The Hydrogen & Fuel Cell Letter
Alternative Energy News Since 1986 **November 2008** Vol. XXIII No. 11 ISSN 1080-8019

November 2008

FC Seminar Brings Green Focus to Phoenix, 2015 is Automotive Commercialization Year

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PHOENIX, AZ – "It's good to be in Arizona," said one Fuel Cell Seminar & Expo organizer about this year's 150 exhibitors encamped at the Phoenix Convention Center Oct. 27-30 smack dab inside Presidential candidate John McCain's home state.

This national attention may have offered some advantage, and the organizing committee also issued an "exhibits only" pass for the first time to encourage the public to partake of the fascinating realm of fuel cell technology. One had to admire the chutzpah and hard work of the folks who volunteered to put on this annual meeting; conference co-chair and Technical Programs Chair, Valerie Browning, touted the event as "facilitating and perhaps even accelerating fuel cell commercialization," by way of the networking and technical exchange opportunities over the four days.

A Honda Clarity and two other fuel cell cars are lined up for ride-and-drive demonstrations at the Phoenix Fuel Cell Seminar. (Picture by Vicki McConnell)

She also said that "global demand for clean energy is one of the engines driving fuel cell commercialization." Connecting renewable energy sources to commercialization formed the essence of the 2008 theme, "Fuel Cells for a Greener World."

Preliminary figures indicated this year's attendance was 15% or perhaps 20% higher than last year, or 1,500 to 1,700. Exhibits and attendance at conferences at the Convention Center for many industries are down by 30%, so the Seminar was well ahead of this curve.

Most Attendees from U.S.

While 66% of attendees appeared to be U.S. based, 17% came from the Pacific Rim and 12% from Europe. Germany, Canada, Korea, the UK and Taiwan ranked in the top five countries among initially registered attendees. In its calculation of industry segments represented, the Seminar reported 76% attendees from companies with commercial products, 8% from government, 12% from academia and 3% from related associations such as the Electrochemical Society, the European Fuel Cell Forum, Fuel Cell Development Information Center and others.

Several new additions to the fuel cell industry vernacular caught my ear during the Seminar & Expo: externalizations (referring to factors beyond the fuel cell system hardware that must be factored into ultimate cost such as fuel cell source availability and infrastructure, and permitting and efforts

to create or change regulations) and portfolio approach (referring to multiple H2 feedstocks, fuel cell end markets, and including the multiple fuel cell system types/designs.)

Finally, a new timeline flag has been planted firmly by major automakers and the Energy Department, declaring 2015 as the revised market entry point for commercial fuel cell vehicles, The extension may not be unexpected, but testifies to the need for government support and in-depth R&D time required to move transportation fuel cell products to market.

At the opening plenary session on Tuesday, the wake-up music set a welcoming tone; Les Paul would have been proud of the jazzy guitar and saxophone riffs getting us all ready for a banquet of insights from some of the industry's best thinkers. The stage was decked by large, lighted columns with a moving graphic design of chrysanthemum petals waving across a neon pink background. I thought of the Beijing Olympics (though no Chinese exhibitors came to Phoenix, nor any from India; both countries have rapidly increasing power demand levels that will exceed those of the U.S. and could no doubt benefit from hydrogen and fuel cell technology).

Cordelia Baker announced the Dr. Bernard S. Baker Student Awards for outstanding fuel cell technology posters in honor of her late husband, an industry pioneer with Fuel Cell Energy. Winners selected from 40 applicants worldwide were Yuxiu Liu, University of Rochester; Yuhao Lu, University of Alabama, and Denise McKay, Smith College. Honorable mention posters were attributed to Hyung-Tae Lim, University of Utah; Jack Ferrell, Colorado School of Mines; and Dusan Spernjak, University of Delaware.

Awards to Gottesfeld & Kordesch

Two Fuel Cell Seminar and Expo annual awards went to Dr. Shimshon Gottesfeld and Dr. Karl Kordesch. Though these awards are given for academic and commercial achievement, perhaps the good news is that "the achievements are sometimes hard to distinguish between the two categories," stated Awards Committee Chairman and former NETL scientist, Mark Williams.

Dr. Gottesfeld, of newly formed CellEra, recalled attending his first Fuel Cell Seminar 20 years ago when he worked at the Los Alamos National Lab, "and ended up staying in this field for the next 17 years." In the "techno/personal perspective" he shared, Gottesfeld recalled the time when fuel cells were not well supported either by outside industry/agencies or even within the fuel cell community itself. He specifically cited work by other professionals in 1997 that made it clear that the barriers to successful commercialization of fuel cell technology are awesome and no small task to overcome. Gottesfeld's new company, Israeli startup CellEra, has developed a platinum-free membrane and low cost stamped metal plates, and it expects to introduce a 100W PEMFC unit in 2009 at 50% the cost of existing units. This will position CellEra as stack makers in target markets such as back up power, materials handling, telecommunications, and range extension.

Speaking for Dr. Karl Kordesch, who was too ill to travel to Arizona, Dr. Peter Kalal acknowledged his colleague's 60 year legacy in electrochemical research, particularly for building one of the first FCVs (an Austin A40 with two roof-mounted hydrogen tanks) and in propagating the benefits of alkaline and ammonia-based fuel cell technology. "Ammonia is an often overlooked hydrogen carrier," Kalal noted, "and can solve the storage and distribution issues encountered with hydrogen." He noted a resurgence of recent interest in alkaline fuel cells, especially since the oxygen reduction is easy, as is the operating temperature. "One doesn't need humidifiers, compressors or high purity hydrogen with AFCs, and they have proved less CO2 sensitive than first thought and can work at -20°C."

All five plenary speakers echoed what might be deemed "the mantra of the converted" at this event, which is that the development of alternative energy is critical to the U.S. economy and indeed this planet's future and requires a global perspective and global collaboration. EnergyBiz Insider editor, Ken Silverstsein, moderated the plenaries and reflected upon the state of the alternative energy segment: "With businesses choosing either to hunker down and wait or go aggressive and buy assets on the cheap, winning new investments in this climate is a challenging ordeal." He added, "one of the winners in the $700 billion bailout is the fuel cell industry in

terms of the reenacted tax credits that will advance technology and keep fuel cell companies in business, I believe.....Renewable energy is the strongest fuel source and technology candidate, especially wind and solar. We have 16,800 MW of installed wind generation capacity today."

Sjunnesson: Be Patient

The time it has taken the wind energy industry to develop gives guidance to the patience needed for fuel cell technology commercialization, reflected Lars Sjunnesson, Adjunct Professor at Lund University, president of the European Hydrogen Association, and Director of Corporate R&D for E.ON Sverige AB, the largest private energy utility in Sweden. His take on the needed steps toward fuel cell commercialization: solve official technology issue, get cost down, stimulate the market, demonstrate long-term commitment, and again, "be patient." Among alternative energy projects in Scandinavia, Sjunnesson cited a Topsoe plant in Denmark due to open by the end of this year; the Scandanavian Hydrogen Highway partnership, and the new public/private partnership, and Europe's Joint Technology Initiative (JTI), just announced in October (p.1).

Dr. Klaus Bonhoff, Managing Director of the Germany's NOW GmbH National Organization Hydrogen and Fuel Cells Technologies and Coordinator of the German National Innovation Program (NIP)/Hydrogen and Fuel Cell Technologies, paid tribute to the German government's funding of 500 million euros in 2005 for a 10 year project to bridge the gap between R&D and demonstration projects. "This has provided stability for analyzing if we are on the right track and developing the right technology." NIP is networking globally with other organizations such as JTI and the International Hydrogen and Fuel Cell Partnership (IHFCP). "R&D needs to increase fuel cell system lifetime, reliability and efficiency as well as consider manufacturing and a systems application," Bonhoff said. NIP has initiated a number of lighthouse projects with energy and transportation OEMs toward the goal of generating 15% of hydrogen from renewables. "We need a portfolio of hydrogen supply options from many different feedstocks."

Japan's limited resources have resulted in a high priority for fuel cell R&D, stated Atsushi Yamamoto, Deputy Director of the Fuel Cell and Hydrogen Promotion Office of the Agency of Natural Resources and Energy within Japan's Ministry of Economy, Trade and Industry (METI). To that end, METI has requested 40 billion yen ($405.6 million) in both stationary and transportation application research for 2009, including a target of 10,000 residential combined heat and power units, with a ramp up to 30,000 units/year by 2010. The agency also has a 2010 target for 20 to 100 MW of hydrogen generated electricity from stationary fuel cells.

McCormick: "We've Got to Start Somewhere"

The greener world theme resonated strongly with GM's Executive Director of Fuel Cell Activities/Powertrain, Byron McCormick, who declared he was speaking from the heart after watching University of Arizona students drive the Equinox FCV several days before the Seminar opened. "Looking at those 18 and 19 year olds, I thought, the cars we make today will be out on the roads for at least 14 years, and to get FCVs out there, we've got to start somewhere. I'm coming right at you, the people in this conference hall are the leaders who are going to make this [transportation revolution] happen. The world and our kids deserve no less."

In order to bring out commercial FCVs by 2015, he believes automakers will have to "go through the Valley of Death from non-commercial tooling to automated, high volume commercial products, with each of us telling the tale of the context of what is needed for each area of technology development [such as the membrane, stack, BOP] but in a holistic way that considers an integrated system." McCormick reported positive input from drivers testing GM's Chevy Equinox FCVs in the U.S. and said versions of this vehicle will begin testing in Germany this month (November) and in China in 2009. Again he referenced the university students he'd watched testing the Equinox in Phoenix. "I kind of got this sinking feeling — we need to accelerate the commercialization of fuel cells, and we have little time to lose."

(The second part of this report will be published in the next issue in December)

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The Hydrogen & Fuel Cell Letter
Alternative Energy News Since 1986 December 2008 Vol. XXIII No. 12 ISSN 1080-8019

December 2008

FC Seminar (Cont'd): CEOs See Rough Near Term, But Real Fuel Cell Viability Ahead

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PHOENIX, AZ – High on the agenda and coming early in this year's Oct. 27-30 Fuel Cell Seminar here, the CEO Roundtable provided a useful glimpse into the thinking and expectations of the guys on the front line, moderated by EnergyBiz Insider's Ken Silverstein. This roundtable, in its second year at the Seminar, brought together Gary Flood of ReliOn, Harol Koyama of IdaTech LLC, Henri Winand of Intelligent Energy, and Andy Marsh of Plug Power in the lively hour-and-a-half exchange.

Some key points: Winand suggested the time it takes to successfully bring new technology to market can range from 17 to 20 years. Flood reflected that among ReliOn customers, people are now budgeting for fuel cells as a viable energy generation option as a matter of course. He was concerned, however, about the lack of clear connection between fuel cells and renewable fuels. Koyama noted that IdaTech is on a definitive volume commercialization timeline with contract delivery in 2010 of 10,000 units (H&FCL, Nov. 08), adding he believes that overall, fuel cells can replace 90% of battery and diesel sets. Marsh said recent tax credits are good but the process for collecting on them is not particularly easy.

Other observations: fuel cell companies short on cash will be in trouble in the next six to eight months, but a positive uptick for materials handling or backup power products is likely in the next 18 months.

Rich-Content Multitrack Sessions

The multitrack technical sessions, always a challenge to pick and choose among them given their richness of content, covered the waterfront. Topics included high temperature R&D and fuel processing (SOFCs and MCFCs), low temperature R&D (PEMFCs and DMFCs), global market overviews, testing, hydrogen R&D, demonstrations and end user perspectives, education and public outreach, manufacturing, and pathways to commercialization.

The U.S. Energy Department, a key U.S. funding resource, reviewed its portfolio of technology accomplishments, and industry and academia shared innovative findings. In her overview of DOE's hydrogen and fuel cell programs, Sunita Satyapal stated that delivery cost of hydrogen remains a key issue in reaching the near-term $2-3 gallon gas equivalent goal, and the agency is examining the use of glass composite piping for distributed generation of hydrogen from reformed natural gas. In automotive fuel cell R&D, reduced catalyst loading has brought costs down from $94/kg to $73/kg. The 5,000 hour life target has been met by a 3M MEA, demonstrating 7,000 hours lifetime under load. The goal to meet $2/kWh in transportation hydrogen storage will require more materials technology; carbon fiber composite tanks currently provide storage at $27/kWh.

Since fiscal 2004, DOE has awarded $850 million in hydrogen and fuel cell funding in more than 400 projects, and has 122 FCVs in operation and 16 hydrogen stations to validate R&D innovations, Satyapal said. The next DoE overview will come in May 2009 when the agency will present its annual Merit Review of the hydrogen and fuel cell programs, including the vehicle technology program for the first time.

Highlights from other technical presentations:

* Medis Technologies claims its $50 24/7 Xtreme charger, with proprietary liquid fuel system, can now be purchased in Best Buy stores to provide 20 Wh of run time for handheld devices such as cell phone, laptops, flashlights, and emergency power kits. Replaceable fuel cells (after the initial purchase) run $25, shelf life is estimated at a year, and the company said it has orders to ship tens of thousands of the chargers starting last month.

Need for Education

* In this editor's opinion, more attendees should have taken advantage of the education track sessions. Individual school efforts at all levels create the familiarity with fuel cell technology that will evolve into an expected energy option, and to help train the technicians needed to service commercial fuel cell systems.

* Samsung researcher Ju Yong Kim stated that "we think fuel cells could be our future," while discussing R&D into 20W portable power units for boats and RVs and concluding further improvements are possible in noise reduction, efficiency, and protection from sulfur degradation.

* Italy's Ansaldo expects to reach 55% efficiency with its molten carbonate fuel cells (MCFCs), using any fuel, and is working to simplify its balance of plant and reduce material costs. In the last year, the company's technology has focused on proper melt and distribution of electrolyte and oxidation/lithiation of the cathode. In Korea, a 10,000 cm2 MCFC will be demonstrated next year, using an electrolyte impregnated anode and three piece current collector design.

Rewards for the hearty souls who stayed through the final sessions of the conference on manufacturing included technological nuggets, such as a description of the very small focal spots in lap-welded thin metal sheets possible with laser beam welding (Edison Welding Institute); net-molded, adhesively bonded bipolar plates to allow integral gasketing and tailorable individual fuel channels (Dana Holding Corp.); powder manufacturing of catalyst on MEAs for DMFCs achieves very small (2-3nm) and spherical platinum crystals that translate to 3,000 hours of operating life time in portable electronics (Cabot Fuel Cells).

Ski Milburn of Vairex Corp., an OEM of blowers and vane compressors, answered the question "how do companies move from prototypes to

production volume manufacturing" with this genuine and good-humored response: "with prayer." Over the last decade, Vairex has reduced unit costs by up to 20%/year and demonstrated 50% reduction in assembly/test time and 15% reduction in direct material spend. Customer demand for world-class quality has resulted in the company building a 25,000 unit/year production line. "We're on the path, we can get there, we can make product and make money," Milburn asserted.

States Showcase Programs; Fewer Exhibits

Colorful state program booths by Ohio, Connecticut, and South Carolina emphasized multidimensional fuel cell projects. Growth in the fuel cell industry's supplier base was reflected by the number of component vendors displaying pumps, blowers, humidification and heating systems, flow controls, membranes and MEAs, software modeling, and test equipment. Material suppliers on exhibit covered metals, ceramics, and polymeric composites useful in fuel cell system construction.

Compared to previous years, the number of exhibits in Phoenix were dwindling, based on the obvious absence of major stack and system producers as well as dramatically fewer test station OEMs. (Credit Fuel Cell Energy, AeroVironment, IdaTech, and UTC Power as exceptions to this statement.) Nonetheless, exhibitors told this editor that good leads continue to be generated at the show, albeit in smaller quantity. A six-booth contingent representing various companies/institutes in Germany anchored one corner of the exhibit hall. Intelligent Energy displayed a 15 kW automotive power system prototype for APU or primary power. (See photo, p.4) .

Intelligent Energy's automotive fuel cell stack on display at the Fuel Cell Seminar. (Photo by Vicki McConnell)

New exhibitor Violet Fuel Cell Sticks showed off its alternative SOFC architecture, which incorporates aspects of both plate and tube technology. NexTech Materials had two booth locations, one a new entry to announce the Commercial Services Division formed to help customers bridge the research to product introduction gap and the other touting the company's hydrogen and hydrogen sulfide sensors, which they expect to have in full production late next year as an OEM product with common voltage. The U.S. Fuel Cell Council, a source of information on all things fuel cell, handed out a list of commercially available fuel cell products at its booth so one could walk away with proof in hand that this technology is well beyond the benchtop.

Conference poster sessions provide an extended opportunity for companies and researchers to discuss recent technical innovations. Some 154 were listed in the official program. Two related to low-temperature solid oxide fuel cells (SOFCs) were presented by the National Research Council of Canada's Institute for Fuel Cell Innovation (NRC-IFCI) and discussed onsite by NRC's SOFC program manager, Dr. Radenka Maric. Through a process called reactive synthesis deposition technique (RSDT), NRC-IFCI has demonstrated the ability to create a cathode coating in one step that eliminates sintering aspects of the thermal treatment. This results in a 30% potential savings. So far, NRC-IFCI's bench test six-cell SOFC short stack has operated as designed at 600°C on methanol fuel. In another low-temp SOFC project, pulse laser deposition of a thin layer of purely ionic, conductive, stabilized zirconia on a ceria-based electrolyte has improved SOFC efficiency by 40% compared to heat-stabilized zirconia.

Cars Are Big Draws Once More

Vehicles are always a draw at the seminar; the Chevy Equinox at the GM booth and a PEM-powered Suzuki motorcycle at the Intelligent Energy booth offered full-scale two and four wheelers, but the vehicle at hydrogen producer Air Products' booth was clearly designed to bring a smile (see photo). The company has outfitted this mini-roadster with its hydrogen fueling connection to demonstrate the familiarity and ease of use drivers can expect at their local filling station. (One might go so far as to conclude it's mere child's play.) A company rep at the booth said Air Products has a new design soon to be released that looks extremely similar to a gasoline pumping mechanism.

It's child's play: Air Products' fueling station exhibit featured a toy roadster hooked up to a hydrogen dispenser. (Photo by Vicki McConnell)

This year's Ride-and-Drive had folks lined up to hop into fuel cell vehicles from Daimler, General Motors, Toyota, Honda and Hyundai. Each delivered a smooth ride round the block, plus plenty of accelerative power and gleaming advanced design cockpits. (Long gone are the high pitched whines or jerry-rigged dashboard laptops or trunk-scavenging storage tank layouts of the past.) GM's Chevy Equinox features a display panel showing the inner workings of the fuel cell and battery, including fuel flow. Honda's Clarity is a rock star sedan both swoopy and muscular - a downright "Sexy Beast," if you ask me.

Fondly remembered In Memoriam were technology pioneers and alternative energy ambassadors who passed away during the past year, including Geoff Ballard, an original founder of Ballard Power Systems and General Hydrogen; Allan Casanova of Westinghouse/Siemens; Edward Gillis of EPRI; and Shalom Zellingher of the New York Power Authority.

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