

High Energy Costs, Oil Shock Memories Are Backdrop to Hydrogen + Fuel Cell Exhibit

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HANNOVER, GERMANY – With skyrocketing oil prices and 1970s energy crises memories looming as ominous backdrop, the 12th annual Hydrogen + Fuel Cell Group Exhibit last month here took on, in the eyes of many participants, special *gravitas*.

With 122 exhibitors, participants in the daily "Forum" sessions plus the 12 winners of the exhibit's "Hydrogen Ambassador" competition (*H&FCL March 06*), the number of exhibitors at the April 24-28 event was roughly the same as last year. But the number of countries represented - 32, from Argentina, Armenia and Austria to Samoa, the United Arab Emirates, United Kingdom and United States - was considerably larger than last year when exhibitors from 21 nations were on hand, part of the giant Hannover Industrial Fair that every year attracts tens of thousands of visitors in more than two dozen large exhibit halls and pavilions.

The specter of the 1970s was invoked by the president of the Association of German Industries (BDI), Juergen Thiedemann, in his keynote speech at the opening session of the World Energy Dialogue series of conferences as part of the Fair. Thiedemann said the last time discussions about the world's energy supply reached a similar pitch was three decades ago during the OPEC embargo of the 1970s. Consumers are now feeling the effects of record oil prices, and they are venting their anger, according to a report on his remarks published during the Fair.

With U.S. Ambassador to Germany William Timken, Jr., UN Environment Programme Director Klaus Toepfer and a number of top energy CEOs in the audience, Thiedemann complained that environmental guidelines such as the CO2 emission limits set by the Kyoto Protocol are economically damaging to countries such as Germany that abide by them, as long as others like the United States ignore these international agreements.

Evers Relinquishes Day-to-Day Functions

Probably the biggest organizational news was the announcement that Arno A. Evers, the founder, operator and generally guiding light of the 12-year-old event is relinquishing day-to-day operations of the Group Exhibit. That job will be assumed by Evers' long-time co-worker and general manager Tobias Renz. Arno Evers Fair PR will be renamed Tobias Renz Fair PR and will be integrated into the management structure of Deutsche Messe AG, the organizer of the main Hannover Fair.

Evers, under terms of his contract with Deutsche Messe AG, will continue to be involved in the Group Exhibit, promoting it with, as he told H&FCL, "all my energies," by giving speeches, participating in other relevant conferences and meetings and acquiring new exhibitors in coming years. He added, "my goal is to contribute to the commercialization of this avant-garde technology."

With Renz now running the show's day-to-day operations, continuity of what is generally regarded as the biggest event of this kind and a smooth transition looks like a sure thing. "Our exhibitors can rest assured that they will be able to enjoy the same level of complete service and assistance as in the past that they have come to expect and appreciate," said Renz. Operating under the Deutsche Messe umbrella presents many advantages, Renz says, because he support of this globally operating fair organizer provides the preconditions for not only maintaining the commitment of long-time exhibitors but also attract new companies, organizations and r&d institutions with innovative concepts.

Fair Organizers: "Investment in the Future"

Deutsche Messe project manager Arno Reich told H&FCL his company sees the takeover as "an investment in the future, not as a risk." At the same time, the mechanics and the day-to-day work stay "pretty much as it

is now," he says. One difference: Exhibitors will now be billed by Deutsche Messe directly instead of by the new operator, Tobias Renz Fair PR.

Deutsche Messe, with 750 employees in Germany, some 50 representative offices abroad, also runs various fairs in other countries, including a very large one in China. The company which is owned, but not subsidized, in equal shares by the State of Lower Saxony and the City of Hannover, wants to advance this whole area worldwide. Especially since around 2000, "energy in all its forms has become a major issue," Reich says, "and hydrogen is a very important part of it," with a large growth potential:

Reich points to the example of CEBIT, one of the world's largest electronics fairs which also takes place in Hannover, as an example of this potential. In the early years, CEBIT was part of the overall fair but since then has grown into a specialized large venue of its own.

Group Exhibits, Starter Kits, Premieres

Notable was the sprinkling of large group exhibits throughout the exhibition area, either subsidized by state or local governments such as the City of Hamburg and the State of Massachusetts (www.massh2.org), or organized by coalitions such as the German "Initiative Brennstoffzelle" (IBZ - Fuel Cell Initiative, www.initiative-brennstoffzelle.de). Eventually these companies may be competing in the market place but they pooled their resources for Hannover exhibit. "It's more glamorous and more of an attention getter to have one big stand rather than six or seven little stands," as Renz explained.

New were diminutive "starter kit" booths for first-time exhibitors, half the size of the standard 10 sq. m. booth at half the price. Many exhibitors just want to have enough space to sit down, meet people and talk, Renz said, and for that, the smaller space is "good enough."

The opening press conference was highlighted by a couple of premieres, the unveiling a new PEM electrolyzer by Norway's Hydro (www.hydro.com) and the first showing in Europe of Medis Technologies' (www.medistechnologies.com) small "Power Pack" charging system for handheld devices. Hydro's new Inergon device is rated at a maximum output of 10 Nm³/h, variable from 5 to 100 % of maximum, making it especially suitable for applications with large variations of input such as wind power, or output, such as in fueling stations.

Standard for PEM electrolyzers, the hydrogen gas is produced under pressure - 30 bar for the Inergon - obviating the need for an external compressor, and reducing maintenance. Under development for the last five years, Hydro has sold a "handful" of units already and is taking orders now, said Knug Harg, Hydro's executive in charge of hydrogen activities.

Holding up high the cigarette pack-sized "Power Pack" for better visibility on the exhibit's stage, Gennadi Finkelshtain, general manager of the Medis subsidiary More Energy Ltd., of Lod, Israel, said the device will be offered in selected stores in the United States and Canada this year - "not next year, but this year." Reiterating what Medis had said previously in the United States (*H&FCL Feb. 06, April, July 05*), Finkelshtain said current plans call for producing 100,000 units this year for testing and sales, to be ramped up to 1.5 million units per month next year. The units will retail for around \$20, but for service providers such as cell phone companies, the price could be as low as \$12, he said.

Pumpable Hydrogen Slurry for Current Pipelines

One of the more fascinating projects exhibited was a slurry-based hydrogen storage and transport technology currently under development by a tiny U.S. company, Safe Hydrogen LLC, (www.safehydrogen.com) of Lexington, MA, one of eight companies and entities at the Massachusetts group booth (the others: Acumentrics Corp., www.acumentrics.com; Beacon Power Corp., www.beaconpower.com; Fat Spaniel Technologies, Inc., www.fatspaniel.com; Irradiance Inc., www.irradiance.com; Massachusetts Renewable Energy Trust, www.masstech.org; Practical Solar Inc., www.practicalsolar.com; Satcon Technologies, Corp. (www.satcon.com)). The magnesium hydride based slurry is pumpable in existing piping, pipeline and fueling systems. It doesn't require pressure, and functions at ambient temperatures. It's safe, recyclable with low-cost materials, and it stores lots of hydrogen: 6 % by weight, but, CEO Sigmar H. Tullmann told H&FCL, "it's actually better" than that. It's really 12 % if water, such as waste water from a fuel cell needed to release the hydrogen, is factored in.

The most important upshot is that the slurry system may achieve the 300 miles-between-refueling stops target set by DoE with a three-container tankage system that potentially would be only about 25% bigger than

current vehicle fuel tanks. Secondly, Tullmann believes the system will also meet another DoE key target for 2010, hydrogen at \$4/kg.

The slurry is not caustic and does not contain any environmentally hazardous materials, says Tullmann: "It looks like whitish grey latex paint." All that's left over is "something like Pepto Bismol" once the hydrogen has been released, Tullmann enthuses.

Safe Hydrogen's three-man management is operating under a \$2.4 million DoE grant, plus funding from the Massachusetts Renewable Energy Trust. "It's not a new idea," says Tullmann. "It's textbook chemistry, but it's an extreme packaging problem."

Also at the Massachusetts booth, Acumentrics, of Westwood, displayed charts and data illustrating progress of its 1 to 10 kW solid oxide fuel cells. Thomas W. Philbin, senior vice president for corporate affairs and business development, told H&FCL the company has gone from 1 W output per tube four years ago to 60 Watt within the last year, and it has achieved a 50% reduction in the cell count of a system combined with a 50% increase in output to 7 kW. It has provided an SOFC fuel cell to the building at the exit of the Glacier National Park in Montana and to the Cuyahoga Valley National Park near Cleveland. It has started a joint venture with Italy's MTS (Merloni Termosanitari S.p.A.), Fabriano near Ascona, to build natural gas-powered wall-mounted combined heat-and-power micro units for residential use within the next three years primarily in Switzerland, Germany, France and Britain.

A British company, Fuel Cell Control Ltd. (www.fuelcellcontrol.com), of Slinfold near Horsham, unveiled both a new 2.5 kW PEM "engine" intended for baseload operations, as well as an ammonia cracker to provide the hydrogen fuel, capable of churning out 3 cubic meters per hour from liquid ammonia.

Managing Director R. L. Hodkinson told H&FCL that the two complementary devices are designed to run repeater stations for cell phone networks in Africa and developing countries elsewhere. Baseload PEM fuel cells have become feasible with the development of new membranes, such as Nafion 115 with life times four times as long as previous versions. Ammonia is widely available in 56 kg tanks in developing countries and can run the 2.5 kW fuel cell at full power for 60 hours, Hodkinson said.

Commercial Danish 3-Wheeled Transporter

Imaginative transportation use of hydrogen and fuel cells was displayed by a young Danish systems integrator company, 3-year-old H2 Logic (www.h2logic.dk), of Herning. The company has developed a small three-wheeled truck for internal transportation and maintenance work, supply chain manager Jesper Nissen Boisen told H&FCL. The company is already offering commercially, at a pricey Euro 46,000, the basic hybrid H2 Truck powered by a 1.5 kW PEM fuel cell. Hydrogen is stored in two quick-connect slide-in hydride canisters each holding 1,900 liters of hydrogen.

The first version was equipped with a Ballard stack, but Boisen says newer versions will be powered by a PEM system developed by a Danish company that Boisen won't name as yet. The company has sold six copies so far, two to the hospital in Aarhus, Denmark's second biggest hospital; the city of Herning bought two for city maintenance and street cleaning duties; another went to Herning's water treatment plant, and the sixth went to the hospital in nearby Holstebro.

Transportation of a decidedly more entertaining variety was on display at the booth of Formula Zero BV (www.formulazero.nl), a Dutch company based in Amsterdam that promotes hybrid fuel cell-powered zero-emission go-cart racing and demonstrations. Their sponsors include Shell Hydrogen, Hydrogenics, Delft Technical University and industrial gas provider Linde. The developers have assembled one vehicle, dubbed Mark 2, and they'll sell you a cart for a mere Euro 250,000 (Value Added Tax included).

An 8 kW Hydrogenics Mark HyPM7 fuel cell plus Maxwell Boostcap ultracapacitors provide a maximum of 48 kW, good for a pretty quick 0-100 km (62.5 miles) acceleration of less than 8 seconds for the tiny vehicle. Formula Zero's events director Eiso Vandrager tells H&FCL they expect to enter the car in the upcoming Bibendum Challenge for alternative vehicles next month in Paris, and the company plans to set up a demonstration race track underneath the Eiffel Tower.

Fuel cells are even expected to take to the air later this year when a fuel cell-powered version of a small unmanned aircraft dubbed HyFish is expected to start trials. In its original version, the small Smartfish - wingspan is only about 1.5 meters - is powered by a 1 kW battery system which provides the energy for a so-called impeller, essentially a propeller encased in a housing, giving it the appearance of and functioning like a

jet-powered plane. This prototype, designed and built by the Swiss Smartfish company (www.smartfish.ch), has flown for up to 10 minutes.

In the next phase, the German Aerospace Center (DLR - www.DLR.de) wants to substitute a fuel cell for the battery system. A German company headquartered in Berlin, Staxon GmbH (www.staxon.com), has developed a lightweight 300 W PEM fuel cell which is now being upgraded to 1 kW, Till Kaz, a DLR engineer who is working on the project, told H&FCL. Interestingly, the fuel cell is not expected to be airbreathing but is likely to be fueled by both hydrogen and oxygen carried onboard for greater efficiency. The target is to achieve 2-3 k/kW weight efficiency in the small unmanned demonstrator. The Swiss aircraft developers hope to build larger planes - initially a two-seater prototype and eventually perhaps versions for up to 20 passengers - that could cruise at altitudes of up to 7,000 (23,000 feet) meters at speeds of 200-300 km (125 - 187 miles) per hour and that hopefully would be more efficient than conventional jets and turbo-engined planes.

Anniversaries: Turns out not only "H&FCL" is celebrating this year (see our lead story). Both the German Hydrogen and Fuel Cells Association (DWV) and France's ALPHEA celebrated their anniversaries on separate days during the exhibit's traditional networking evenings that feature German food, fun, German beer and other imbibables, and entertainment.

ALPHEA, which stands for "Association Lorraine pour la Promotion de l'Hydrogene Et de ses Applications" (www.alphea.com) was founded also in 1986 as outgrowth of a report by the Lorraine Economic and Social Council which had been looking at hydrogen and its potential since 1975. Headquartered in Forbach, ALPHEA HYDROGENE, as it has been known since 2005, has 20 members and 20 partners today.

The German DWV association (www.dwv-info.de) was founded ten years later, in June 1996 by a handful of interested academics and engineers. Today, Berlin-based DWV has 207 individual members - professors, engineers, interested individuals - plus 60 institutions ranging from large multinationals to tiny outfits as well as citizens' initiatives. In 2000, DWV helped organize the European Hydrogen Association, based in Brussels.

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