

FUEL CELL POWER

The magazine for the power source of the future



HEADLINE NEWS

This summer, a yacht using a fuel cell auxiliary power unit won the race to the Azores and Back! The winning skipper said that the fuel cell gave them a competitive advantage. The fuel cell saves on weight in terms of equipment and in the amount of fuel carried. It gave them constant power to run the yacht's systems, as well as autopilot, navigation and the communications computer.

This is one of many applications for fuel cells for leisure use supplied by Fuel Cell Systems Ltd.

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FUEL CELL SYSTEMS POWERS WINNER OF AZORES RACE!



Experienced yachtsmen Chris Tibbs and Don Wright were the winners of this year's Azores and Back race (AZAB). Their boat, Taika, had on board a fuel cell providing auxiliary power, which was supplied by Fuel Cell Systems. AZAB is held every four years, and is hosted by the Royal Cornwall Yacht Club. This year 60 competitors took part in the 2,500 mile race from Falmouth to the Azores and back.

Winning boat Taika had on board an EFOY 2200 supplied by Fuel Cell Systems. The unit is powered by methanol and generates 90W of electricity to power the boat's navigation and communication equipment.

Winning skipper, Chris Tibbs, said, "Taika is a standard J105 and beat many larger yachts on the water. For the first time she was equipped with a fuel cell that gave us a competitive advantage. Only 8-9 litres of fuel were used for each leg; a considerable weight saving on diesel.

"The great thing I found with the fuel cell was the way you turn it on and can forget about it. No more monitoring the batteries and running the engine to charge them. - and a first for me when racing, a fridge! Installation was quick and easy and once installed we had plenty of 'silent' power."

Fuel Cell Systems' Chief Technical Officer, Tom Chicken, commented, "We're delighted that Chris won the AZAB race with the aid of fuel cell technology. It's not the first time a fuel cell has helped win a race. In 2009, Tom Sperrey had an EFOY 1600 on board his boat Nightlife when he won the ARC race in St. Lucia. Fuel cells offer a great alternative to diesel generators for providing on board power. They're small, compact and lightweight, produce no emissions and are virtually silent when operational."

Fuel Cell Systems, the newly created subsidiary of UPS Systems PLC, is the UK's first business dedicated to fuel cells for all leisure applications. It offers a wide range of products from the industry's leading manufacturers.

The EFOY Comfort range from SFC Energy comprises three units offering outputs of up to 210Ah per day. It's a more user friendly unit with a warranty of up to five years, increased power outputs and fuel level monitoring as standard. The fuel cell may be used in a hybrid design, in order to top up a battery to meet higher power demands.

As a clean, silent alternative to diesel generators, fuel cells are suitable for many leisure pursuits, including sailing yachts and power boats, motor homes, caravans and beach huts. Tom Sperrey, Managing Director of Fuel Cell Systems, said, "Our newly formed leisure-market focussed subsidiary, Fuel Cell Systems, is delighted to be able to represent the new EFOY Comfort range throughout the UK. The previous EFOY RV range was a great success, selling over 21,000 units throughout mainland Europe." www.fuelcellsystems.co.uk

NEWS

FUEL CELL POWERS AMSTERDAM 17TH CENTURY CANAL HOUSE

A consortium of innovative companies has installed a gas-to-electricity power plant in a 17th century canal house called "De Groene Bocht" in the centre of Amsterdam. This power plant uses the world's most efficient fuel cell technology to convert gas to electricity and heat. The technology - BlueGen - enables "De Groene Bocht" to produce most of the electricity it needs on site. The electrical efficiency of the BlueGen unit is over 60%, the highest electrical efficiency of any such technology in the world. In addition, the recovered heat is used for domestic hot water, bringing the total efficiency above 85%. Besides the benefits of distributed generation of electricity (no costs of centralized production and distribution), the new fuel cell technology provides a direct carbon emission cut of more than 50% compared to the net carbon emissions in the Netherlands. In the short term the unit will run on gas from renewable sources making the unit's operation CO2 neutral.

BlueGen units are manufactured by the Australian/German company, Ceramic Fuel Cells Limited, in a consortium with Cool Endeavour, Eneco, Liander, GasTerra and Amsterdam Smart City. The project fits well with the strategy of the various parties in the consortium - which is to accelerate the energy transition. Key components are the use of green gas and controllable decentralized energy to balance the fluctuations in the supply of solar and wind power. Paddy Thompson, General Manager Business Development at Ceramic Fuel Cells, said "This is an important first step into the heritage market for BlueGen which can help older buildings - which have notoriously poor carbon emission credentials due to their age - to substantially improve their carbon footprint." Matthijs Guichelaar at Cool

Endeavour, added: "This is the first time a fuel cell has been installed in an existing Dutch office building. It is expected that in the near future more companies will follow the lead of "De Groene Bocht". The technology is likely to develop into a mass-market product and should make an important contribution to the transition to a more sustainable economy."

www.cfcl.com.au

PRESENTATION OF FUEL CELL SCOOTER

Intelligent Energy has announced that the Suzuki Motor Corporation has presented an Intelligent Energy powered Suzuki Burgman Fuel Cell Scooter to the Chairman of Nippon Steel at a ceremony in Kita-Kyushu, Japan. It is the first time that one of the zero emission fuel cell vehicles, which recently achieved European Whole Vehicle Type Approval (WVTA), has been delivered outside the Suzuki Motor Corporation. Mr Akio Mimura, Chairman of Nippon Steel, remarked: "The current situation in Japan tells us more about the importance of distributed generation and energy source, and we hope we can contribute to it with the hydrogen generated from our factory."

Mr Osamu Suzuki, Chairman of Suzuki Motor Corporation, said, "We applied fuel cell technology to scooters, but we would also like to seek for further opportunities to extend this technology to other vehicle applications." Dr Henri Winand, Chief Executive, Intelligent Energy added: "Japan has made clear its intention to support mass consumer market adoption of hydrogen fuel cell technology, which makes our 'design once, deploy many times' proprietary technology very attractive to global blue chip companies looking to target these markets." www.intelligent-energy.com

PARTNERING WITH AUTOMOTIVE DESIGNERS

ACAL Energy are partnering with automotive experts, Gordon Murray Design, in a 12-month project to design a very low cost, durable fuel cell vehicle utilizing their innovative fuel cell technology. The 12-month project is funded by the Technology Strategy Board under its Low Carbon Vehicle programme.

The study, led by Gordon Murray Design, combines ACAL Energy's novel Flowcath® technology that significantly reduces the cost and improves the durability of a fuel cell, with Gordon Murray Design's award winning iStream® concept, which allows for fast, low cost production of light weight vehicles. Together, these British innovations could make carbon emission-free fuel cell autos affordable for buyers in both developed and emerging markets.

Dr S.B. Cha, CEO of ACAL Energy said of the partnership: "We are very excited to be working with the team at Gordon Murray Design on this important project. Without carbon emission free vehicles that are affordable in both developed and developing countries, we will not address one of the core drivers of climate change.

By combining a low cost fuel cell engine with a lightweight auto platform and a low cost production process, ACAL Energy and Gordon Murray Design aim to show that carbon emission-free fuel cell autos can be an affordable alternative to petroleum fuelled cars, especially for the millions of new buyers in developing countries that will enter the market over the coming decade."

CERES POWER OPENS VOLUME MANUFACTURING FACILITY

Ceres Power welcomed the UK Minister of State for Business and Enterprise, Mark Prisk MP, to conduct the official opening of its volume fuel cell manufacturing facility in Horsham, Sussex. Ceres Power has created more than 170 highly skilled 'green collar' jobs at the manufacturing facility in Horsham and the technology centre in Crawley. As part of the Group's plans for a mass market launch of the combined heat and power (CHP) product in the UK, the manufacturing facility can be expanded to produce up to 30,000 fuel cell CHP products per annum. This will create substantial additional skilled jobs in advanced manufacturing, engineering and operations and in the local supply chain. There are also further opportunities to export significant volumes of the CHP product globally.

Ceres Power has completed the first phase of its advanced fuel cell manufacturing facility that produces the Group's unique fuel cell module. The fuel cell module is integrated within a compact wall mounted residential CHP product that replaces a conventional boiler and also generates almost all of a typical home's electricity. The Group has partnered with British Gas to sell, install, service and maintain the CHP product in UK homes, offering households savings of up to 25% of their annual total energy costs and reducing their CO2 emissions.

As part of the visit, the Minister of State toured the factory seeing fuel cells being manufactured and CHP products being assembled and undergoing lifetime testing in the Group's new test facilities. He commented: "Here in Britain we have a vibrant low carbon environmental goods and services market which is already the sixth largest in the world and worth £112 billion. It is thanks to innovative research and product development by companies such as Ceres Power that we are leading the

world with this sort of technology and which will help us realize our ambition to make the UK a leading high tech, highly skilled economy. Ceres Power's work in developing a revolutionary new product that can convert natural gas into electricity and heat without burning it will cut costs of annual energy bills and has the potential to make a major contribution to reducing carbon emissions in millions of homes in the UK and across Europe." Brian Count, Executive Chairman of Ceres Power, added: "Ceres Power is committed to continuing to commercialize its world-leading technology, and position the UK as a leader in the deployment and manufacture of low carbon advanced manufactured products. We look forward to creating significant further skilled jobs in the UK and generating export opportunities in partnership with the UK government." www.cerespower.com

SOFC CUTTING LONG-TERM OPERATING COSTS

San Jose Arena Management, the operator of the San Jose City-owned Sharks Ice public ice facility, has announced plans to install Bloom Energy Servers™, which incorporate solid oxide fuel cell (SOFC) technology. Installation of the Energy Servers is scheduled to be completed by next January, when they will provide a cleaner, more reliable and more affordable energy source to power the ice complex. The 500 kW Bloom boxes will replace about 85% of the electrical utility power at Sharks Ice and due to their efficiency, Sharks Ice will reduce its carbon footprint by 30% over the course of the next 10 years.

Sharks Ice will be using cheaper and cleaner electricity to power a facility which currently generates an electrical energy bill of more than \$65,000 per month, largely due to the 24-hour a day, seven days per week refrigeration requirement.

By unanimously approving this project, the San Jose City Council advanced the City's goals found in their Green Vision, Economic Development Strategy, and Climate Action Plan. The City will fund the purchase and installation of the Bloom Energy Servers™ with \$2 million from the Ice Centre Revenue Fund, which is dedicated to paying for operating expenses, maintenance and improvements at the facility. "This is a great example of how we can make a capital investment to reduce long-term operating costs," said San Jose Mayor Chuck Reed. "Adoption of this cutting-edge technology at Sharks Ice also supports our region's growing clean tech industry and brings us closer to achieving our Green Vision goals." Mayor Chuck Reed introduced San Jose's Green Vision four years ago. This is a 15-year plan with 10 ambitious objectives, including the creation of 25,000 clean tech jobs, reduction of per capita electricity use by half, becoming a zero waste city, and moving to 100% renewable energy.

The General Manager of Sharks Ice, Jon Gustafson, said "We are pleased to be working closely with the City of San Jose and an innovative company like Bloom Energy to install an environmentally-friendly resource that will provide electricity to our facility. Utilizing the Bloom Energy Servers will not only allow Sharks Ice to continue to provide a state-of-the-art public ice facility for our patrons but will enable us to reduce our carbon footprint, which will benefit the entire community." www.bloom-energy.com

BLUEGEN FUEL CELLS ENTER EUROPEAN MARKETS

NEW DISTRIBUTORS IN GERMANY, THE UK AND THE NETHERLANDS

Ceramic Fuel Cells Ltd (CFCL) has signed agreements with distributors in Germany, the UK and the Netherlands. Sanevo Lizenz-GmbH & Co. KG will market, sell, install and service BlueGen gas-to-electricity products in regions of Germany and Austria. Sanevo has placed an initial order for 100 BlueGen fuel cell units to be delivered in the first year, with a target minimum order of 500 for delivery in the second year and a target of 2000 over years three and four. Provided sanevo orders these agreed minimum numbers of BlueGen units during 2012 to 2014, it will have exclusive rights to distribute BlueGen to commercial and residential customers in the German States of Baden-Württemberg and Bavaria, and in Austria. CFCL retains full rights to sell BlueGen units to utilities and energy service companies. The order for 100 units is the largest order so far for the Company's BlueGen product, and builds upon the recent order for 25 units from Ausgrid in Australia.

INSTALLATION AND AFTER SALES SERVICE

Based in Offenbach, near Frankfurt, sanevo has substantial experience in marketing and selling new technology power and heating products in Germany. Sanevo has partnered with SAG GmbH – one of Germany's largest independent service and system providers for electricity, gas, and telecommunications products and networks - to provide installation and after sales service for BlueGen products. SAG has more than 8,000 staff at over 120 locations throughout Germany and is able to provide a high level of service availability. Last April,

sanevo and SAG each purchased a BlueGen unit for their own buildings.

BlueGen uses ceramic fuel cells to turn natural gas into electricity and heat for hot water. Each unit is capable of producing more than three times the electricity needed to power the average German home, which consumes an estimated 4,100 kilowatt hours (kWh) of electricity per year. Surplus electricity is sold back to the grid or used in supplementary applications such as charging an electric car. In addition, surplus heat is captured for domestic hot water use. BlueGen units generate electricity with the highest electrical efficiency of any small scale generating technology in the world, reducing energy bills and cutting carbon emissions. BlueGen customers in Germany are eligible to receive a feed in tariff for the power exported back to the grid.

Ceramic Fuel Cells has now received orders for a total of 206 BlueGen units and up to 200 integrated micro combined heat and power (mCHP) products. In these units a fuel cell is integrated with appliances, such as high efficiency condensing boilers or heat pumps, to provide both electricity and all the heating requirements of a building. The German Government has formally approved funding for an order of up to 200 Ceramic Fuel Cells integrated power and heat generators from German energy service provider EWE. The previously announced order is the largest that CFCL has received, with total revenue of up to €4.9 million over two years. Part of the funding for the order is being provided by the German government's national hydrogen and fuel cell technology innovation program. Ceramic Fuel Cells is supplying the core Gennex fuel cell module and related components to its local manufacturing partner, Gebrüder Bruns Heiztechnik GmbH, which is combining the fuel cell

module with a boiler into an integrated power and heating product for supply to EWE. EWE will then install the units in homes in the Lower Saxony region in northern Germany.

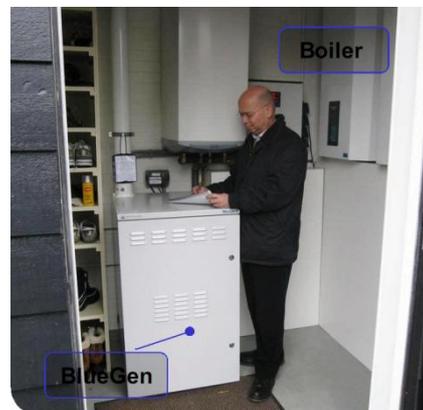
NEW UK DISTRIBUTION AND AFTER SALES SERVICE

In the UK, CFCL has made a non-exclusive agreement with RES On-site Ltd to market, sell, install and service their BlueGen fuel cells. RES holds Microgeneration Certification Scheme (MCS) installer accreditations in a wide range of technologies and is adding the microCHP accreditation to this. To date the RES Group has delivered more than 5 gigawatts of renewable energy projects worldwide. Each BlueGen unit can provide more than three times the electricity needed to power the average UK home, which is estimated at 3,300kWh per annum. Surplus electricity can be sold to the grid or used to recharge an electric vehicle. BlueGen units generate electricity at up to double the efficiency of the current power grid, reducing energy bills as well as making significant carbon savings. There is also the benefit of providing heat for domestic hot water.

Commenting on the announcement, Brendan Dow, Managing Director of Ceramic Fuel Cells said, "To be working with the RES Group is another endorsement of BlueGen. The reputation, expertise and market penetration that the RES Group offers means that we are now even better placed to capitalise on the significant market opportunities that the UK offers." Mike Atkinson, Managing Director, RES On-Site Limited added: "RES are delighted to add the world leading BlueGen microCHP product from CFCL to our portfolio of class leading renewable and low carbon energy technologies. This diverse portfolio allows RES On-site to offer our customers the most suitable solution for their specific carbon reduction application. The UK Government's tariff structures supporting the deployment of exciting new products such as

BlueGen makes the UK a hugely dynamic developing market for renewable technologies and RES On-site is committed to being at the forefront of that market." Paddy Thompson, General Manager Business Development at Ceramic Fuel Cells added: "RES On-Site Limited is highly experienced and MCS accredited, and together we are ready to enable BlueGen customers to take full advantage of the microCHP feed in tariff as well as the considerable energy cost and carbon savings made available by BlueGen."

HUGE MARKET IN THE NETHERLANDS



Zestiq B.V. and its partners will market and sell Ceramic Fuel Cells' BlueGen gas-to-electricity products to small commercial and residential customers in The Netherlands. Zestiq is part of the consortium of innovative companies which earlier this year bought and installed a BlueGen in a 17th century canal house "De Groene Bocht" in the centre of Amsterdam (see report on page 3). The aim of Zestiq is to accelerate the introduction of clean technology which is market ready. By developing smart business models for different technologies, Zestiq aims to significantly reduce the time to mass market. The units will be installed and maintained by the service company, Eneco Installatie Bedrijven. The other members of the consortium are leading energy companies in The Netherlands, including Liander, which is a distribution company with 2.9 million

electricity customers and 2.1 million gas customers, and GasTerra, which is an international natural gas trading company. Responsibility for the planet and for society go hand in hand at GasTerra, which is why sustainability is an important component of their policy. The company supports the development of gas technologies, such as BlueGen units, that could make a significant contribution to the transition to sustainable sources of energy.

The other consortium member, Eneco, currently provides services for a range of heating and cooling technologies, including small-scale combined heating and power products. The Company invests in sustainable energy sources, heating and cooling and in decentralised, local generation of energy. Eneco is active in the north-western European market with operations in Belgium, France, Germany and the United Kingdom. In The Netherlands the average home consumes an estimated 3,700 kWh of electricity per year and they are eligible to receive a feed in tariff for up to 5,000 kWh of electricity exported to the grid. Matthijs Guichelaar from Zestiq said "Zestiq sees a huge market potential for BlueGen in the Netherlands. With its dense gas network, large gas reserves and growing interest in distributed generation, we think the Netherlands and the BlueGen are a perfect match. We see great possibilities in carbon reduction and smart grid applications."

FUEL CELLS FOR THE SMART GRID

Ceramic Fuel Cells has announced their participation in CE Electric UK's £54 million low-carbon Smart Grid project. Durham University is one of the partners involved with the project and CFCL's BlueGen microgeneration heat and power unit will be housed in the Durham Energy Institute research laboratory at the University. BlueGen will run alongside other low carbon technologies and will, through its contribution to the project, help shape

the future for a low-emission and more efficient power grid across the UK. Durham University estimated that the improvements to the power grid that result from the project could potentially save homes and businesses across the UK around £8 billion in energy costs and 43 million tonnes of CO2 emissions. The Smart Grid project involves 14,000 homes and businesses and will assess the impact of technologies such as micro combined heat and power units on the electricity grid and lay the foundations for helping electricity consumers to reduce their carbon footprint, cut energy use and save money.

Commenting on the announcement, Paddy Thompson of CFCL said: "The integration of BlueGen into the Smart Grid Project will prove that the technology needed to create a low-emission, highly efficient power grid for the future exists today and its use is a significant step towards achieving far reaching cost and environmental benefits for the UK." Prof Phil Taylor of Durham Energy Institute added "We are excited about the opportunity of researching how BlueGen can work alongside other technologies and are grateful to One North East for their support."

BlueGen units will also be used in a Smart Grid project in Newcastle, Australia, where CFCL has signed a contract to sell 25 BlueGen gas-to-electricity units to Ausgrid (formerly Energy Australia). The units will be installed in homes in Newcastle as part of Ausgrid's 'Smart Grid, SmartCity' project. The \$100 million project, funded by the Australian Government, is Australia's largest smart grid project. The 25 BlueGen units will be installed in homes, generating electricity from natural gas with the world's highest electrical efficiency, as well as providing hot water for the home.

The 'Smart Grid, Smart City' initiative utilises a smart grid – a new type of electricity network that uses advanced communication, sensing and metering that more efficiently manages electricity supply and demand. The

initiative is gathering robust information about the costs and benefits of smart grids, and will inform future decisions by government, electricity providers, technology suppliers and consumers across Australia. The order from Ausgrid follows the company's previous purchase of a BlueGen unit for its Smart Home in the Sydney suburb of Newington. It is nearly 10 months since the unit was installed, and during that time it has generated 9,283 kilowatt hours of power and saved 10.4 tonnes of CO₂ compared to power from the local grid. Ausgrid has run the unit in a variety of modes, including constant power and modulating power, to match the typical load of a home. The BlueGen at the Smart Home has been generating about twice as much electricity as the family has been using to run their household appliances and charge an electric vehicle. Any excess electricity generated by the BlueGen has been exported to the grid.

Brendan Dow, Managing Director of Ceramic Fuel Cells, said: "We are delighted that Ausgrid has selected BlueGen units for its 'Smart Grid, Smart City' project. The distributed generation of electricity – creating electricity near the place of use, rather than centrally – is an important part of the future of smart grids." Ausgrid Managing Director George Maltabarow added: "We're testing whether adding distributed generation like fuel cells can make the grid more efficient by flattening out peaks in electricity demand, as well as deliver benefits to households."

SEVERAL AWARDS FOR BLUEGEN

BlueGen won the Microgeneration UK 2011 Technical Innovation Award, which was announced at the culmination of the Microgeneration UK 2011 conference in London.

The conference was run by the Micropower Council, the British Photovoltaic Association and the British Heating and Hot Water Industry Council. The Technical Innovation Award was presented by Baroness

Maddock of Christchurch, President of the Micropower Council, who said: "CFCL is playing a key role in pioneering technology that can help provide a source of cleaner, more efficient, low cost energy. Currently collaborating with multiple partners across the globe to help bring cleaner electricity, CFCL is a great example of how innovation within the microgeneration sector can deliver tangible benefits."

BlueGen has also won two awards from DuPont Australia and New Zealand, the 2010-11 CEO Award as well as the Design for a Sustainable Future Award.

BLUEGEN RECEIVES TYPE A CERTIFICATION

BlueGen is now certified as a "Type A" gas appliance, which allows the units to be installed by a licensed and trained plumber / gasfitter as for any other typical gas appliance in Australia. After rigorous testing and evaluation for compliance, the Australian Gas Association (AGA) has certified the BlueGen to a new safety standard for fuel cell appliances. BlueGen is the first product to comply with this new standard in Australia. BlueGen has also been certified for both indoor and outdoor installations.

BlueGen has already received full CE safety approval for installation in homes and other buildings in Europe and CFCL is working towards receiving safety approval for North America by the end of the year. www.cfcl.com.au

WORLD'S PREMIER REAL ESTATE SERVICE PROVIDES UTC FUEL CELLS

Newmark Energy Solutions, LLC, which provides cost-saving, sustainable, alternative energy solutions for commercial real estate owners globally, has announced that it has formed strategic relationships with Newmark Knight Frank, UTC Power Corporation (UTC) and Austin Energy Partners Solutions, LLC (AEP) to market, deliver, maintain and warranty the most advanced fuel cells to commercial real estate markets across the United States. The announcement was made by Paul Frischer, CEO of Newmark Energy Solutions. According to Mr. Frischer, Newmark Energy Solutions provides the following benefits for property owners: cost reductions of 20-30% over a 10-year period - a 50% reduction in a property's carbon footprint - and significant cost reduction for heating and cooling through the provided cogeneration. In addition, under a power purchase agreement or energy service agreement, no upfront capital investment is required.

FAST GROWING DISTRIBUTED ENERGY MARKET

"The Distributed Generation energy market represents the fastest growing segment of power delivery, increasing 5 GW every year," said Mr. Frischer. "It's an important business, and we are thrilled to offer the very best product in its class to office, datacenter and hotel real estate owners and managers. Demand for clean, renewable energy has never been higher, and we deliver clean, silent, continuous power at rates that can be controlled for a decade or more." Newmark Energy Solutions is the exclusive distributor of UTC Power stationary fuel cell units in the United States for key market segments and will permit, design, finance, construct, and operate a fleet of UTC fuel cells that will grow at a rate of 20MW installed capacity per year.

"UTC Power is proud to partner with the world's premier real estate service provider to provide clean, secure energy to property managers and owners across the United States." said Joe Triompo, VP and General Manager of UTC Power. "With its proven track record of performance, durability and environmental savings, the PureCell® system provides customers of Newmark Energy Solutions with the most advanced distributed energy system and the peace of mind of controlled energy costs for a decade or more." UTC fuel cells have been installed at over 300 locations worldwide with more than 9.6 million hours of operation and 1.6 billion kWh of operating experience. The technology is being used at One World Trade Center (Freedom Tower), currently under construction in Lower Manhattan.

FIXED CHARGE FOR 10 YEARS

The distributed generation units – measuring 8 feet by 28 feet – can be provided under an Energy Service agreement or Power Purchase agreement from Newmark Energy Solutions on a kilowatt hour basis. Property owners can house the unit in their building or campus. They will pay a fixed charge for their energy over 10 years, with the option to extend for an additional 10 years. The cost for electricity from fuel cell technology is consistent with current prices for utility electricity and will be cheaper in the future. There will also be the advantage of pricing control as well as benefits to the environment. The fuel cell unit can be scaled to the specific requirements of the building. As a clean and silent source of energy, it is the most efficient technology on the market today, providing 25-30% improved electrical efficiency with double the life-span of a micro turbine. This technology enables thermal

integration for either heating or cooling, providing a total energy efficiency as high as 80% or more. Thermal integration further improves the control a customer has over their total energy cost.

"Owners are searching for ways to control their energy costs and to make significant contributions to the greening of their properties," said Barry Gosin, CEO of Newmark Knight Frank. "We are fundamentally committed to reducing the carbon footprint of our business and the assets we own and manage." Phillip P. Gennarelli, Managing Director at AEP Solutions, added: "UTC and Newmark Energy Solutions have developed a technology and marketing platform that can significantly transform the US energy landscape and we look forward to supporting it throughout its growth."

www.newmarkenergysolutions.com
www.utcpower.com

NEWS

AMERICA'S MODERN MOON SHOT!

Nancy Sutley, Chair of the White House Council on Environmental Quality, visited UTC Power and said afterwards that as countries around the world race to seize the economic opportunities of clean energy, we have the chance to harness the incredible ingenuity and entrepreneurship of Americans to capture the advantage – and the jobs of the future – for the U.S.A.

President Obama has compared this to our 'moon shot' moment – the moment we decided that through determination and innovation, we would come from behind and win the race to be the first country in the world to put someone on the moon.

"I had the opportunity to visit a company that is part of both yesterday's moon shot and today's," she said. "UTC Power in South Windsor, Connecticut, supplied clean energy to the 1969 Apollo space mission that first took Americans to the moon. Today, the company is using its fuel cell technology to deliver clean, highly efficient power to transit systems, schools, hospitals, supermarkets and corporations around the world. UTC Power is one example of how the global appetite for clean energy is presenting opportunities for our businesses. The jobs of the future are in smart, sustainable, and modern clean energy technologies."



Nancy Sutley stands in front of a zero-emissions CT Transit bus powered by a UTC Power fuel cell. From left to right are Dan Esty, Commissioner of the Connecticut Department of Energy and Environmental Protection; Joe Triampo, Vice President and General Manager of UTC Power; Nancy Sutley; Connecticut Lt. Gov. Nancy Wyman; CT State Senator Gary LeBeau; and Mike Brown, UTC Power's Vice President of Government Affairs.

www.utcpower.com

UK ENERGY WHITE PAPER

KEEPING THE LIGHTS ON IN THE CHEAPEST, CLEANEST WAY

As the electricity supply industry changes from burning fossil fuels to new low carbon generation, there is a great opportunity to utilize fuel cells for combined heat and power (CHP). During the coming decade, about a quarter of the installed electricity generating plant, in the region of 20 gigawatts (GW), will have to be replaced and the electricity system will contain more generation from intermittent renewables, as well as inflexible base load generation with nuclear power. The White Paper recommends investment in renewable energy, mainly large wind farms, nuclear power and fossil fuels with carbon capture and storage.

The electricity industry has achieved good reliability and freedom from blackouts and the White Paper makes useful proposals for ensuring that this continues in the future. However, there is little support for distributed generation, although the White Paper accepts that combined heat and power (CHP) is more efficient and further consideration is being given to this. Our present electricity generating system is only about 35% to 40% efficient because the heat is not utilized and there are losses during transmission from central power stations. For comparison, combined heat and power systems achieve in the region of 85% efficiency, with fuel cells generating a high ratio of valuable electricity.

FAIR TERMS FOR COMPETITORS?

The White Paper aims to ensure that the markets provide the investment needed by both existing energy companies and new entrants. However, Government policies discriminate against fuel cell combined heat and power, which is the cleanest and most efficient

technology, as systems over 2kW do not qualify for Feed in Tariffs (FITs). Fuel cells are already providing electricity, heat and cooling in hospitals, schools, data centres, supermarkets, office buildings and at wastewater treatment facilities. Their wider implementation is being held back by competition from cheap fossil fuels which are not covering their external costs and have an established infrastructure. Fuel cells could become competitive if they received the same support as other technologies while they are being fully developed and economies of scale achieved. The new Green Deal should encourage solutions which save both electricity and heat.

In the past, the Government backed the development of two types of fuel cells, the Proton Exchange Membrane (PEM) and the Solid Oxide Fuel Cell (SOFC), both of which have great potential, but have required lengthy materials development. The R & D of larger Molten Carbonate Fuel Cells (MCFC) and Phosphoric Acid Fuel Cells (PAFC) have not been supported. For the Apollo Project in the 1960s NASA put \$100 million into Alkaline Fuel Cells (AFC) which had been developed in the UK by F T Bacon, but since then this potentially cheaper technology has not been supported by the Government.

LOAD BALANCING AND STORAGE

Energy storage will help to smooth out the supply from intermittent renewables. This will allow electricity from the sun to be used for lighting homes in the evening and for large quantities of energy from wind farms to be stored for use in CHP systems or to power transport. According to a report by the Bow Group, local hydrogen storage will have the following benefits:

- improved efficiency as supply matches demand

- the need for fossil fuel back-up is removed
- lower carbon emissions
- less investment in infrastructure costs
- reduced stress to the system as ramping up and down is minimized
- grid stability and continued freedom from blackouts
- community, business and individual self-sufficiency.

However, further technical improvements and cost reductions are necessary to make wind power with hydrogen storage competitive with diesel generators. It is recommended that there should be a renewable energy storage incentive (RESI) to build up a distributed renewable system which generates, stores and utilizes green energy at the point of use.

ENERGY SECURITY

Fuel cells could contribute to energy security as they can be powered by a variety of fuels including: biofuels from waste; hydrogen obtained via the electrolysis of water when there is surplus wind, solar or marine energy; off-peak nuclear power; and fossil fuels with carbon capture and storage. Highly efficient fuel cell CHP systems will help to conserve depleting resources of natural gas. An important source of renewable energy to power fuel cells is the tremendous energy store locked up in existing landfill sites. The clearing, reclamation and restoration of the older sites could deliver massive benefits by recovering and recycling metals and converting the organic material into useful end products. This would be a high value energy exporting, profit making clean-up programme, providing millions of tons of usable energy on our doorsteps. Converting this energy has massive benefits, by producing green energy locally, reducing traffic to traditional generators, restoring and reclaiming land, removing potential pollutants, creating employment and

avoiding investment in polluting technologies.

FUTURE ENERGY

In the future, electricity and heat will increasingly be generated by highly efficient fuel cells. There will not be separate fuel sources for electricity, heat and transport, but more electricity and heat will be generated on site, with electric vehicles acting as load levellers. For example, in a future Europe where vehicles were powered by fuel cells, all the major power plants could be eliminated if 25% of drivers used their electric vehicles as power plants to sell energy back to the inter-grid. Electrochemical energy conversion will enable clean, efficient production of electricity and heat. Energy will be stored as hydrogen, just as digital is now the universal method for data storage. In the words of Jeremy Rifkin, the same design principles and smart technologies that created the internet and the vast distributed global communications networks are beginning to be used to reconfigure the world's power grids. This will mean that people can produce renewable energy and share it, just as they now produce and share information, creating a new decentralized form of renewable energy use.

Fuel cell power, alongside efficient renewable technologies, will enable businesses, communities and individuals to choose the cleanest energy, which will also be the cheapest, not just for them, but for future generations.

Additional information on **Government Policies, Related Technologies and Global Warming Gases** is available in three Appendices given at the end of this report on the Fuel Cell Power website. www.fuelcellpower.org.uk

HYDROGEN STORAGE IN THE UK AND GERMANY

ITM Power participated in a Hydrogen and Fuel Cells Demonstrator showcase event at London's City Hall, which was sponsored by the Technology Strategy Board and the Department of Energy & Climate Change (DECC). The keynote address was delivered by the Hon. Greg Barker, Minister of State for Energy & Climate Change, who said, "Hydrogen and fuel cell technologies are at the forefront of new energy solutions, which will dramatically cut emissions from transport, and the Coalition government is determined to support their development." Innovation in hydrogen and fuel cell technologies has advanced significantly as a result of the £7 million DECC-funded demonstrator programme delivered by the Technology Strategy Board. Lead partners of the projects involved described and demonstrated their technologies.



Dr Graham Cooley (left) CEO of ITM Power, seen here with the Mayor of London, Boris Johnson, gave a presentation on the company's hydrogen technology, and demonstrated its HFuel hydrogen refueller product to an invited audience of government, industry and media. ITM believes that renewable power needs energy storage and that exporting the stored energy to the transport sector would be a great solution both to reducing our carbon footprint – green hydrogen is a zero

carbon option – and increasing energy security.

ITM Power's Hydrogen On Site Trials (HOST) of its HFuel refueller have attracted 21 commercial partners, confirming the company's view that early adopters of this technology are likely to be commercial fleet operators.

MORE UK GOVERNMENT BACKING FOR HYDROGEN AND FUEL CELLS

The Technology Strategy Board announced that it is planning the next step in helping to accelerate innovation in hydrogen and fuel cell technologies with a new £7.5 million programme, commencing in early 2012. Commenting for ITM Power, Graham Cooley said, "We are very pleased that the Government is providing support for our projects. Hydrogen technologies are here today, workable in real life situations and commercial. Adoption around the world is accelerating and is being led by Germany, USA and Japan. The UK now has the technology companies to be a very close follower."

David Bott, Director of Innovation Programmes at the Technology Strategy Board, said, "We now have technologies at a relatively mature stage of development, with a number of hydrogen and fuel cell systems being demonstrated for buildings or vehicles. The new competition is designed to help business-led consortia develop innovative, large-scale projects that integrate hydrogen and fuel cell systems with key elements of our energy and transport systems and the wider built environment."

CALLS FOR RENEWABLE ENERGY STORAGE

Earlier, ITM Power welcomed the call from the Department for Energy and Climate Change (DECC) and the National Grid for better energy storage facilities to be connected to renewable power sources. This follows a report from the Renewable Energy Foundation and recent press coverage noting that energy companies had been paid to halt wind turbine energy production. A spokesman for DECC commented: "In future we need greater electrical energy storage facilities...so that energy supplies can be sold or bought where required."

Graham Cooley said: "As more intermittent renewable power is assimilated into the network, these events will increase in frequency. An example is Denmark where 20% of the generating capacity is wind but only a few percent of the demand can be met with that wind power, the rest has to be exported to Sweden or Norway or wasted. ITM Power's HFuel product can be used as a flexible load which can be operated by power companies to absorb excess power. The use of hydrogen electrolysis and storage to manage the grid means that we would never have to cease renewable energy production. The market for the hydrogen produced from renewable electricity is potentially huge. It is the market for a zero carbon footprint fuel."

GERMAN HYDROGEN INFRASTRUCTURE

NOW GmbH, the German national organization for hydrogen and fuel cell technology, is the body responsible for the H2Mobility initiative to roll out the hydrogen refueling infrastructure throughout Germany. ITM has welcomed the conclusions of a NOW Workshop held in Germany. NOW GmbH Managing Director, Dr. Ing. Klaus Bonhoff, argued that any move towards a renewable economy

inevitably raises the issue of energy storage, and that any discussion of storage cannot avoid hydrogen in general and electrolysis in particular.

Dr. Oliver Ehret, the NOW GmbH Project Manager responsible for hydrogen infrastructure provision, gave an outline of the Clean Energy Partnership (CEP) that is entering its third phase, focusing on preparing the German market for the hydrogen infrastructure. This phase will see the construction of the hydrogen corridor between Berlin, Hamburg, North Rhine Westphalia and Hessen. The CEP aims to have 50% of its hydrogen provided by renewable energy systems and they anticipate that wind energy will be a significant source of hydrogen by 2020. ITM Power agent for Germany, Phil Doran, commented: "Germany is clearly the leading centre for hydrogen infrastructure development in Europe and ITM Power is now fully engaged with the key players. Germany's renewed emphasis on renewable energy following its review of nuclear technology is focusing attention on energy storage and the use of hydrogen in particular. This is a very exciting time for the company."



NOW and Japan's New Energy and Technology Development Organization (NEDO), jointly hosted a workshop in Berlin this summer. The workshop focused on exchanging information on operational experiences; regulations, codes and standards; and commercialization plans for fuel cells in both transportation and stationary applications. Some of the delegates are seen here with a hydrogen powered bus. www.now-gmbh.de
www.itm-power.com

BALLARD FUEL CELLS FROM KILOWATTS TO MEGAWATTS

CITY COUNCIL USES FUEL CELL BACK UP

Meiningen City Council in Germany is using a fuel cell to provide extended duration backup power for its critical information technology services. Ballard Power Systems' FCgen®-1020ACS fuel cell stack is the power source for the ten kilowatt (kW) backup power system deployed by Heliocentris Energy Solutions AG, the specialist in environmentally-friendly energy storage solutions.



Backup power solutions based on fuel cell technology deliver a number of advantages over conventional batteries and diesel generators, including higher reliability across a wide range of operating conditions, lower maintenance costs and longer operating life, as well as reduced size, weight, installation footprint, noise signature and environmental impact. Ballard's FCgen®-1020ACS fuel cell stack gives all of these advantages, with its compact and cost-effective air-cooled design.

The Heliocentris direct hydrogen system is hybridized with lithium-ion batteries and replaces an uninterruptible power supply system using lead-acid batteries, which has proved to be insufficient for long power outages. This installation is the latest in a series of field trials demonstrating the capabilities of the Heliocentris solution to meet industrial customers' requirements for remote

monitoring stations, emergency power supplies and auxiliary power units. The trial in Meiningen is being supported by the German Federal Ministry of Transport, Building and Urban Development, as part of the National Hydrogen and Fuel Cell Technology Innovation Programme. NOW GmbH is coordinating the programme.

BALLARD RECEIVES DOE AWARD FOR COST REDUCTION

Ballard Power Systems is the only commercial enterprise to receive a 2011 Annual Merit Review Award from the US Department of Energy. The award recognizes Ballard's success in reducing the manufacturing cost of gas diffusion layer (GDL) material, a critical component of the membrane electrode assembly used in every Ballard fuel cell product.

Implementation of improved process control tools, the installation of web-handling equipment and initiatives focused on the production process have facilitated high-volume production of GDL material at Ballard. This has reduced the fabrication cost of each PEM fuel cell product from \$36 down to \$16 per kilowatt. Bill Foulds, President of Ballard's material products division, said that GDL cost reduction contributes directly to their corporate goal of lowering fuel cell product costs by a further 20%-25% this year. Ballard's material products division is the only major North American manufacturer of GDL fuel cell material and their products are designed to meet the rigorous demands of a wide range of fuel cell applications, from kilowatt-scale backup power systems to megawatt-scale distributed generation solutions.

1MW DISTRIBUTED GENERATION SYSTEM POWERED BY RENEWABLE BIOGAS

Ballard Power Systems recently entered the distributed generation market and is now deploying a one-megawatt CLEARgen™ fuel cell generator that will provide peak electrical power and heat at the sales and marketing headquarters of Toyota Motor Sales U.S.A., Inc in Torrance, California. Michael Goldstein, Ballard's Chief Commercial Officer said, "This agreement with Toyota for our CLEARgen™ system reaffirms the attractiveness of fuel cell power generation solutions for large-scale needs. The ability to 'power up' and 'power down', load-follow and dispatch power when required, are all keys to our flexible and reliable grid-scale solutions."

The CLEARgen™ fuel cell system will utilize hydrogen produced by steam-reformation of renewable bio-gas generated at a landfill site and will enable Toyota to satisfy peak and mid-peak power needs using electricity from either the fuel cell system or from the power grid. CLEARgen™ will provide power for a number of locations on the multi-building campus, including Toyota HQ and the data centre operations building. It is estimated that the system will reduce consumption of peak grid power and avoid up to 10,000 tons of CO2 emissions annually. Mark Yamauchi, Toyota Motor Sales Facilities Operations Manager, said that the ability to offset peak electricity usage with an emission-free fuel cell system will create significant savings, while reducing their environmental footprint. Heat created by the fuel cell system will also be utilized to provide hot water and space heating. This will offset natural gas consumption, thereby avoiding as much as a further 28 tons of CO2 emissions annually.

The system is expected to be commissioned in 2012, with project

funding contributed by California's Self-Generation Incentive Program (SGIP). A stationary fuel cell power generation platform, currently under development at Ballard and financially supported by Sustainable Development Technology Canada (SDTC), will be utilized.

ASIA-PACIFIC PROJECT WITH MUNICIPAL SOLID WASTE

Ballard Power Systems is working with GS Platech, one of South Korea's largest petroleum refiners, to demonstrate waste-to-energy power generation using zero-emission fuel cells and hydrogen produced from processing municipal solid waste. GS Platech's pilot plant in Cheongsong, South Korea is capable of treating five tons of organic solid waste per day using plasma gasification technology and producing sufficient high purity hydrogen to generate 50 kilowatts (50kW) of clean power. Ballard will supply a fuel cell generator that will be fuelled by this hydrogen, based on its Dantherm Power DBX5000 technology.

"While conventional waste combustion - such as garbage incineration - can lead to the discharge of carcinogenic pollutants, our technology drastically reduces emissions," said Young Suk Kim, Vice-President of GS Platech. "This could certainly open up another very promising application for hydrogen fuel cell technology."

Plasma gasification plants are another good source of high quality hydrogen, in addition to hydrogen-producing chemical operations, such as chlor-



DBX5000H48-B-HV

alkaline plants," said Michael Goldstein, Ballard's Chief Commercial Officer. "On a larger scale, this solution can produce a significant amount of electricity that could be sold back to the grid." This will be the first demonstration of a waste-to-energy solution incorporating both these technologies.

Following upon successful demonstration, GS Platech intends to further promote this technology to new customers worldwide. The treatment of municipal solid waste is a growing problem in many nations, including Asia Pacific countries with high population densities, such as China, India, Korea, Japan and Singapore. This solution can potentially allow municipalities to address two key environmental issues in tandem - environmentally responsible waste treatment - as well as clean power production.

This project is undertaken with the financial support of the Government of Canada provided through the Department of the Environment, under the framework of the Asia-Pacific Partnership on Clean Development and Climate. This Partnership is a group of public and private sector partners focused on expanding investment and trade in cleaner energy technologies in key market sectors. (www.asiapacificpartnership.org) (www.gsplatech.co.kr)

6 MW DISTRIBUTED ENERGY SYSTEM FOR INDUSTRY

Ballard Power Systems has been conditionally awarded up to Canadian \$7 million by Sustainable Development Technology Canada (SDTC).

This funding will be used to extend the operating life and lower the product cost of their FCgen™-1300, the fuel cell that powers the CLEARgen™

distributed generation system. The first application of this new lower cost distributed generation solution is expected to be a 6 MW CLEARgen™ system at the ERCO Worldwide sodium chlorate plant in North Vancouver, British Columbia. The ERCO plant generates large quantities of hydrogen, as a by-product of sodium chlorate production. This by-product hydrogen can be used to power the Ballard CLEARgen™ system to generate megawatts of clean electricity.

Paul Timmons, President of ERCO Worldwide stated, "Electricity represents over 70% of our input costs, so this new fuel cell power generator will be a valuable cost management tool. It also supports our corporate goal to make efficient use of available resources as we continue measures to lower our carbon footprint." Terasen Gas, a leading integrated energy provider, will undertake a feasibility study to look at the use of heat created by the CLEARgen™ system at ERCO's site for district heating applications in North Vancouver. Subject to final agreements being approved, the manufacturing and site commissioning work is planned for 2012-13.

John Sheridan, Ballard's President and CEO said, "This SDTC award, along with the co-investments by Ballard and ERCO, will enable our CLEARgen™ solution to become more competitive with grid power in regions that support zero-emission clean energy generation. This is a win-win-win program for Ballard, Vancouver and Canada, since it enables clean energy generation in Canada and export opportunities." www.ballard.com

NEWS

EXPONENTIAL GROWTH OF LARGER SOFC

Bloom Energy® has announced a significant expansion of its manufacturing facility in Sunnyvale, California. The Company expanded its workforce by over 70% in 2010 alone, and has, over the past decade, experienced exponential growth to meet the increasing demand for Bloom Energy Servers™. "Bloom Energy's decision to create clean tech jobs in Silicon Valley is more evidence that California is the epicenter of innovation and industry," said Governor Brown. "Our state is at the forefront of the growing clean technology sector, which is creating the jobs of the 21st century." Approximately 120 Bloom Boxes have been deployed across California, reducing the carbon footprint and operating costs for its customers.

STORAGE FOR FUTURE ENERGY SYSTEMS

ITM Power is participating in a project with E.ON, eminate Limited, the University of Nottingham, Teer Coatings Ltd (Miba Coating Group) and Sunamp Ltd, which is part-funded by the UK Government-backed Technology Strategy Board. Hydrogen is accepted as an integral part of the move towards clean, sustainable energy systems, but one of the main issues yet to be resolved in a commercially viable way is that of safe and cost effective gas storage. One attractive option is the use of solid hydrides that can absorb and release hydrogen on demand at relatively low pressures. However, storage systems must combine optimum gas kinetics with the practicalities of system manufacturing and safety.

A novel approach was addressed successfully in a feasibility study funded by the Technology Strategy Board,

which will be progressed in this latest project. ITM Power's role will be to test and critically analyse the hydrogen storage hydrides produced by the project partners. The hydride stores will be directly coupled with ITM's electrolyzers and the hydrogen will be re-used in fuel cells. ITM Power will analyse the efficiencies of the system and the ease of use, as well as contributing to market analysis. Dr. Graham Cooley, CEO of ITM Power commented: "Energy storage will be the critical component in future energy systems and ITM Power is at the centre of this technology. There will be many solutions to the energy storage conundrum and all of the solutions will be required if we are to harness renewable energy successfully."

www.itm-power.com

NEW BUSES IN HAMBURG

Hamburger Hochbahn AG has acquired four new generation Mercedes-Benz Citaro FuelCELL Hybrids under the German "NaBuZ demo" scheme to promote sustainable bus systems for the future. Three more buses are to follow next year. Hartmut Schick, head of Daimler Buses, handed over the first two buses of this new generation to Günter Elste, CEO of Hamburger Hochbahn and said: "This transport company has already acquired good experience with its trials in Europe of fuel cell buses from the previous generation. Passengers and drivers were delighted with the new technology."

Günter Elste observed: "According to all the forecasts, 20 to 25 years from now mineral oil and, in turn, diesel will be in short supply and too expensive to be a viable fuel for buses. From the coming decade on, Hochbahn thus aims to purchase only electrically driven zero-emission buses. Commissioning this new generation of buses represents an important step on the road to electric mobility." Demonstration of the Citaro FuelCELL Hybrid buses is to take place on Hochbahn's regular services.



The "NaBuZ Demo" project receives funding through the federal transport ministry's National Innovation Programme and is coordinated by NOW GmbH. The project is integrated into the Clean Energy Partnership (CEP) and there will also be close cooperation with the European Clean Hydrogen in Cities (CHIC) project, in which 26 fuel cell buses are being run in five European cities.

The Citaro FuelCELL Hybrid operated by Hamburger Hochbahn AG features a number of key innovations since the first fuel cell buses went into trial operation in Hamburg in 2003. Lithium-ion batteries are used to store energy recovered from braking and powerful electric motors in the wheel hubs offer a continuous output of 120 kW.

The advanced fuel cells are designed for an extended service life of at least six years or 12,000 operating hours. These improvements result in almost 50% reduction in hydrogen consumption compared with the previous generation, while maintaining a range of around 250 kilometres. The drive system with the fuel cells is virtually maintenance-free and has a very long service life.
www.media.daimler.com

EVENTS

26th-27th September 2011, f-cell congress. International focus on mobile applications: fuel cells and batteries moving the future. Stuttgart.
www.f-cell.de

31st October – 3rd November 2011 Fuel Cell Seminar and Exposition Florida, USA. www.fuelcellseminar.com

Fuel Cell Power brings you news about fuel cells and related technologies as it arises. Our Blog covers all types of fuel cells and their applications for portable power, CHP and transport. Fuel cells utilize fossil fuels or energy from waste very efficiently. They can be powered by hydrogen which balances the electrical load obtained from intermittent renewable energy sources. Articles and features on the operation of fuel cells will enable potential operators to plan for long term energy efficiency, price stability and cuts in harmful emissions.

www.fuelcellpower.org.uk

Fuel Cell Power provides information on the practical application of fuel cells. It is produced by the family and friends of the late Dr F T Bacon OBE, FRS, who dedicated his life to the development of fuel cell technology.

Information can be obtained from: Jean Aldous, Editor, Fuel Cell Power, The Gallery, The Street, Woolpit, Suffolk, IP30 9QG.

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