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Fuel Cells Summit VI took place on May 29-30, 2002, at the University of Maryland, College Park, Maryland. The Fuel Cells Summits are supported by the Department of Energy, Office of Energy Efficiency and Renewable Energy to bring together a diverse group of interested parties to facilitate a receptive codes and standards environment for fuel cell technologies. Fuel Cells Summit VI was attended by a total of 91 participants, representing manufacturers, codes and standards organizations, building code officials, government organizations, and other relevant parties who came to share information and identify needs for cooperative activities to address regulatory and institutional barriers to fuel cell implementation.

This document contains a summary of notes taken at the conference and does not necessarily contain all of the points made by speakers. Individual presentations should be reviewed and/or original speakers contacted where more information or detail is desired.

May 29, 2002—Day 1 of Conference

Ron Fiskum (DOE): Office of Distributed Energy and Electric Reliability - Welcome

- DOE is undergoing a reorganization and Ron will continue managing the Cooling, Heating and Power for Buildings program under the Office of Distributed Energy and Electric Reliability. The Fuel Cells for Buildings program is moving to Office of Hydrogen and Infrastructure and will likely have a new program manager, however.
- The continuance of this Fuel Cells Summit depends on the support of this group. If people see value in it and want to see it continue then they should write letters to the Department expressing their support. DOE needs to hear that this activity is important.
- A similar situation exists for the Fuel Cells Summit newsletter. If people see value in it they should express their support to DOE, otherwise it may not continue.
- Buildings are ready for fuel cells, and fuel cells are ready for buildings but code officials may still present a road block. There is much work that remains to be done in creating the receptive institutional and regulatory environment that we have undertaken as our goal.

Pete Devlin (DOE): Office of Hydrogen and Infrastructure

Fuel Cells are being incorporated into the Office of Hydrogen and Infrastructure next year, and this is in line with the National Energy Policy (NEP) issued by the new Administration last year. The Partnership for a New Generation of Vehicles (PNGV) has become the FreedomCar program and will also be incorporated into this Office's activities next year.

The organization of DOE is changing from the former "market sector" structure to one more centered around programs, e.g., fuel cells, and the focus is on results rather than process. Under the new structure 31 programs will be reduced to 11. June 3 is the new target date for final implementation of the reorganization.

- The "Fuel Cells" component will focus on cost, durability, startup time, air/thermal/water management and codes and standards. Several sub-programs will exist in the fuel cells technology area.
- For the transportation sector, the startup time of 10 minutes is a focal point.

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- The “Hydrogen” component will focus on storage, hydrogen fuel cost, fuel infrastructure and codes and standards. Storage is the major point of emphasis for the near term.
- “Power Parks” will focus on co-production of hydrogen and electricity.
- “Off-board Reforming” will focus on purification, compression, dispensing, and natural gas reforming.
- Renewables will focus on wind and biomass-derived hydrogen fuels.
- Carbon composites are being evaluated as a material for the construction of pressurized tanks.

Key Program Activity budgets (FY03) are expected to be

- Transportation $50.0M
- Distributed Generation $ 7.5M
- Hydrogen Program $39.9M [FreedomCar].

In summary, the Fuel Cells Program in EERE is designed to offer several valuable national benefits, including lower oil imports, improved grid reliability, reduced air pollution, and lower carbon emissions. In this endeavor we intend to pursue industry collaboration and focus on the critical technology needs.

Questions from Audience:

- Why is low-pressure storage of hydrogen deemed necessary? **Answer**: Storing hydrogen at 5000 psi scares people. Public perception of safety is critical for successful implementation of this technology.
- Then why not spend money on educating the people rather than spending it on developing a low-pressure storage technology? **Answer**: Both will be explored.
- What about encouraging conservation? **Answer**: Outreach will continue to encourage conservation; conservation is also a critical part of successful implementation as lower loads are easier to meet, i.e., require less system capacity.

Donna Lee Ho (DOE): Related Efforts (DER, Buildings, and Automotive)

Our program will focus on PEM fuel cells as these appear to have the characteristics most closely aligned with our application needs. Because platinum is a significant contributor to PEM cost, alternatives to platinum and minimization of platinum loading are being pursued. For our purposes, hydrogen may be either stored on the vehicle or reformed as needed—the program supports both avenues of research.

Our new program structure supports the Administration’s FreedomCar (Freedom Cooperative Automotive Research) initiative. There is a Fuel Cell Report to Congress due 12 months from the date of enactment of the FY02 budget (due November 5, 2002) and an interim report due within 6 months (due May 5, 2002), which must include an assessment of the need for public and private cooperative programs to demonstrate fuel cells for stationary, distributed generation, portable, and transportation applications. The report must also include recommendations on program adjustments based on an assessment of the technical, economic, and infrastructure requirements needed for the commercial use of fuel cells by the year 2012. The latest draft interim report can be found at www.sentech.org.

Andrew Skok (FuelCell Energy): ASME PTC 50

The Performance Test Code (PTC) 50 under development is a standard for providing a basis of comparison among different fuel cells, perhaps using different technologies. The standard looks at the complete system—fuel and output, heat and power—and will allow a potential user to assess how one fuel cell will perform in a given application relative to another fuel cell.

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Completion of the standard is expected this year; the public comment period on the latest draft of the document closed May 28, 2002. ANSI may accept the code this summer and the resulting standard will then be distributed for public use.
Other pertinent codes include NFPA 853, which deals with fire safety standards, and CSA FC 1, which has replaced ANSI Z21.83. More is discussed about these standards elsewhere in the program.

Bob Rose (USFCC): U.S. Fuel Cell Council Activities Update

The Council has grown from 14 to 107 members—49 Executive Members and 58 Associate Members. The Council publishes the *Weekly Currents* for members and the *Fuel Cell Connection* newsletter (monthly), and the *Fuel Cell Catalyst* (quarterly) , which are free to the public. We also produce numerous other materials.

Programs of the Council are carried out by six working groups:

- Stack Materials and Components (newest WG)
- Codes and Standards (51 members)
- Power Generation
- Education and Outreach (conferences and exhibitions)
- Transportation
- Portable Power

The Council is "member driven." Members are actively involved in governance. Two of the working groups were founded by member companies seeking to collaborate with their peers on issues of special concern.

The Council is actively involved in code and standard setting activities in the U.S. and around the world, and participates in trade shows selected for their ability to reach important audiences (BOCA) and potential customers (American Institute of Architects)

Among the analyses and reports under way are an industry economic survey, an assessment of portable power markets, development of a market assessment model, and discussion of material and component "round robin" testing.

Our web address is www.usfcc.com.

Tom Basso (NREL): IEEE Standards Coordinating Committee (SCC) 21

"Making Connections" is a report from NREL that identified technical, business practices, and regulatory barriers to interconnection that need to be addressed, including adopting uniform technical standards.

The electrical interconnection standard under development for fuel cells and other distributed generation equipment at the sub-transmission level and below is IEEE P1547, and draft 10 will go to ballot this summer. The intent of 1547 is to establish a consensus standard that provides the minimum functional technical requirements that are universally needed for interconnection. It was recognized there was a critical need to prevent having to "negotiate" each installation to conform to numerous local practices and guidelines.

The P1547 standard is not a design handbook, nor guide, nor a "how to/procedure" document; the following interconnection documents are also under development by SCC21 work groups:

- P1589 Conformance Test Procedures
- P1608 Application Guide
- P1614 Monitoring Guide for Information and Control

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The efforts of Tom Basso and Richard DeBlasio on P1547 are supported by the NREL Distributed Power Program.

Jim Ohi (NREL): Hydrogen Safe and Clean Alternative Program

There are three components of a clean and safe alternative program:

1) hydrogen infrastructure planning and deployment — identify resources, needs, and opportunities and develop data and analytical tools;
2) codes and standards — incorporate hydrogen safety issues into existing and proposed national and international codes and standards; and
3) renewable hydrogen and distributed generation — assemble and test "renewable power packages".

As an initial part of this activity we have looked at the national distribution of hydrogen producers and sites to determine where they are located relative to the national interstate highway system, the national electrical grid and the natural gas transmission system, as well as renewable resource availability. All these networks and resources mesh nicely and appear to present opportunities to accelerate deployment of a future hydrogen infrastructure based on both conventional and renewable energy resources.

An extremely important element of this activity is the coordination of all codes and standards activities for the DOE Hydrogen Program. We are looking to create an integrated, multi-year codes and standards effort involving all key stakeholders, and want to integrate the codes and standards activities with the overall infrastructure planning and deployment effort. Related activities include development of the Sourcebook for Hydrogen Applications (1998) and formation of the HTAP Safety Committee, collaboration with the International Hydrogen Infrastructure Group, and work with other related organizations. NREL plans to develop and maintain a database for one-stop shopping on codes relevant to fuel cells on a website within the next year or two.

Guy Tomberlin (Fairfax County): 2000 International Mechanical, Fuel Gas and Residential Code

Mr. Tomberlin is a code enforcement official in Fairfax County, Virginia, and serves on the International Code Council's Ad Hoc Committee on Hydrogen. This is an ICC consensus committee and is soliciting public input on proposed changes to the International, Building, Fire, Mechanical Fuel Gas, and Residential codes. He stressed the importance of gaining support for these changes. He gave some examples of opposition to their proposals, such as "elevation systems" i.e., hydrogen storage on the roofs, was eliminated because some fire marshals organizations raised issues relating to containing fire situations, and having great concerns of how to deal with hydrogen systems located on roof structures in these situations. Guy noted that there have been recently submitted "definitions" to the ICC relevant to hydrogen, and the importance of their becoming adopted in order to have those common terminology included in the model code books used today.

In general, code officials are ready to see code text relating to hydrogen technology and they support it, knowing that hydrogen infrastructure may soon to be appearing in their local jurisdiction. Currently the code official has no guidance to provide them minimum safety guidelines for coverage of hydrogen. Code officials need guidance, they don't know the technologies or how they operate. The model codes typically provide prescriptive requirements because they are easy to implement and to ensure that they have been followed. Standards sometimes contain permissive language that is subject to a broad range of interpretation and difficult to enforce, e.g., whether a requirement of "10 feet from the nearest wall" has been satisfied is easy to determine. He also included comments relating to the advantages and benefits of listing and labeling appliances, products, and equipment by nationally recognized organizations. Industry will have to become more participative in the International Code Council process in order to keep the model codebooks updated.

Mr. Tomberlin's presentation includes handouts of the current text changes to be submitted for approval within the ICC process, which will be heard at Ft. Worth Texas, in September, for which he was soliciting input and support from the Summit attendees.

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Todd Strothers (CSA International): CSA Fuel Cells Standards Development

CSA International is the result of a merger of the major electrical testing laboratory for Canada with the major natural gas testing labs of Canada and the USA. CSA is working on several standards for fuel cells, some that will replace existing standards developed elsewhere. These include

CSA FC 1:	Fuel Cell Power Systems (replacing ANSI Z21.83 when finalized)
CSA FC 2:	Residential Fuel Cell Power Plants
CSA FC 3:	Portable Fuel Cell Power Systems
CSA Req. 5.99:	Hydrogen Generators (includes reforming technology)

In addition, CSA is the U.S. administrator for IEC TC 105 so it is involved in the development of international standards as well.

A question arose as to the reason for the upper limit of applicability of FC 1. Mr. Strothers suggested that this upper limit is somewhat arbitrary, there is no real reason for an upper bound. Units larger than this could likely be listed according to the same criteria as smaller units.

Russell Hewett (NREL): NFPA Activities (NFPA 50, 853, 70)

NREL participates in various NFPA code development efforts. Codes are developed through the consensus process, and current codes include:

- NFPA 50A Bulk Gaseous Hydrogen Systems
- NFPA 50B Bulk Liquid Hydrogen Systems
- NFPA 853 Stationary Fuel Cell Systems over 50kW
- NFPA 52 Compressed Natural Gas (CNG) Vehicular Fuel Systems

NFPA 52 applies to the design and installation of compressed natural gas (CNG) engine fuel systems on vehicles of all types, and is being expanded to include hydrogen for vehicles. NFPA 853 is to be expanded to cover small fuel cell applications (residential usage under 50 kW). Also, the 2002 edition of the National Electrical Code includes a new article, Article 692, that covers the electrical installation requirements for fuel cell systems, and NFPA is looking to develop a training program in NFPA hydrogen standards. NREL is working with NFPA to document hydrogen refueling facilities and providing technical support to NFPA within their hydrogen-related codes and standards development.

Karen Miller (NHA): International Standards Organization (ISO) TC 197/22/SC21/58

The National Hydrogen Association (NHA) is dedicated to commercializing hydrogen-related energy systems and currently has about 70 members, including national, international and multinational. NHA works with existing codes and standards groups on the development of codes and standards but it does not publish any of its own. NHA attempts to identify areas where codes and standards for the safe use of hydrogen energy systems are needed, determine if adequate codes and standards exist, identify other stakeholders and expertise, and finally develop new draft standards when the work is needed but not being accomplished elsewhere in a timely way. Ms. Miller noted that there is a lot of activity in the international arena (see presentation for an extensive listing of standards activities) and that it is critical for the United States to maintain a presence to ensure a level playing field. She also noted that it is important to allow for a regional focus in codes, as a particular installation may be planned in areas prone to flood or in an earthquake zone, for example.

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Discussion Issues: Attendees

Ron Fiskum asked the audience for reports on problems encountered with actual installations.

- Frank Holcomb (CERL) described difficulties encountered with Niagara Mohawk Power (NIMO) while installing ten 5kW Plug Power fuel cell units at the Watervliet Arsenal in New York. NIMO required that each of the ten units be metered separately for output, an estimated $40,000 cost that the Army was unwilling to bear for this demonstration. NIMO's contract with the Army, however, imposed a penalty for having units installed even if those units were not running. The rule assumes 100% run time and monthly charges are computed on that basis.
- Steve Kalland (North Carolina Solar Center) stated that his experience has been that electric utilities generally "oppose" net metering and DG capabilities being installed on their lines, and have been successful in getting legislation in place to support their position. Utilities have negotiated on several fronts and now appear to add together all the concessions they have been granted and use that as their opening position.
- David Smith (PNNL) called the group's attention to two significant dates related to the ICC codes—the closing date for comments on currently proposed code changes and the closing date for proposing new code changes for the 2004 Supplement. Code change proposals submitted after February 15, 2003, will be considered in developing the 2006 Editions of the I-Codes.

May 30, 2002—Day 2 of Conference

Russell Hewett (NREL) and Neil Rossmeissl (DOE): DOE Hydrogen Codes Coordinating Committee

There are numerous activities ongoing related to codes and standards for fuel cells. To help coordinate activities related to hydrogen fuels, DOE formed the Hydrogen Codes Coordinating Committee. The mission of the committee is a consistent set of codes and standards for production, delivery, and use of hydrogen in all stationary (i.e., buildings), transportation, and portable applications. The intent is to ensure development of codes and standards in advance of and in parallel to the relevant technologies. The committee has assembled a version of a matrix that describes the various activities being undertaken by different organizations.

Many accomplishments have been made recently. The first U.S. hydrogen fueling station has been established in Las Vegas, NV. Certification of various storage tanks has been achieved. Various hydrogen Power Park concepts and co-production systems have been pioneered.

A major political battle is currently brewing between the natural gas and hydrogen interests, because the natural gas industry is concerned they will be put out of business – if the coordinating committee is unsuccessful hydrogen could be put 2-3 years behind in development/deployment.

Doug Read (SAE): SAE Fuel Cell Standards Committee

First point: "Automotive" in the Society of Automotive Engineers (SAE) should be read as "self-propelled," as we cover all vehicles in addition to automobiles. We have been involved in codes and standards for the transportation sector for nearly a century. SAE currently develops more than 600 standards per year in response to customer and market needs.

SAE's Fuel Cell Standards Committee has 6 working groups working on fuel cell-powered vehicles, including Emissions & Fuel Consumption, Interface, Performance, Recyclability, Safety, and Terminology. Our mission is to ensure the safety, performance, reliability and recyclability of fuel cell systems in vehicles with emphasis on efficiency and environmental impact. The standards will also establish test procedures for uniformity in test results for the vehicle/systems/components

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performances, and define interface requirements of the systems to the vehicle. Our ultimate goal for technologies such as fuel cells is one standard, universally applied worldwide.

Dave Conover (National Evaluation Service): IEC TC 105 on FuelCells

The scope of the International Electrotechnical Commission (IEC) Technical Committee (TC) 105 is to prepare international standards covering fuel cell technologies for all fuel cells in stationary, propulsion, and portable power generation systems applications. In this effort it also communicates and coordinates with other international standards efforts where relevant, such as ISO TC 197 on hydrogen, and the Society of Automotive Engineers.

Just because a standard is developed and implemented in the United States doesn't mean that products meeting that standard can be readily accepted in other countries. If those countries have developed and adopted different standards then access to those markets for U.S. manufacturers may be impeded. U.S. manufacturers may have to develop variant designs for different countries and/or conduct numerous duplicative testing and certification efforts in documenting compliance with multiple standards. This supports a growing focus on international standards as a way of facilitating intra-country technical communication and uniform global acceptance of technology.

As there are strong alliances of countries such as the European Union participating in the development of international standards, it is increasingly important to look beyond the U.S. borders and participate in international standards activities. This can help to ensure that what is published as an international standard and subsequently adopted by various countries does not preclude or impede the deployment of U.S. technology. Sometimes these international activities start with a U.S. standard, but many times they start with a standard developed elsewhere. "One country, one vote" is a key point that must be understood, furthering the importance of U.S. participation to ensure that U.S. interests are addressed.

A U.S. Technical Advisory Group monitors IEC TC 105 activities, determines the U.S. position on IEC TC 105 efforts, supports U.S. input to IEC TC 105 efforts and provides for U.S. representation at the meetings. Within IEC TC 105 there are seven working groups. Working groups develop standards that implement a program of work designed and approved by all voting members (countries) of the TC. Working Groups under TC 105 include WG 1: Terminology, WG 2: Fuel Cell Modules, WG 3: Safety of Stationary Fuel Cell Systems, WG 4: Performance of Stationary Fuel Cell Systems, WG 5: Installation of Stationary Fuel Cell Systems, WG 6: Fuel Cell Systems for Propulsion and Auxiliary Power Units, and WG 7: Portable Fuel Cell Appliances. Some of these have developed a draft standard or technical report that is close to being approved by the TC for a wider public review. Other working groups are just beginning to draft standards.
Dave Conover is the past Deputy Technical Administrator of the U.S. Technical Advisory Group (US TAG) to IEC TC 105 and made this presentation on behalf of Kelvin Hecht the Technical Administrator of the US TAG and U.S. delegate to the IEC TC 105.

Harry Jones (Underwriters Laboratories): UL Standards Development

The development of codes and standards for fuel cells is going to be an ongoing process, and we are going to see a lot more standards in the future in order to consider fuel cell power systems with various operating features and to address the various market categories.

There was an early disconnect—technical developers had no idea of codes to be complied with and code developers had no idea of what the technical issues would be. The good news is a lot of competent work is underway.

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UL 1741 was first developed for photovoltaics (PV) and later adapted for fuel cells and other DG technologies. UL 1741 will be harmonized with IEEE/P1547 when that standard is adopted. UL 1741 may become a reference for an international standard.

UL 2262 addresses portable power systems and modules but may be retired after CSA FC 3 is adopted. UL 2264 addresses gaseous hydrogen generating appliances and UL 2265 addresses replacement fuel cell power units for appliances and micro-fuel cell units.

Numerous UL component standards are already referenced in adopted and proposed standards for both fuel cell power systems and hydrogen generating equipment.

Frank Holcomb (CERL): Department of Defense Fuel Cell Demonstration Program

The Department of Defense has helped fund numerous demonstration projects for fuel cells around the U.S. The first systems demonstrated were 200-kW phosphoric acid units from International Fuel Cells (aka ONSI, UTC Fuel Cells). Recently the program has expanded to include residential-scale proton exchange membrane (PEM) units. These later units reflect improvements in the technology that are apparent in their higher availabilities: the ONSI Model Cs average 75% compared to the earlier Model B's 57%. These percentages are raw availability; the numbers do not include downtime for site work, scheduled maintenance, etc.

In the new residential program, ERDC/CERL is looking for units that can satisfy minimum 1-year commitments to power at 90% availability. The Plug Power units installed to date have shown about 98% availability over 24,000 hours since they were installed in January 2002, operating at about 25-27% electrical efficiency.

DoD's objectives for these demonstration programs are to contribute to reduced fuel cell prices through manufacturing economies of scale and to effect improvements in the units from actual field use. In the FY01 Residential PEMFC Program, approximately $3 million was awarded to six contractors for a total of 21 units at nine sites. A similar level of funding is anticipated for FY02.

Rebate Program

In 1995, Congress appropriated funds for the Office of the Deputy Under Secretary of Defense, Environmental Security (ODUSD-ES) to establish a competitive, cost-shared, near-term Climate Change Fuel Cell Program (H.R. 103-747). The overall goal of this incentive program is to expedite the market introduction of fuel cell systems. Currently, the program provides up to $1,000 per kilowatt of power plant capacity with a not-to-exceed limit of one-third of the total program cost (capital and installed costs, pre-commercial operation).

Most of the fuel cell projects receiving grants were feasible only with support from the rebate program. The primary benefits of this program include:

- Enables early adopters to participate in demonstrations and field tests.
- Facilitates manufacturer cost reductions through increased production quantities.
- Encourages financial project support from other supporting agencies.
- Expands options for distributed generation technologies needed to meet growing electricity demand.

ERDC/CERL is a major sponsor of the Fuel Cell Test & Evaluation Center (FC*Tec*). Operated by Concurrent Technologies Corporation (CTC), it is located in Johnstown, PA. FC*Tec* 's primary mission is to provide independent and unbiased testing of fuel cell power plants for military and commercial applications. Its primary goal is to significantly accelerate the development and commercialization of fuel cell power plants. Specific objectives for the FC*Tec* are:

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- Validate prototype, pre-production systems and components.
- Evaluate design and off-design characteristics of fuel cells.
- Develop standards for commercial and near-commercial applications.
- Reduce life-cycle costs for commercial fuel cell technologies.
- Enhance the performance of fuel cells.

Shawn Herrera (DOE) - FY2002 DER Call for Projects

Federal funding is available up to $500,000 to support cost-effective federal projects using Distributed Energy Resources. Through this call, the Federal Energy Management Program will provide subsidies for DER hardware as well as technical assistance.
The generation technology can be any of the following sources, powered by natural gas and/or renewable energy:

- Microturbines
- Advanced industrial turbines
- Combined, heat and power systems (CHP)
- Fuel cells
- Hybrid systems
- Natural gas reciprocating engines
- Photovoltaic systems
- Wind energy systems

Selection criteria will be based on cost sharing with project partners and agency support, financial and technical merit, strategic value and showcase potential, the project description, and the project implementation plan.

Michael Finney (MEDC): Michigan's NextEnergy Program

The Governor of Michigan recently announced the NextEnergy program, intended to develop a state of the art, full service fuel cell and alternative energy industry positioned to capture a portion of the future alternative energy technology market. In addition to the obvious link with the transportation industry (about 97% of R&D that is done for the transportation sector occurs in Michigan, according to Mr. Finney), Michigan wants to become a center of development for all fuel cell applications. The program is administered by the Michigan Economic Development Corporation (MEDC), which manages about $200 million worth of programs. Next energy has a 3-year budget of $52 million. The state is offering many attractive tax and other benefits to relevant companies willing to locate in Michigan.

The need for a Federal research facility has been the most consistently mentioned one identified in surveys undertaken by MEDC. Such a Federal facility would act as an "underwriters laboratory" to develop industry standards, house a collaborative testing facility, serve as a national clearinghouse and provide other functions. Communications are underway to site such a facility in the state.

Jim Foster (NYSERDA): NYSERDA R&D Activities

The New York State Energy Research and Development Authority (NYSERDA) is a public benefit corporation with goals of improving the efficiency, environmental and economic performance of energy use in New York state. NYSERDA does product development and testing and has had numerous successes, and has been involved in fuel cell technology since 1992. In fact, Plug Power, Inc. originated out of a NYSERDA R&D effort.

NYSERDA has been supporting an 80-unit demonstration of proton exchange membrane fuel cells since 1999, with the goals of deploying units at publicly-owned and accessible facilities across the state, verifying the clean, environmentally friendly nature and accelerating their wide scale commercialization. Several things have been learned during the course of this project:

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- The water supply system on several units deployed during the initial stages of Phase III accidentally froze up when exposed to cold temperatures while not in operation. Some piping and, in one instance, a water pump required replacement. There was no damage to the stack. Measures have been taken to prevent future problems with the water supply system when the unit is exposed to sub-freezing temperatures.
- Fuel cell stacks displayed accelerated degradation because of off-gassing of materials in the enclosure. Relocating the air intake outside of the enclosure slowed the degradation.
- As expected, overall emissions from Plug Power's fuel cell systems are extremely low, however, hydrocarbons tend to spike during startup. Although this does not represent a significant issue, Plug Power is working to reduce this transient spike.
- Interconnection rules with the utilities continue to present challenges. NY state interconnection is pretty well understood, and the recognition of the Plug Power units as meeting the requirements of New York's Standard Interconnection Requirements (SIR) helps the process along but, in many cases, working with the utilities is still a difficult process.
- At the beginning of the program, it took 8-10 days to get the units from the point of unloading from the trailer to operation startup; by the end of the activity this time was down to 8 hours.

Discussion question from audience

Article 692 of the 2002 National Electrical Code talks about the "Fuel Cell System", which includes all components, needing to be listed. Is this a problem for system integrators purchasing various components from different manufacturers and assembling installations? Or what if someone takes one component, such as the reformer, and replaces it with another unit. Does this void the listing?

Harry Jones, UL

Not really. Z21.83 covers the components and their interaction. If the manufacturers get the components individually listed and certified, integrators should be able to mix and match and still have overall systems that are certified.

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PNNL Program Contact: BR Kinzey
To Order CDs: CL Thomas
Released: July 2002
PNNL Fuel Cells web site: http://www.pnl.gov/fuelcells/