC Energy's proprietary low cost electrodes, and then deliver further fully operational systems. The commercial goal of AFC Energy is that of an Energy Supply Company ("ESCO") whereby a customer supplies AFC Energy with hydrogen and AFC Energy sells electricity back to the customer or to the grid. The Company intends to initiate commercial discussions with interested parties for the joint development of ESCO models within the chlor-alkali industry where favourable subsidies in Europe and rising electricity prices are enabling the construction of business models with the potential for rapid payback of capital.

Ian Balchin, AFC Energy's Managing Director, said: "This is a major milestone in the progress of the company. I wish to extend my thanks to the team of people from AFC Energy and AkzoNobel who have contributed towards this success. We have commenced work on producing a larger 25kW+ system and broadening commercial relations in the chlor-alkali industry." www.afcenergy.com

BALLARD – POWER TO CHANGE THE WORLD!

Burnaby, Canada

The mission of Ballard Power Systems is to accelerate fuel cell product adoption. They have developed a 1 MW fuel cell power unit for distributed power generation based on their proven heavy-duty proton exchange membrane (PEM) FCvelocity™ products, which power bus fleets around the world and offer first class performance, reliability, and robustness. The 1MW fuel cell will be delivered to FirstEnergy Corp. for distributed power generation in a project to demonstrate utility load management. The project is designed to test the unit's application for providing peaking capacity and load management over a three-year period. Initial plans call for the trailer-mounted unit to be located in Ohio and delivered in December 2009.

This product will position Ballard to enter into a new market focused on clean distributed power generation. Government support for these applications is strong, particularly in the US where the American Recovery and Reinvestment Act has provided stimulus funds in the form of tax code changes, and direct funding for initiatives such as Smart Grid programs. This sale to FirstEnergy utilizes an outstanding product credit and is subject to the receipt of partial funding from tax grants provided by stimulus funds. "We see the sale to FirstEnergy as an entry step into distributed power generation, in niche applications where Ballard can

provide fuel cell solutions which leverage the unique advantages of PEM, such as scalability and responsive load following. We are also exploring other clean energy distributed power generation opportunities using waste hydrogen," said John Sheridan, Ballard's President and CEO. Gary R Leidich, President of FirstEnergy Generation added: "This demonstration project will provide valuable information about utility scale fuel cell technologies and their potential to provide cost-effective solutions for peak demand and load management, as well as helping to meet our advanced and renewable energy goals." www.ballard.com

COUNTY COUNCIL CHOOSES FUEL CELL

California, USA

Sonoma County in California has purchased a 1.4MW power plant from FuelCell Energy. The highly efficient Direct FuelCell® (DFC®) will supply 100% of the base load electricity needed to power county office buildings and a county jail. "Installing a DFC fuel cell power plant is not only a wise financial decision," said Jose Obregon, head of Sonoma County's General Service Department. "It also demonstrates we're being responsible stewards of the environment by dramatically lessening the impact of County operations on our community. No distributed power generation alternative we evaluated was able to compete with its high efficiency combined with its environmentally responsible benefits."

Sonoma County considered numerous options before deciding that the DFC unit was the best solution for its needs. The fuel cell installation is a major component of the \$22 million Comprehensive Energy Project to make Sonoma County buildings energy efficient, reduce greenhouse gas emissions, and meet the reduction targets established in the County's Climate Protection Action Plan.

The power plant will generate 1.4 megawatts of ultra-clean electricity and its byproduct heat will be recovered and used to replace approximately half the natural gas the County currently purchases to make hot water for space heating, cleaning, and cooking.

Overall, the County of Sonoma expects significant energy cost savings during the first year of operation. When operating in a Combined Heat and Power (CHP) mode such as this, DFC power plants can achieve up to 80% efficiency. This high efficiency will substantially reduce carbon dioxide emissions. By comparison, typical grid electricity is only 33% electrically efficient. In addition, since DFC power plants produce electricity without combustion, they produce near zero nitrous oxides, sulfur oxides and particulate matter, and are one of the most effective means of meeting air

quality standards with around-the-clock electric generation.

The state of California has over 75 different laws and incentive programs to further the use of clean energy and reduce greenhouse gas production. These include caps on carbon dioxide emissions; the state's requirement for 33% clean energy generation by 2020; and its government office building initiative to reduce energy use by 20% by 2015. Additionally, the California Air Resources Board strictly regulates distributed generation power plants, specifying limits for nitrous oxides, carbon monoxide and volatile organic compounds. DFC fuel cells meet all of these limits. Sonoma County's purchase of the DFC unit was partially funded with a \$3 million grant under California's Self-Generation Incentive Program. The DFC power plant is scheduled to be in operation in spring of 2010. www.fce.com

THE NEXT ISSUE WILL INCLUDE:

UK Chancellor affirms role for ITM Power's hydrogen technology.
Fuel Cell Power contributes to the National Grid's consultation *Operating the Electricity Transmission Network in 2020*. The deadline for responses is 14th August 2009.

EVENTS

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.grovefuelcell.com

6th - 7th October 2009, Annual General Assembly of the European Partnership of Regions and Municipalities for Hydrogen and Fuel Cells (HyRaMP), Brussels. www.hy-ramp.eu

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