

Fuel Cell QUARTERLY

Volume 4, Issue 2

Summer 2001

Contents:

Feature Story	Pg.
Fuel Cells Camp Out	1
<i>Inside This Issue</i>	
"Who Said That?"	2
Ask Fuel Cells 2000	2
Recycling Fuel Cells	3
Two New Cars	3
Industry Watch	4

Camping Out With Fuel Cells

When camping in the woods, the last thing you need is a noisy generator attracting wild animals, annoying other nature enthusiasts or emitting stinky exhaust that looms around the campsite. Fuel cells have long-term potential to replace standard generators. Smaller, portable fuel cells will provide silent, reliable power for camping and other recreational activities, short-term power for power outages at home, or backup for telecommunications.

The global market for portable power is now served by batteries and small internal combustion engines (ICE). Batteries have a limited lifespan, and combustion systems can present maintenance and emissions problems. There is a market for clean, quiet, reliable power independent of the electric grid in small amounts. Small, portable fuel cell power generators usually weigh up to 20 pounds and can provide up to 2 kW of reliable, uninterrupted energy for long periods of time, without all the noise.

Portable fuel cells can run on various fuels, such as compressed hydrogen gas, low temperature metal hydrides, and methanol, making them extremely versatile and accommodating for mobile applications.

GreenVolt Power Corporation is one company already offering small fuel cells for use in portable power and emergency power applications. The PM-60 magnesium/air/water fuel cell (MAWFC) includes a two function detachable lamp and operates at 6 volt and 2 amp continuous current for up to 50 hours. The electrolyte is saltwater or ocean water acting with magnesium anodes, and carbon cathodes to produce electricity. The unit weighs less than five pounds and operates without an external fuel supply source by utilizing energy contained in its lightweight metal anodes. GreenVolt is also beginning production of the GV-Flash(TM), a compact, inexpensive fuel cell emergency blinker that emits a red flash-visible day or night-every second, 24 hours a day for more than a week without any servicing.



GreenVolt's products are available today.

H Power is another company that produces a wide array of commercial portable fuel cell systems for applications requiring a low, steady state power draw for long duration. It has supplied the New Jersey Department of Transportation with 65 power units for the state's variable message highway signs. H Power's PowerPEM-PS250 can power small electric carriages like utility vehicles and can work in tandem with batteries and an inverter, becoming a hybrid system for emergency power in remote loca-

(cont'd on page 2)

Fuel Cell Quarterly is a publication of Fuel Cells 2000, a non-aligned, non-profit educational activity of the Breakthrough Technologies Institute, a 501(c)(3) organization. Contributions to Fuel Cells 2000 generally are tax deductible and are most welcome.

Initial support for *Fuel Cell Quarterly* has been provided by grants from Argonne National Laboratory and the W. Alton Jones Foundation.

Copyright 2001 by the Breakthrough Technologies Institute, Inc. Reproduction in whole or in part prohibited except by permission. All rights reserved.

Jennifer Gangi, writer/editor
email: jennifer@fuelcells.org

Bernie Geyer, contributing writer
email: bernie@fuelcells.org

tions. The units are being offered as backup power for communications equipment and as a UPS for uninterrupted power to small computer systems.

The U.S. Army's Communication Electronics Command is testing hydrogen fuel cells for field generators used by soldiers. Engineers say they expect fuel cell technology to be cheaper and more efficient than the heavy and expensive battery technologies they now use.

DCH Technology's subsidiary, Enable Fuel Cells, is developing fuel cells for mobile mini generators, providing power for lighting, communications, recreational vehicles, as well as police and military applications. IPS MeteoStar, a global supplier of remote data-logging systems, will begin distributing products with these fuel cells serving as the internal electric power supply. The fuel cells eliminate the problems with limited battery life and are impervious to bad weather.



Enable's portable fuel cell

Fuel cells offer an attractive energy source in the low power range, and the telecom industry is another market that may value their reliability and effectiveness. The increased use of computers, the Internet, and communication networks call for more reliable power than is available on the current electrical grid. H Power has already sold fifteen 50-watt and one 100-watt evaluation fuel cell systems to a major Scandinavian energy company for remote telecommunications backup power applications.

Nuvera Fuel Cells has successfully demonstrated a natural gas fuel cell powering a Verizon telecommunication system. The joint effort between Nuvera and Verizon, which will span a two-year period, includes the development, testing and evaluation of fuel cell powered demonstration units in the 5 kW range. Such systems could be used in the future to provide primary or backup power for telecom switch nodes, cell towers, and other electronic systems that would benefit from on-site, direct DC power supply.



1 kW Hydrogen Power Module

Who Said That?

"...and what will men burn when there is no more coal? Water. Yes, my friends, I believe that one day water will be employed as a fuel, the hydrogen and oxygen that constitute it, used singly or together, will furnish an inexhaustible source of heat and light."

Ballard Generation Systems is in the process of testing of its 10 kW natural gas fuelled stationary fuel cell power generator. The unit is being designed for backup, light industrial and standby applications. Ballard has also joined with Coleman Powermate to develop portable and standby power products.

Some portable fuel cells are available today for a variety of uses, be it recreational or for telecommunications, and the ultimate vision of fuel cells lining the shelves at Home Depot isn't too far away. Who knows, they may even be powering the store as well. (JG)

Choose Your News

Do you have a fuel cell application you would like to see covered in the *Fuel Cell Quarterly*?

Send an email to jennifer@fuelcells.org with topics that interest you.

Ask Fuel Cells 2000

a new feature that highlights questions received via our website - www.fuelcells.org.

How pure is the water emitted from the fuel cell?

Water is produced in all fuel cells. The amount depends upon the efficiency of the unit and the fuel used. With pure hydrogen, the equation is $2H_2 + O_2 = 2H_2O$. The energy provided as electrical energy is calculated by multiplying the lower heating value of the fuel by the efficiency, so for each mole of hydrogen used, one mole of water is produced.

The water formed when the energy is made in a fuel cell is usually released as invisible water vapor, but it can also be captured by a condenser for recycling. Excess water has not been a problem in any applications so far. Transit agencies in Vancouver and Chicago have recently completed bus demonstration projects and didn't have problems getting rid of the water vapor through an exhaust stack, although it did sometimes cause a "fog plume".

Water emitted from a fuel cell is clean enough to drink - during the early 1960s, the fuel-cell-based electrical power system for NASA's Gemini and Apollo space capsules provided drinking water for the crew. Developers used the principles found in Frances Bacon's 1932 fuel cell as the basis of its design. Today, the Space Shuttle's electricity is provided by fuel cells, and the same fuel cells provide drinking water for the crew. (JG)

Answer:

Jules Verne, *The Mysterious Island*, 1874

Recycling Fuel Cells

Fuel cell power plants may be environmentally friendly while in operation, but when a fuel cell is no longer usable, what happens to it? Will it go straight into a landfill or can it be recycled?

The “recyclability” of fuel cells was one of the topics covered at “Fuel Cells: Cradle to Grave”, a recent workshop sponsored by the U.S. Environmental Protection Agency. John Trocciola’s presentation for International Fuel Cells detailed the company’s study of the “recyclability” of its own fuel cell power plant. IFC has examined the disposal issues surrounding its PC25 200kW phosphoric acid fuel cell power plant system, along with all its major sub-systems – air processing, fuel cell stack, power control, fuel processing, thermal & water system, and the structural components.

Trocciola presented a chart of the fuel cell power plant’s components along with the current method used to dispose of the materials. Out of a total fuel cell power plant system weight of 40,000 lbs., the majority of the weight came from the balance of plant components. In looking at the materials’ disposition by weight percent, 95% of the materials are recycled or reclaimed: metals, catalysts, deionizer resin, printed circuit boards, lead acid battery. Five percent of the materials are sent to a landfill: carbon, thermal insulation. Only 0.03% of the materials are treated as Hazardous Waste.

Trocciola noted that IFC’s goal is to phase out the use of materials of concern by 2007 in new products. The company is in the process of identifying substitutes for the materials of concern, which include heavy metals and solvents such as cadmium, lead and mercury.

At the EPA workshop, Tom Gilboy of Siemens Westinghouse noted they have not had to retire a SOFC power plant yet, and will need to focus on this topic. At present, the company is in the process of identifying the environmental impacts of manufacturing its fuel cells, and is developing re-

sources for its own recycling activities.

Fuel cells are better for the environment than conventional power generation technologies. Developers are working to make sure they are good for the environment in all stages of their life – from manufacturing to disposal. (BG)

Driving Closer to Commercialization

Toyota Motor Corporation has unveiled a hydrogen-fed fuel cell vehicle based on its new Highlander SUV. The top speed of the FCHV-4, which stands for “fuel cell hybrid vehicle,” is 95 miles per hour and has a cruising range of more than 155 miles. In addition, Toyota engineers succeeded in giving the FCHV-4 three times the vehicle efficiency of an ordinary gasoline-powered car. The Japanese automaker is conducting road tests with the vehicles in Japan and the United States.

Ford Motor Company has also unveiled a new car.

The P2000 H21CE concept vehicle is based on the Ford Focus compact, but



Toyota’s FCHV-4

is equipped with a modified version of the 2.0-liter Zetec gasoline-engine to run on clean-burning hydrogen gas.

Ford said hydrogen improves the internal-combustion engine’s efficiency by 25 percent to 30 percent. Engineers said they hoped using hydrogen instead of gasoline can be a near-term, “greener” technology until hydrogen-powered fuel cell cars become commercial.

The prototype engine can travel 62 miles on a tank of fuel. It emits only a tiny fraction of the carbon dioxide produced by a gasoline-powered engine. Ford plans an upgraded fuel system to boost the vehicle’s range to 160 miles. (JG)

Yes! I would like to support Fuel Cells 2000’s educational efforts. (\$25.00 contributors receive the *Fuel Cell Quarterly** for a full year. Contributors of \$125 or more also receive the most recent *Fuel Cell Directory*.)

Circle contribution level: \$25 \$50 \$100 \$125 Other _____

Name _____ Company _____ Country _____

Address _____ City _____ State/Prov. _____ Zip/Post Code _____

Credit Card Payment (circle type): Visa / Mastercard Number: _____ Exp Date: _____

Name on Card: _____ Signature: _____

Make check or money order payable to “Breakthrough Technologies Institute” in U.S. dollars only, and send to:

Fuel Cells 2000, 1625 K Street, NW, #725, Washington, DC 20006 USA; Phone (202) 785-4222; Fax (202) 785-4313

Industry Watch

Allied Business Intelligence (ABI) is sponsoring "**Fuel Cell Dynamics 2002: Reality, Not Hype**," February 6-7, 2002, at the Marriott Marquis in New York City, New York. For more information, go to <http://www.fcd2002.com>.

H2fuel and Argonne National Laboratory have joined on a project to develop a small, low-cost hydrogen generator that would convert fuels such as gasoline, natural gas, propane, and methanol into hydrogen for powering fuel cells.

Hydro-Quebec, Shell Hydrogen and German alloy company Gesellschaft fur Elektrometallurgie (GfE) will form a common company to develop, manufacture and market hydride-based hydrogen storage systems for use in fuel cell vehicles and other applications.

Ballard Power Systems, Shell Hydrogen and Westcoast Energy have created **Chrysalix Energy Limited Partnership**, a new private capital joint venture focused on promoting early stage companies with high growth potential in fuel cells and related systems, hydrogen infrastructure, maintenance and support techniques.

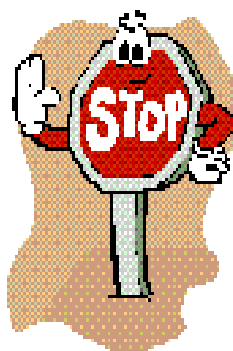
Teledyne Technologies Inc. combined its Energy Systems business unit with Energy Partners Inc. to create **Teledyne Energy Systems Inc.** The new company

will continue focusing on hydrogen gas generators and thermoelectric power systems as well as proton exchange membrane (PEM) fuel cell stacks, test stands and systems.

Energy Ventures Inc. has changed its name to **Energy Visions Inc.**

TechSys, Inc. has recently acquired a majority interest in both SOFC Energy, Inc. and Micro Fuel Cell Systems, Inc.

Mechanical Technology, Inc., and DuPont have formed a strategic partnership to accelerate the development and commercialization of direct methanol fuel cells for portable electronics. (JG)



Register now for Fuel Cells 2000's FREE Fuel Cell Match Maker, an online news group, designed to help businesses and organizations reach out to fuel cell suppliers and other collaborators.
www.fuelcells.org

Fuel Cells 2000

1625 K Street, NW, Suite 725
Washington, DC 20006

Non-Profit Org.
U.S. Postage
PAID
Washington, DC
Permit No. 1850

A fuel cell produces electricity by harnessing the chemical reaction of oxygen and hydrogen. In structure, it is very much like a battery. But it will not "run down;" instead, it consumes hydrogen as a fuel. Inside the fuel cell, this hydrogen combines with oxygen from the air to produce electricity, useful heat and pure water. For more details about fuel cells and how they work, visit our world wide web site at:



www.fuelcells.org