

# FUEL CELL POWER

*The magazine for the power source of the future*



## HEADLINE NEWS

Around the world huge investments are being made in new energy technologies to meet growing demands for secure, low carbon energy supplies. Fuel cells powered by renewable biogas are beginning to provide electricity, heat and cooling around the clock. The US Government has launched their draft plan for the implementation of hydrogen and fuel cell technologies, which they envisage can address critical challenges in all energy sectors - commercial, residential, industrial and transportation.

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# GROWING MARKETS FOR DISTRIBUTED ENERGY

## RENEWABLE ENERGY 24/7

G3 Power Systems Inc is installing one of FuelCell Energy's 1.4MW fuel cell power plants at Olivera Egg Ranch in French Camp, California. This is the first order by G3 under their agreement with FuelCell Energy which gives them non-exclusive distribution rights for fuel cell power plants. The fuel cell will utilize renewable biogas for fuel, converting what is currently a waste problem for Olivera Egg Ranch into clean electricity that is generated at the point of use. The waste stream from the poultry operation emits ammonia, methane and other gases, resulting in both environmental and economic disposal challenges.

Ed Olivera, owner of the ranch said, "This pioneering fuel cell power plant enables me to convert the waste stream from my poultry operations into biogas, which in turn is processed into clean, green power. My waste disposal costs will decrease as will my power bill, as the poultry operation will continually generate the fuel needed to create electricity, which is planned to meet all our power needs. The by-product heat from the fuel cell energy conversion process will be directed to the anaerobic digester, avoiding the need for a combustion-based boiler to provide the necessary heat for the digester process. This will increase the overall efficiency of the fuel cell power plant, while reducing greenhouse gas emissions. The power plant is expected to be operational by mid 2011 and FuelCell Energy will service it under a five year agreement.

Ray Brewer, President of G3 Power Systems, explained that they had evaluated all of the power generation options in the marketplace today and identified fuel cell power plants as the best commercial technology available to meet baseload power needs in an efficient and environmentally friendly

manner. They have identified a number of opportunities in agriculture, along with other commercial opportunities, that are well suited for fuel cell applications and look forward to developing their relationship with FuelCell Energy to grow the market for fuel cells. G3 has completed 14 energy projects including fuel cells, solar and biomass applications, and is currently under contract to design three different fuel cell projects, each of multiple megawatts. G3 provides complete turn key fuel cell installations along with engineering and construction services and power purchase agreements. Chip Bottone, Senior Vice President of FuelCell Energy, commented: "Converting agricultural waste into renewable biogas and then into clean power is a large market for fuel cells."

## ELECTRICITY FROM RENEWABLE BIOGAS

A 2.8MW DFC3000 power plant has been purchased by UTS BioEnergy LLC for installation at a wastewater treatment plant operated by Inland Empire Utilities Agency (IEUA), a municipal water district based in Chino, California. UTS BioEnergy will sell the power generated from the biogas to IEUA under a 20 year power purchase agreement.

*Front cover: Fuel cell plant at Pohang, South Korea, built by FuelCell Energy's partner, POSCO Power.*

FuelCell Energy will service the power plant under a long term service agreement and the unit is expected to be operational in early 2012. Terry Catlin, Board President of IEUA, said: "Installation of this fuel cell operating on renewable biogas is an important component of our renewable energy generation strategy. The clean electrical generation process and the reliable 24/7 operating nature of the fuel cell will help us attain the objectives of our strategic energy plan and position us to meet ever more stringent clean air emission requirements."

Arun Sharma, Vice President Business Development of UTS BioEnergy, added: "Fuel cells represent an economically and environmentally compelling solution for converting renewable waste streams into clean electricity. We believe fuel cells are a critical component of improving the reliability and efficiency of power supplies and expect to replicate this fuel cell business model with other power users that have baseload 24/7 energy requirements." This distributed generation fuel cell helps the IEUA reach its goal of generating all of their power needs on-site in a renewable manner and reducing reliance on the electric grid.

The Eastern Municipal Water District (EMWD) in California has purchased two more of FuelCell Energy's 300kW DFC300 fuel cells, which will be fuelled by renewable biogas. EMWD is already operating three of FuelCell Energy's DFC300 fuel cell power plants at their Moreno Valley wastewater treatment facility. Ron Sullivan, Board President, EMWD, said that they have been very pleased with the reliability of the system. EMWD operates around the clock and they value the energy security that an on-site fuel cell provides.

The EMWD new wastewater treatment plant under construction at Perris Valley, Riverside, has been designed to be environmentally friendly and energy efficient, so the ultra-clean power generation by the fuel cell



power plant was an important aspect of their purchasing decision. The efficiency of fuel cells can exceed 80% when by-product heat is utilized and, due to the lack of combustion, virtually no harmful NOx, SOx or particulate matter pollutants are emitted by the fuel cells.

This ultra-clean power generation will help the EMWD meet the stringent emission regulations issued by the South Coast Air Quality Management District. Fuel cells that operate on biogas are powered by renewable energy, but unlike other renewable technologies, such as wind and solar, DFC fuel cells deliver 24/7 baseload power, which is critical to the operation of waste water treatment plants. EMWD will receive a \$2.7 million grant from the State of California under the Self Generation Incentive Program for this renewable fuel cell power plant project.

The Water Pollution Control Plant in San Jose, California, is also acquiring one of FuelCell Energy's 1.4MW fuel cell plants powered by biogas. Dale Ihrke, Plant Manager commented "About two-thirds of the energy used by our 11 MW facility comes from methane derived from digester and landfill processes. We want to operate as much as possible on clean, sustainably-produced electricity, and adding this fuel cell generated power to our energy portfolio will help us do that. We're also getting the fuel cell generated power at a reasonable, known price over the 20-year term, helping to remove uncertainty in future power costs."

## SAN DIEGO UTILIZES BIOGAS FOR HEAT, POWER AND COOLING

FuelCell Energy has also sold 4.5MW of power plants to BioFuels Fuel Cells, LLC, a California renewable energy company. Three fuel cell power plants, a 2.8 MW DFC3000, a 1.4 MW DFC1500 and a 300kW DFC300, will be installed at different locations in the San Diego area and will utilize purified biogas from the Point Loma wastewater treatment plant. This project incorporates a unique solution that purifies and uses the biogas on site, and then injects surplus biogas into an existing gas pipeline to supply fuel cells at two other locations in the San Diego area. Termed 'directed biogas,' this project will represent the first time that a FuelCell Energy power plant will be fueled by renewable biogas generated at a distant location. The Mayor of the City of San Diego, Jerry Sanders, said: "The citizens of San Diego will benefit from this project as we protect our air quality while also generating revenue for the City. This is yet more proof that San Diego is leading the change in the exciting world of clean energy technology."

Two of the fuel cell power plants will be configured to utilize the by-product heat from the electrical generation process, which will enable them to achieve up to 90% efficiency. The 2.8 MW DFC3000 will be installed at the University of California-San Diego to supply power to the campus electrical grid. The by-product heat from the fuel cell energy generation process will be utilized as a continuous power source for 320 tons of chilling capacity to cool campus buildings, thereby increasing the overall efficiency of the power plant and generating cost savings for the University. "Our new biogas-fed fuel-cell project will improve the reliability and flexibility of the campus power grid and it will also be an important step towards achieving the university's goal of climate neutrality by 2025," said Gary C. Matthews, Vice Chancellor of Resource Management

and Planning, University of California-San Diego. The by-product heat from the 1.4 MW DFC1500 will meet the heating needs of the pumping station at the South Bay Water Reclamation Plant in San Diego.

## FUEL CELL OR LEAN BURN ENGINE?

The Rancho California Water District (RCWD) has purchased a 1.4 MW fuel cell to power a pumping station located in Temecula, California. The plant will use natural gas as fuel and is expected to be operational by late 2011. Corey Wallace, Engineering Manager, Rancho California Water District said, "RCWD's 2010 Strategic Plan included an objective to evaluate the use of renewable and efficient energy systems when economically appropriate. The favorable cost profile of the fuel cell power plant and the ability to meet current and future emissions requirements drove this purchasing decision. The high efficiency of the fuel cell will decrease the amount of natural gas that we purchase, generating savings, and the estimated lifecycle costs of the fuel cell power plant, when coupled with available financial incentives, are lower than the alternatives considered."

Their analysis included an evaluation of the economics, compliance with future expected emissions regulations, protection against energy price volatility, reliability/redundancy, maintenance simplicity and noise considerations. RCWD chose electric pumps powered by a DFC1500 fuel cell power plant as the fuel cell emits virtually no pollutants, generates higher electrical efficiency, and offers the most attractive economics compared to the alternatives considered. The electrical efficiency of the fuel cells is 47% compared with 34% efficiency estimated by the District for lean burn reciprocating engines, one of the alternatives considered. This higher efficiency will reduce the amount of natural gas purchased, resulting in fuel savings for customers and lower

greenhouse gas emissions compared to combustion based power sources.

## CLEAN AIR, SAFETY AND OPERATIONAL STANDARDS

FuelCell Energy's 2.8MW DFC3000 power plant, operating on natural gas, has been certified under the California Air Resources Board's distributed generation emission standards that were established in 2007. "This clean air certification is important for our clients as it demonstrates the ability of Direct FuelCell power plants to meet challenging clean air standards," said Jeff Cox, Director Policy Development, FuelCell Energy, Inc. "Our technology generates ultra-clean electricity, an attribute that is highly valued in locations with strict air pollution standards, such as the State of California. Combustion based sources of power generally require clean air permits, which are sometimes difficult to obtain in certain regions of California."

Additionally, the DFC3000 received certification that the power plant meets national product safety standards. This assures local authorities and insurers that the power plant meets all design, construction, quality, safety and operational requirements and confirms that the power plant can be safely connected to the existing power infrastructure.

These certifications help to simplify and accelerate the approval process for installing distributed generation DFC3000 power plants. The DFC3000 joins FuelCell Energy's other power plants that previously attained these certifications, including the DFC1500 and DFC300.

## RELIABLE AND SECURE POWER GENERATION



*Fuel cells provide 70% of the electricity at Pepperidge Farm Bakery, Bloomfield, Connecticut and greatly improve the reliability of electricity at the site.*

FuelCell Energy has recently announced the sale of a 300 kilowatt DFC300 fuel cell power plant to LOGAN Energy, which will install the system at the frozen food processing facility of Carlo's Pasta, Inc., South Windsor, Connecticut.

Sergio Squatrito, Vice President, Operations, of Carla's Pasta, said "We operate our frozen pasta plant 24 hours per day and were attracted by the fuel cell power plant's reliability and energy security as it generates power right on our property. The high efficiency of the fuel cell power plant decreases our fuel and electrical costs, and lowers our carbon footprint. Our environmental stewardship is further enhanced with the installation of these fuel cells as the energy generation process emits virtually zero harmful pollutants." Sam Logan, Jr., CEO of LOGAN Energy, commented, "We are providing a fully functional turn-key fuel cell power plant for our customer, Carla's Pasta, Inc. Partnering with FuelCell Energy enables us to offer our customers economical power generation that is highly efficient, environmentally friendly and reliable." The purchase of this fuel cell power plant was partially funded by a \$750,000 grant from the Connecticut Clean Energy Fund and it is expected to be operational next summer.

The US Navy is also acquiring two of FuelCell Energy's 300 kilowatt fuel cell power plants for operation at the U.S. Naval Submarine Base New London, located in Groton, Connecticut. The two DFC300 fuel cell power plants will be installed adjacent to the existing energy plant on the Base and will provide reliable base load electricity. The by-product heat generated by the fuel cell energy conversion process will be utilized for pre-heating the water used in the boiler at the existing energy plant, thereby increasing efficiency and reducing fuel costs. The high efficiency of the fuel cell also reduces greenhouse gas emissions, improving the carbon footprint for the Base. LOGANEnergy will purchase, install and operate the fuel cell power plants, subcontracting maintenance services to FuelCell Energy.

## ON SITE HYDROGEN PRODUCTION FOR INDUSTRIAL PROCESSES

Another advantage of versatile fuel cells is that they can be utilized onsite to provide hydrogen for industrial processes. FuelCell Energy has been awarded approximately \$2.8 million by the U.S. Department of Energy to demonstrate the hydrogen production capacity of a Direct FuelCell power plant for industrial users of hydrogen. For this first-of-a-kind industrial application, FuelCell Energy will demonstrate how a 300 kW DFC300 fuel cell can produce hydrogen for use by the metal processing industry, along with clean electricity and high quality heat. The fuel cell will be installed at a metal processing facility owned by ACuPowder International LLC, located in Union, New Jersey.

The fuel cell system produces its own hydrogen internally from the hydrocarbon fuel and unutilized excess hydrogen from the exhaust is available at no additional cost. Co-production of electricity and hydrogen offers a potentially lower cost option for the hydrogen infrastructure. High temperature fuel cell power plants can

produce electricity, hydrogen and heat at an overall efficiency of 80-85%. The electricity produced on-site can power the local grid, while hydrogen can be used for fuel cell vehicles or industrial customers. The fuel cell power plant cost is paid for by the on-site power sold to the grid, and the by-product hydrogen is available practically for "free" except for the cost of its separation. The ability to generate multiple products and the flexibility to vary the hydrogen and electricity production to match with the on-site demand helps to improve the overall economics of on-site hydrogen generation.

The metal processing industry uses significant amounts of electricity and heat, along with industrial gases such as hydrogen, to treat metal prior to stamping, shaping or forming. ACuPowder uses this process, which is termed annealing, to make powdered copper. This project will capitalize on the versatility of fuel cells by configuring the fuel cell to generate three value streams: clean electricity, hydrogen, and high quality heat. The objectives of the project are to demonstrate a highly efficient and clean fuel cell that will reduce costs for a metal processor, including electricity and heat, as well as the costs associated with purchasing, transporting and storing industrial gases. The DFC300 can generate about 300 pounds of hydrogen per day which generally meets the daily requirements of the ACuPowder facility. The cost of hydrogen to an industrial operation depends on the volume of hydrogen purchased and the distance from the production source. An industrial operation using this amount of hydrogen may pay up to \$5 per pound, or approximately \$325,000 to \$550,000 per year, depending on their location. The hydrogen produced by the DFC300 is expected to substantially reduce this cost. There will also be a reduction of greenhouse gas emissions by approximately 12,000 tons annually.

"We expect this fuel cell configuration to allow us to operate more efficiently by reducing electricity, heat and industrial gas costs at our New Jersey location," said Edul Daver, President of ACuPowder International LLC. "These costs are substantial and represent a significant portion of our total operating expenses so this project has the potential to make our Company more competitive globally." The target markets for this fuel cell application are industrial consumers of hydrogen, including the metal treating and annealing industry and the transportation industry. There are over 600 companies in North America operating in the metal treating and annealing industry, which are potential customers for this technology and the international market is potentially larger.

## HIGH PRESSURE HYDROGEN COMPRESSOR

The U.S. Department of Energy (DOE) has also awarded approximately \$2 million to FuelCell Energy to further develop and demonstrate a highly efficient and reliable method for compressing hydrogen for storage under high pressure, utilizing its solid-state Electrochemical Hydrogen Compressor (EHC) technology. DOE's Fuel Cell Technologies Program fosters the development and enhancement of technologies that will expand the market for hydrogen and fuel cell technologies for both transportation and stationary power generation. Hydrogen is generally produced at a different location from where it is used, resulting in the need for transportation and storage. High compression storage is an important component for expanding the use of hydrogen, particularly for vehicle refueling.

Fuel cells generate electricity using an electrochemical process, without combustion and the by-products of this electrical generation process include heat and hydrogen. Utilizing these by-products allows the DFC® power plants to generate three revenue streams: clean electricity:

usable high quality heat; and hydrogen for vehicle refueling or industrial uses. Fuel cells provide reliable power around the clock and can be located at the point of use for the hydrogen. The benefit of the EHC technology is the ability to compress the hydrogen produced by the fuel cell for on-site storage and use at a later time. Additionally, the EHC technology has no moving parts, which should enhance reliability while potentially decreasing costs compared to traditional, multi-stage mechanical compressors.

FuelCell Energy has already received an achievement award from the DOE for the successful demonstration of single stage EHC technology to compress hydrogen to 3,000 pounds per square inch (psi). Under the new contract, the Company will enhance its existing EHC technology to compress greater quantities of hydrogen efficiently and cost effectively at 3,000 psi, in order to target the market for industrial users that currently use multi-stage mechanical compressors.

They will also develop an EHC prototype within the next three years to compress hydrogen to 12,000 psi to meet the requirements for hydrogen vehicle refueling. "Efficient and cost effective hydrogen compression is a key enabler for hydrogen-powered vehicle refueling or for using hydrogen as a fuel for power generation" said Christopher Bentley, Executive Vice President, Government R&D Operations, FuelCell Energy. "Our existing fuel cell technology provides a unique and economically compelling approach to generating clean power, usable heat and hydrogen. Capturing and storing this excess hydrogen by-product from the fuel cell potentially opens new markets for our fuel cell technology." [www.fce.com](http://www.fce.com)

## NEWS

### HYDROGEN HAWAII



The Gas Company (TGC), the major gas supplier on Hawaii, is linking up with General Motors in a project which could change the island's transport to hydrogen fuel cell power. The State is committed to reducing petroleum use by 70% through a combination of renewable energy resources, conservation and efficiency.

TGC already adds more than 5% of hydrogen to its synthetic natural gas and plans to tap into its 1,000 mile utility pipeline system at key locations. The hydrogen will be separated by a proprietary process for use in fuelling stations for hydrogen fuel cell vehicles. Chevrolet fuel cell vehicles are part of GM's 'Project Driveway', the world's largest demonstration of fuel cell vehicles and they are aiming for commercialization by 2015. Charles Freese, executive director of GM Global Fuel Cell Activities, said that the Hawaii infrastructure could eventually support tens of thousands of fuel cell vehicles. [www.gm.com](http://www.gm.com)

### US PLAN FOR HYDROGEN AND FUEL CELLS

The US Department of Energy (DOE) has published their draft *Hydrogen and Fuel Cell Program Plan*, which envisages that hydrogen and fuel cells can address critical challenges in all energy sectors - commercial, residential, industrial, and transportation. In the last few years,

DOE has greatly advanced the state of the art of hydrogen and fuel cell technologies, making significant progress toward overcoming many of the key challenges to commercialization, including reducing the cost and improving the durability of fuel cells, reducing the cost of producing and delivering hydrogen, and developing technologies to improve the performance of hydrogen storage systems. The *Hydrogen and Fuel Cell Program Plan* presents the broad benefits that hydrogen and fuel cells can provide to the nation, as well as the advantages that they offer to the end-user in a variety of applications. Advances made by the Hydrogen and Fuel Cell Program can be seen in the marketplace today. Commercial customers are choosing fuel cells for the benefits they offer, including increased efficiency and reliability; clean, quiet, low-maintenance operation; and reduced lifecycle costs. The draft *Hydrogen and Fuel Cell Program Plan* is available now and will be followed by the final report in 2011. [www.eere.energy.gov](http://www.eere.energy.gov)

### REPORT BACKS ELECTRIC VEHICLES

A *Portfolio of Power-Trains for Europe* examined a range of different vehicle power-trains and found that both fuel cell and battery powered electric vehicles could be cost-competitive with internal combustion engine vehicles by 2020. The costs for a hydrogen infrastructure are comparable to installing a charging infrastructure for battery-electric and plug-in hybrid electric vehicles. The fuel cell cars could become the best low carbon substitute for family cars. The report's sponsors included BMW AG, Daimler AG, Ford, General Motors LLC, Honda R&D, Hyundai Motor Company, Kia Motors Corporation, Nissan, Renault, Toyota Motor Corporation, Volkswagen and the European Fuel Cells and Hydrogen Joint Undertaking, NOW GmbH. [www.now-gmbh.de](http://www.now-gmbh.de) [www.cafcp.com](http://www.cafcp.com)

## MERCEDES-BENZ STARTING SMALL SERIES PRODUCTION IN THE USA



In time for the Los Angeles Auto Show, Mercedes-Benz presented the new B-Class F-CELL as the first fuel cell powered electric car produced under series production conditions in the USA. The first vehicles will be handed over to selected customers before the end of 2010. In 2012 a total of around 70 of these environmentally friendly cars, which are being made available on a rental basis, will be operating on a daily basis in California. The full-service rental rate is 849 US Dollars excluding tax, with a contractual duration of up to 36 months.

Dr. Thomas Weber, a member of the Daimler AG Board of Management, said: "After more than 580,000 kilometers covered with the A-Class F-CELL trial fleet in practical operation, we will continue to build on our experience with the latest generation of electric cars with fuel cell drive. The fleet of 70 B-Class F-CELL cars in customer hands in California alone is more than twice the size of the U.S. A-Class fleet and a further milestone on the way to market maturity of this technology by 2015."

With an operating range of around 400 kilometres and short refuelling times, the Mercedes-Benz B-Class F-CELL combines locally emission-free mobility with long-distance comfort and compelling performance figures. The technical basis for the drive system of the B-Class F-CELL is the optimised, latest-generation fuel cell system. This is some 40% smaller than the system in

the A-Class F-CELL, which has been undergoing practical trials in the USA since 2004, but generates 30% more power, while consuming 30% less fuel. The cold-start capability of the B-Class F-CELL is down to minus 25 degrees Celsius.



In order to further the commercialization of fuel cell powered vehicles, Mercedes-Benz is involved in the California Fuel Cell Partnership (CaFCP), an association of automobile manufacturers, energy suppliers, government bodies and technology companies, as well as in the newly formed Fuel Cell and Hydrogen Energy Association (FCHEA).

The CaFCP is currently furthering the transition from a demonstration project to early commercialization of fuel cell drive systems at all levels, and the State of California has already made \$27 million available towards the development of a hydrogen infrastructure, with an additional \$14 million anticipated in 2011.

There are currently five public hydrogen filling-stations in the greater Los Angeles area, with four more due to be opened by the end of 2010 and one more in the San Francisco Bay area.

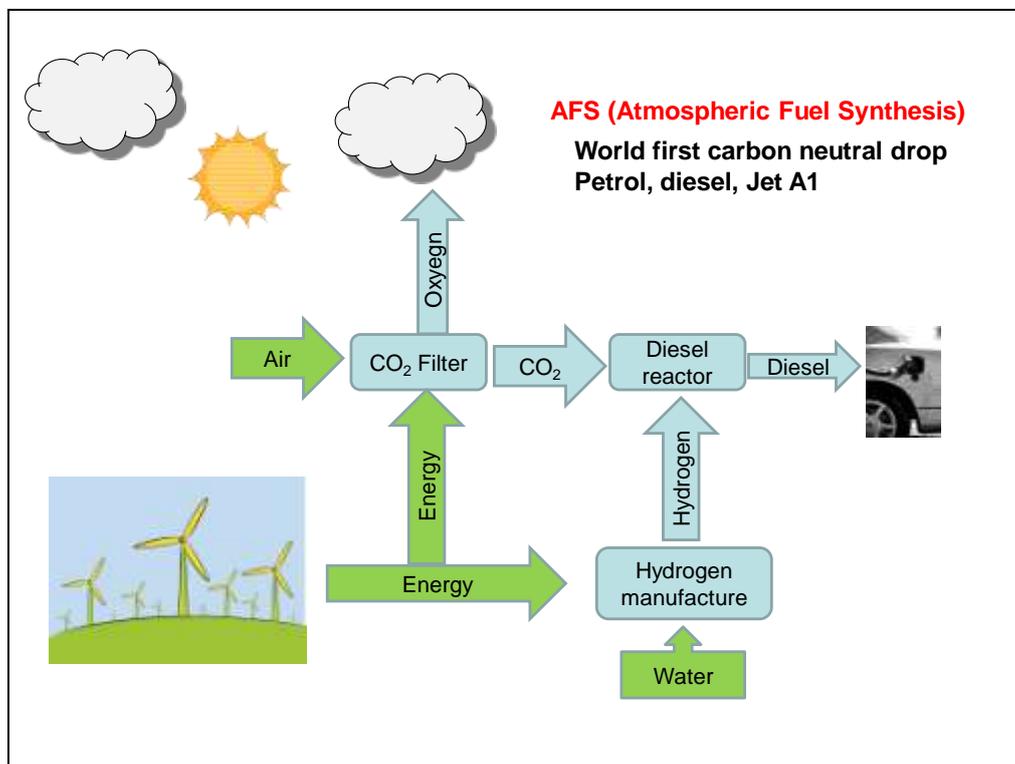
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# FUEL FROM RENEWABLE HYDROGEN AND CAPTURED CO<sub>2</sub>



Beacon Energy started experiments with hydrogen as a balancing medium for the intermittent supply of renewable electrical energy from wind turbines, solar power from PV, and hydro power, in order to give a constant supply of energy from an inconsistent, but sometimes surplus, supply. To this end they installed a 38kW DC electrolyzer, and carried out extensive evaluations of three different types of PEM fuel cell.

Prof Tony Marmont of Beacon Energy is preparing proposals for the future development of PEM fuel cells and in the meantime, this article focuses upon making fuel from renewable hydrogen. They have succeeded in designing, at an economic cost, a pilot plant for the production of a Carbon Neutral Petrol Diesel Jet A1, in a process which they have called air fuel synthesis. Following upon their success with the pilot plant, they have set up a new Company, Air Fuel Synthesis Ltd, in order to build a 10 ton a day plant costing £18m, leading to a standard unit producing 1,000 tons a day, requiring £6bn investment. The fuel is made from air. CO<sub>2</sub> is captured, as is water, and with the two raw materials, CO<sub>2</sub> and hydrogen, they are able to enter a Fischer Tropsch exothermic reaction to manufacture crude oil for fractional distillation into Carbon Neutral Jet A1, petrol and diesel.



Air Fuel Synthesis is using the hydrogen to make liquid fuels, in order to meet future requirements when fossil oil supply is insufficient to meet demand, mainly due to increasing uptake from China and India. There will be no need to manufacture a whole new world fleet of vehicles using fuel cells immediately, but this will be phased in as technologies mature, costs are reduced and the potential high efficiency of electrochemical conversion is achieved in vehicles.

Air Fuel Synthesis employs a carbon capture process that can be located wherever there is renewable energy, especially where that energy is stranded. Renewable energy is used to do what nature does with photosynthesis, converting atmospheric carbon dioxide back into organic molecules. This technology will significantly reduce CO<sub>2</sub> levels in the atmosphere.

[www.beaconenergy.com](http://www.beaconenergy.com)

[www.airfuelsynthesis.com](http://www.airfuelsynthesis.com)

## NEWS

### TOWARD A DISTRIBUTED-POWER WORLD

A leading international consulting firm, Boston Consulting Group, says the emergence of distributed generation (producing energy where it is needed, rather than centrally) is the biggest transformation to the power sector since Thomas Edison's invention of the light bulb! It also says that by 2020 renewable technologies and combined heat and power units could jointly provide more than 50% of all electricity consumed within the European Union. In their report entitled *Toward a Distributed-Power World: Renewables and Smart Grids Will Reshape the Energy Sector*, Boston Consulting Group says the power generation landscape worldwide is facing disruptive changes. "Europe's power utilities are entering a period of great uncertainty and change, with seismic shifts transforming the energy

landscape," the report says. "Energy security concerns and related worries about price and political volatility are driving governments across Europe to re-examine the source of energy supplies. The climate imperative has moved up the agenda, with European policymakers expressing clear political support for the move to a low-carbon society." Notably, the report analyses the investment needed to maintain the European power grid and concludes that the model of large centralized generation is "no longer sustainable". It says there are prospects for a distributed-energy system in which decentralized and renewable-power generation eventually displace conventional power plants, reducing the balancing role of the transmission grid and shifting intelligence to the distribution grid through the creation of local and regional energy systems.

[www.cfcl.com.au](http://www.cfcl.com.au)

### FEED-IN TARIFF PAID FOR FUEL CELL ELECTRICITY

The first of Ceramic Fuel Cells' BlueGen units being installed in public housing properties in Australia is now producing electricity from natural gas in a home in Melbourne. Origin Energy has offered all tenants who install BlueGen units a package of Green Gas plus a one-for-one feed-in tariff for the excess electricity generated by the BlueGen units. This means that a tenant who exports power to the grid will get a credit on their bill equal to the normal retail rate of electricity. The Victorian Minister for Housing, Richard Wynne, said: "I am delighted to see the first of the BlueGen ceramic fuel cells being installed, because each unit will save tenants money on bills and help lower Victoria's carbon footprint. It is estimated that these fuel cells will save each of Victoria's most vulnerable families hundreds of dollars each year on their energy bills." The Victorian Minister for Environment, Gavin Jennings, added that this new technology will also reduce carbon emissions. [www.cfcl.com.au](http://www.cfcl.com.au)

## GASES OR LIQUID FUELS?

In our occasional series about the next generation of fuel cells, we outline progress with Nordic Power Systems' generator, which incorporates SAFCell's medium temperature solid acid fuel cell. SAFCell Inc., based in California, has delivered a 250W solid acid fuel cell stack (SAFC) to Nordic Power Systems of Norway, for incorporation in their diesel auxiliary power units. The stack was integrated and tested with Nordic Power Systems' (NPS) proprietary cool flame diesel reformer system, converting the chemical energy of the diesel fuel directly into electrical power. Combining these two advanced technologies will result in the lighter, less costly diesel fuel cell systems that NPS plans to market, for both mobile and stationary auxiliary power applications.

The SAFC stack was operated on both dilute hydrogen and NPS' diesel reformate with insignificant difference in performance between the two fuel streams. Operation was at mid-range temperatures around 250°C and showed that the fuel cell could operate with up to 10% CO without any effect on the performance. This confirmed previously demonstrated SAFC tolerances to high levels of impurities that "poison" other lower temperature fuel cell technologies and dramatically decrease their performance. "This confirms that SAFCell's stacks are scalable to the sub-kilowatt level and are very robust for use with conventional fuels," stated SAFCell's founder and CEO, Dr. Calum Chisholm. Dr. Dag Ovrebo, the Technology Director for Nordic Power Systems added: "We are very excited by the results demonstrated so far by using this new innovative fuel cell technology in combination with our reformate gas from conventional fuels. Incorporating SAFCell's stacks may simplify our overall system and lead to both weight and efficiency gains."



Nordic Power Systems' APU demonstrator incorporates SAFC technology which was developed at California Institute of Technology (Caltech). The project is run with support from the Norwegian Research Council. NPS has signed an exclusive license agreement with Caltech for future commercialization of SAFC stacks for use with diesel and bio diesel fuels. SAFCell has a similar agreement for the use of all other "lighter" fuels including gaseous fuels such as propane and methane and liquid fuels such as gasoline and methanol.

Nordic Power Systems is developing efficient, environmentally friendly fuel cell power packs that enable nearly silent and emission-free power generation from commercially available fuels. Their cool flame reformer innovation allows for onboard, on-demand diesel or biodiesel reforming in fuel cell systems, thus opening a variety of markets for fuel cell applications. As a preparation for commercial introduction of the power packs, NPS is currently delivering its first demonstrators to selected partners. SAFCell Inc. is developing scalable solid acid fuel cell stacks for applications requiring tens of watts to tens of kilowatts. The SAFCell stacks' ability to tolerate fuel impurities enables them to run more easily on commercially available gas fuels, such as propane and butane, or liquid fuels, including methanol, diesel and bio-oils. SAFCell is partnering with targeted systems integrators to enter first portable, and then stationary power markets. [www.safcell-inc.com](http://www.safcell-inc.com)  
[www.nordicpowersystems.com](http://www.nordicpowersystems.com)

# NEWS

## FUEL CELLS FOR THE SMART GRID

The fuel cell CHP system developed by Ceres Power has successfully demonstrated its unique capability for rapid electricity load following in response to changing electrical loads being switched on and off, including lights and various standard domestic appliances. Operating on mains natural gas, the system incorporates a solid oxide fuel cell. It ran autonomously generating power on demand, exporting and importing electricity to and from the grid as needed. It also delivered the domestic hot water and space heating needs of a typical household, responding to calls for heat from a standard room thermostat. Peter Bance, Chief Executive Officer, Ceres Power, commented: "Ceres Power demonstrated the unique differentiation of its CHP product; a single wall-mounted unit that can directly replace a conventional boiler and rapidly follow the electrical load. Low-carbon despatchable power, which can be instantly ramped up or down, is what the energy world needs. We are now focusing on installing our CHP products in consumers' homes as part of the commercial field trials in conjunction with British Gas." [www.cerespower.com](http://www.cerespower.com)

## FUEL CELL POWER IN MANUFACTURING PLANTS

Plug Power Inc. is deploying a fleet of 86 GenDrive™ fuel cell units with customer, BMW Manufacturing Co., LLC. The power units will be used at BMW's newly constructed Greer, South Carolina automotive manufacturing plant in different types of pallet trucks manufactured by the Raymond Corporation and Crown Equipment Corporation. Plug Power's GenDrive units competed against lead-acid batteries and fast charge batteries and was deemed to be the best

power source for BMW's material handling fleet. GenDrive is able to offer BMW increased productivity of its lift truck fleet as well as a more efficient use of its facility space. Operational costs are reduced as a result of decreased operator and vehicle downtime. GenDrive fuel cells can be fueled by truck drivers in 60 to 180 seconds, whereas it takes specialized maintenance personnel an average of 20 minutes to change a depleted lead-acid battery.

BMW will also benefit from reduced greenhouse gas emissions by using GenDrive power units in its operations. The removal of toxic lead-acid batteries from this new facility also creates a safer environment for employees as well as the community and helps fulfill BMW's commitment to a hydrogen based economy. BMW Manufacturing's new 1.2 million sq. ft. assembly plant is being built north of its already-operational production facility. "With proven benefits to BMW's business and an existing hydrogen infrastructure in place, there is a high potential to convert the entire campus to GenDrive-powered material handling vehicles over the next three years," said Andy Marsh, Plug Power's CEO. Robert Hitt, Department Manager of Public Affairs for BMW Manufacturing said: "BMW is pleased to work with partners that share our commitment to clean production. The implementation of a hydrogen fuel cell based application for our material handling equipment helps to consolidate BMW's position as the leading, sustainable automotive manufacturer." Linde North America is supplying the indoor hydrogen fueling system to power the trucks. Mike Beckman, vice president of Linde's alternative energy team, said, "Linde's partnership with Plug Power allows us to use our expertise in alternative energy technology and supply systems to deliver safe, clean and efficient hydrogen fueling to BMW and other manufacturing and warehouse customers." [www.plugpower.com](http://www.plugpower.com)

## ADOBE INSTALLS LARGEST "BLOOM BOX"

Adobe Systems Incorporated and Bloom Energy Corporation have announced completion of the largest commercial Bloom Energy fuel cell installation to date, which is designed to supply approximately one-third of the electricity required by Adobe's San Jose headquarters.



A total of 12 Bloom Energy Servers – also known as Bloom Boxes – have been installed on the 5th floor of Adobe's West Tower. Each server is the size of an average parking space and contains thousands of Bloom solid oxide fuel cells – flat, solid ceramic squares made from a sand-like powder – which will convert air and biogas into electricity via a clean electrochemical process, producing zero net carbon emissions. Typically, one server generates enough power to meet the needs of approximately 100 average U.S. homes or one small office building.

Adobe is a recognized leader for its green building efforts, having earned distinction as the world's first commercial enterprise to achieve four platinum certifications under the U.S. Green Building Council's Leadership in Energy and Environmental Design program. As a Bloom Energy customer, Adobe can efficiently generate its own electricity on site, further reducing the company's carbon footprint, lowering energy costs and mitigating power outage risks.

Adobe expects its carbon footprint to reduce by the equivalent of taking 1,810 compact cars off the road annually. "Installing Bloom Energy fuel cells supports Adobe's efforts to remain at the forefront of utilizing impactful, clean technologies to reduce our environmental footprint," said Randall H. Knox, III, senior director, Global Workplace Solutions, Adobe. "We hope to be an example to other companies considering cleaner, more affordable energy sources for their operations."

"Adobe has long been a leader in setting the bar for environmental sustainability in Silicon Valley," said Stu Aaron, vice president of marketing and product management, Bloom Energy. "With its significant installation of Bloom Energy Servers, the company can now enjoy a smarter, localized energy source that will both reduce its carbon impact and its electricity costs. We're fortunate to work with companies that embrace responsible power consumption and make energy innovation a critical part of their business strategy."

[www.bloomenergy.com](http://www.bloomenergy.com)

## ELECTROLYZER SALES TO ASIA AND SOUTH AMERICA

Hydrogenics Corporation has received contracts for the delivery of four electrolyzers to customers in Argentina and Vietnam. The electrolyzers and associated services will be utilized by food processing facilities and thermal power plants, with delivery expected over the next six to nine months. "We are pleased to see further strengthening in our industrial end markets across most regions of the globe," said Daryl Wilson, Hydrogenics President and CEO. "This year has shown steady, rising demand for our high quality electrolyzers, setting the stage for continued improved operating performance."

[www.hydrogenics.com](http://www.hydrogenics.com)

## MORE PARTICIPANTS JOIN ITM'S HYDROGEN ON SITE TRIALS

Several more companies are joining Hydrogen on Site Trials (HOST) with ITM Power's transportable high pressure refuelling unit ("HFuel").

The Scottish Police Services Authority, which manages a fleet of 350 vehicles, has confirmed their participation in the HOST trials. Billy Andrew, Fleet Manager, said: "As an organization we are fully committed to reducing our impact on the environment and to incorporating more sustainable processes into the way we deliver our services to Scottish policing. We are pleased to support this trial and will be interested in reviewing the outcomes of the programme as a considered option for reducing the organization's carbon emissions."



Commenting for ITM Power, CEO Graham Cooley said: "The emergency services support sector manages significant fleets of vehicles and constitutes an important early adoption market. The signing of this agreement marks our entry into this important sector, and the involvement of the Scottish Police Services Authority allows us to evaluate our proposition to store renewable energy as a clean fuel for decarbonizing fleet vehicles which can return to base for refuelling."

Tarmac, The Commercial Group, Enterprise plc, May Gurney International Services plc, Amey and the RAC are also joining the HOST trials. Tarmac is the UK's largest quarrying company and its National Contracting division is the largest road

maintenance and highways services company in the UK. Dr Martyn Kenny, Head of Sustainability at Tarmac said: "There is an urgent need for the construction industry to reduce the carbon footprint of its vehicles. These important trials will help us assess the feasibility of decarbonizing vehicle fleets using hydrogen derived from renewable energy." The Commercial Group, the largest privately owned office services company in the UK, has received praise from Jonathon Porritt, Director of Forum for the Future, for continuing to demonstrate that profitability and business growth can be achieved through environmentally sound practices. Simon Graham, Commercial Group's Environmental Strategist commented: "Vehicle emissions are the largest element of our carbon footprint and a key factor in our environmental performance. As an innovator in low carbon logistics, we are constantly looking for ways to improve our performance and HOST will provide us with a unique opportunity to operationally assess what could be the most important decarbonizing technology for fleets."

### THE DRIVERS' AND FLEET MANAGERS' PERSPECTIVES

Enterprise Plc, the UK's largest dedicated provider of maintenance and front-line services to the public sector and utility industry, operates a fleet of approximately 8,000 vehicles on a return-to-base capacity. David Pattinson, Innovation Manager at Enterprise said: "ITM Power's hydrogen trials will provide us with the unique opportunity to assess energy storage and clean fuel from the perspectives of the driver and the fleet manager. It will help us deliver services with zero carbon emissions and improve air quality as part of our business."

May Gurney is committed to helping clients deliver sustainable

improvements to front-line services across the UK. In the public sector these include highway, environmental, recycling and facilities services. In the regulated sector the company provides utility maintenance services to the water and telecommunications industries, conducts railway maintenance in conjunction with Network Rail and also plays a vital role in the regeneration and maintenance of the UK waterways network. May Gurney Operations Director, Nicholas Salt, said: "As a company we are continuously striving to reduce our impact on the environment, whether through recycling, energy efficiency or the use of renewable energy sources." Amey is one of today's leading public services providers, managing the vital infrastructure and business services that practically everyone, everywhere relies on. The company operates a fleet of approximately 4500 vehicles and delivers services in the highways, roads, schools, waste, rail, fleet solutions, workspace, street lighting, commercial, housing and aviation sectors.

Other participants in HOST are Scottish Water, Scottish & Southern Energy, DHL Supply Chain, London Stansted Airport, Center Parcs, The Forestry Commission, Vestas Wind Systems AS and local authorities Sheffield City Council, the London Borough of Camden and Southampton City Council. The latest signatory to the HOST program is the RAC, which is one of the UK's leading motoring organizations, with around seven million customers. Their roadside recovery and patrol fleet numbers some 1,700 vehicles. Adrian McCarthy, Head of Technical Services, RAC, commented: "As an organization we are committed to reducing our operational emissions through our carbon management programme. We are therefore pleased to join ITM Power's hydrogen trials to enable RAC to appraise both the proposition for a zero carbon fuel and zero carbon emissions for patrol vehicles. Importantly the trial will also provide our roadside recovery and patrols with an invaluable insight into dealing with hydrogen fuelled vehicles at the roadside." [www.itm-power.com](http://www.itm-power.com)

## NEWS

### SUCCESSFUL TRIAL OF FUEL CELL RANGE EXTENDER

Proton Power Systems plc has announced that the first testing phase for their fuel cell range extender system for Smith Electric Vehicles has been successful. The Group is conducting trials on the 'Smith Edison' light commercial vehicle, which is based on the Ford Transit chassis. Once trials on the Smith Edison have been completed, Proton Power will commercially launch its system in the 'Newton', Smith's 7.5 to 12.0 tonne all-electric truck. The initial phase of the operation began in September 2010 at the Stuttgart DLR Institute and showed that the additional energy from Proton Power's fuel cell system provided a

significant increase to the operational range of the Smith Edison. Commenting on the fuel cell range extender system, Thomas Melczer, CEO of Proton Power, said: "We are delighted that the first phase of testing has been such a success and we believe it will provide a significant improvement for the market of electric powered light duty vehicles." Kevin Harkin, Sales Director for Smith Electric Vehicles, added: "Enhancing the range capabilities broadens the application for electric vehicles and we have already received notable interest from fleet operators in the Proton Power system. The second phase of testing will run until next summer and the Group expects the commercial launch of the vehicles towards the end of 2011." [www.protonpowersystems.com](http://www.protonpowersystems.com)

## 300MW ALKALINE FUEL CELL PLANNED

Energy pioneers Powerfuel Power Ltd, B9 Coal Ltd and AFC Energy Plc have signed a binding Letter of Intent to install AFC Energy's revolutionary fuel cell technology at Powerfuel's Hatfield site near Doncaster. Powerfuel is planning to build a 900 MW integrated gasification combined cycle (IGCC) station fuelled by its extensive coal resources and B9 Coal will be responsible for installing up to 300MW of AFC Energy's fuel cell technology alongside. The syngas used in the plant can be passed through a clean-up process to produce hydrogen as a feedstock for AFC Energy's low cost alkaline fuel cells, which convert hydrogen to electricity at 60% electrical efficiency. Grant Budge, Chief Operating Officer, Powerfuel, said "This venture with B9 and AFC supports our aspiration of leading the drive for low cost clean energy from fossil fuels." The agreement also includes an option to roll out the technology to further territories worldwide in the future.

Ian Balchin, CEO of AFC Energy Plc, commented: "This landmark agreement provides further market validation for our low cost, low carbon fuel cell technology in large scale power generation projects. Combined with growing opportunities in the industrial and waste-to-energy sectors, we believe it is truly transitional: solving the carbon conundrum of fossil fuels whilst enabling the renewable energy economy." AFC Energy's fuel cell technology is gaining considerable momentum across a variety of industries and applications, including the chlor-alkali sector, waste-to-energy, clean coal and natural gas. The deployment marks the second clean coal project in the UK to adopt AFC Energy's technology, following upon the bid by B9 Coal for the DECC carbon capture and storage demonstration competition. An independent technical report from the Centre for Process Innovation has confirmed major technical advances

made by AFC Energy, including the fabrication of new Beta electrodes. The company has moved towards a new metal based electrode system, which has a significantly higher volumetric power density and can be refurbished and reused. These electrodes form the basis of the new Beta system; the next generation alkaline fuel cell which is set to be officially launched in 2011. [www.afcenergy.com](http://www.afcenergy.com)

## COCA-COLA EMPLOYING UTC FUEL CELLS

Coca-Cola Refreshments USA (CCR) has announced that operations at its Elmsford, New York production facility are being powered by UTC Power fuel cells. UTC Power is operating two PureCell® Model 400 fuel cell systems that provide 35% of the electricity and heat required by the facility. The clean, efficient power plants will help the Company lower its energy costs and further its sustainability efforts.

A ceremony to commission the fuel cells was attended by leaders from CCR, UTC Power, and representatives of the New York State Energy R & D Authority (NYSERDA), which provided funding to support the fuel cell project. The Elmsford project will prevent the release of more than 2,600 tons of carbon dioxide and more than 4 tons of nitrogen oxide emissions. With its proven phosphoric acid-based fuel cell technology, the Model 400 has a 10-year stack life and overall system efficiency of up to 90%. "Coca-Cola Refreshments is to be commended for working to reduce its environmental impact by choosing clean, efficient fuel cells," said Francis J. Murray Jr., President and CEO of NYSERDA. "We hope Coca-Cola's use of innovative fuel cell technologies will serve as a model for industries and manufacturers all across New York State." Coca Cola recently signed a contract to install two more UTC Power fuel cells at its bottling plant in East Hartford, Connecticut. [www.utcpower.com](http://www.utcpower.com)

## FUEL CELL POWER FOR AIRCRAFT

Hydrogenics GmbH, has been awarded a contract by Germany's national research center for aeronautics and space (DLR) to supply a series of next-generation fuel cell modules for aircraft power applications. The DLR is currently working on several projects such as the Multifunctional APU and the Antares H3, scheduled to take flight in 2011. Hydrogenics GmbH is scheduled to deliver several heavy-duty, high durability HyPM™ HD10 fuel cell power modules early next year. The design and final assembly of the fuel cell systems will be performed in Germany by Hydrogenics GmbH in cooperation with the DLR. "This order is a significant achievement for Hydrogenics as well as for air travel in general," said Daryl Wilson, Hydrogenics President and CEO. "The next generation of our HD Series will demonstrate much higher levels of power density and compactness, enabling easier integration into aircraft applications." [www.hydrogenics.com](http://www.hydrogenics.com)

## INVESTING IN LOW CARBON FUELS

In their *Renewable Energy Country Attractiveness Indices Issue 27*, Ernst & Young outlines the need for governments to set a clear framework for the pricing of carbon. This is critical to the flow of capital to the poorer nations to allow them to move away from fossil fuels. The report finds it ironic that future oil price spikes may be caused by the inability to invest in low carbon infrastructure now. Although the price of oil has risen again, the price of carbon was deflated by uncertainty following Copenhagen and is now priced at only €15. In order to encourage investment in low carbon technologies it would have to be much higher. For instance carbon capture and storage (CCS) technologies would require a carbon price of €29-44 per tonne. While the price of carbon is so low, feed-in-tariffs are essential. [www.e-y.com](http://www.e-y.com)

## TURNING POINT FOR MARINE TECHNOLOGY

Statue Cruises has signed an agreement with Derecktor Shipyards in Bridgeport, Connecticut, to complete the world's first Hybrid Ferry using hydrogen fuel by April 2011. The new 1,400-horsepower Hornblower Hybrid will run on a combination of energy generated by advanced diesel engines, PEM fuel cells, solar panels and wind turbines. Upon completion, the 600-passenger vessel will feature an outdoor sundeck and two spacious interior decks.



*Illustration of the Hornblower Hybrid courtesy Business Wire*

"This is a genuinely breakthrough project, not only for us but for the U.S. marine industry," said Gavin Higgins, Derecktor Vice President for Business Development. "This boat will produce minimal carbon emissions and sip, rather than guzzle, diesel fuel. Along the way it will help make New York harbor a cleaner, safer and more pleasant place. As a local shipyard, we're extremely pleased to have this project." Terry MacRae CEO of Statue Cruises, added: "We expect this pioneering project to inspire continued industry innovations. The technology on the Hornblower Hybrid is now scalable for other hybrid ferries, hybrid yachts and even hybrid tugs. Some may say we are at the turning point in modernizing marine technology and Hornblower plans to be leading the way." [www.businesswire.com](http://www.businesswire.com)  
[www.statuecruises.com](http://www.statuecruises.com)

## CALIFORNIAN UTILITY TO DEMONSTRATE BLUEGEN

Smart Hybrid Systems, Inc., a California based energy appliance manufacturer, has secured a contract with a major utility for the first US demonstration of Ceramic Fuel Cells' BlueGen high efficiency gas-to-electric fuel cell system. Smart Hybrid Systems will provide local installation and support services, including integrating the BlueGen unit with thermal and electrical management systems and metering equipment. The one year project will demonstrate BlueGen's overall electrical and thermal efficiencies, which result in reduced emissions when compared with conventional centralized fossil fuel based electrical generation. BlueGen units can generate electricity at a peak electrical efficiency of 60%, and when heat is recovered for hot water, total efficiency is up to 85%.

By generating power close to where it is used, Ceramic Fuel Cells' generation product can meet the future demand for low emission electricity without the need for huge investments in electricity transmission and distribution infrastructure. Utilizing hybrid electrical and thermal storage components, the Smart Hybrid Systems offer additional benefits for peak demand reduction in response to the Smart Grid pricing signals currently being deployed throughout the US. Jim Andrackin, Smart Hybrid Systems' CEO said: "We are excited by this opportunity to work with Ceramic Fuel Cells, holder of the world record for small scale fuel cell electrical efficiency and with a major utility in demonstrating the benefits of clean, distributed generation for use in homes, businesses, government and institutional facilities. Developing the hybrid approach to electrical, thermal and alternative fuel appliances is a key ingredient to reducing greenhouse gases through efficiency and cost-effectiveness."

[www.smarthybridsystems.com](http://www.smarthybridsystems.com)

## DEMONSTRATIONS OF FUEL CELL CAB AND SCOOTER

There was a great deal of interest in Intelligent Energy's taxi at the Low Carbon Vehicle 2010 exhibition. The taxi was hailed for a tour of the facility by the UK Transport Secretary, Philip Hammond, who said afterwards: "I had an opportunity to drive and ride a number of low carbon vehicles and saw for myself that they are entirely comparable to the petrol-driven vehicles they will replace."

Intelligent Energy demonstrated the Suzuki Burgman fuel cell scooter to His Royal Highness the Duke of York, the UK's Special Representative for International Trade and Investment, when he visited Intelligent Energy's facilities in Loughborough.



Dr. Henri Winand, Intelligent Energy CEO (far left), presented the scooter to the Duke. Also in attendance (left to right) were Prof. Shirley Pearce, Vice-Chancellor, Loughborough University, Dr. Jon Moore, Director of Communications, Intelligent Energy and Sean Crespin, Test Engineer, Intelligent Energy. The Duke also drove the fuel cell cab and commented afterwards: "It's a real privilege to be able to present many of these companies and their ideas around the world." Dr Winand replied "Intelligent Energy has reached a very exciting stage in the development of its clean power systems with the recent opening of Japanese and Indian offices". [www.intelligent-energy.com](http://www.intelligent-energy.com)

## 50% INCREASED CAPACITY

UPS Systems plc, the UK's largest independent supplier of prime and standby power solutions, has added to its product portfolio SFC Energy's latest direct methanol fuel cell, the EFOY Pro 2200 XT. The fuel cell generates 90W of electricity and is suitable for a range of prime power applications. When compared to the EFOY Pro 2200, the EFOY Pro 2200XT offers 50% more guaranteed energy at reduced cost per kilowatt hour and promises a 50% increase in the longevity of the unit, with a 24 month or 4,500 hour warranty. As with all fuel cells in the EFOY Pro Series, the EFOY Pro 2200 XT is a 'plug and play' solution - customers do not need special expertise to install it.

The new unit offers several benefits for traffic regulation, CCTV and remote



Photo courtesy SFC Energy AG

monitoring applications. The EFOY Pro 2200 XT is robust and doesn't require maintenance, so it can be left alone for long periods. While a traditional battery provides sufficient power for only a day before being swapped or re-charged, an EFOY Pro 2200 XT, using a 28-litre fuel cartridge, can power a 50W traffic signal serial blinker for 26 days. [www.upssystems.co.uk](http://www.upssystems.co.uk)

## EVENTS

**13th -16th February 2011. Fuel Cell and Hydrogen Energy Conference and Expo. Washington, DC.**  
[www.hydrogenconference.org](http://www.hydrogenconference.org)

**30th March 2011, 7th Annual International Conference and Exhibition, Generating the Hydrogen and Fuel Cell Society, NEC, Birmingham, UK.** The conference will involve UK and international speakers from business and public sectors. There will be presentations, networking and partnering. There are now opportunities for speakers, sponsorship,

workshops and exhibitions.  
[www.climate-change-solutions.co.uk](http://www.climate-change-solutions.co.uk).

**4th - 8th April, 2011. 17th Group Exhibit Hydrogen + Fuel Cells at Hannover Fair 2011, Germany.**  
[www.H2fc-fair.com](http://www.H2fc-fair.com)

**15th - 18th May, 2011. Hydrogen + Fuel Cells 2011 International Conference and Exhibition: Partnerships for Global Energy Solutions. Vancouver, BC, Canada.**  
[www.hfc2011.com](http://www.hfc2011.com)

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.

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[www.hydrogen.co.uk](http://www.hydrogen.co.uk) [www.futureenergies.com](http://www.futureenergies.com) [www.fuelcellpower.org.uk](http://www.fuelcellpower.org.uk)