FUEL CELL SUMMIT
Volume 2, Issue 1
A quarterly newsletter published by the U.S. Department of Energy for the U.S. fuel cell industry to foster development and adoption of codes and standards

NES Releases National Evaluation Protocol For Stationary Fuel Cell Power Plants

The National Evaluation Service, Inc. (NES)[1] has just completed a National Evaluation Protocol (NEP) for Stationary Fuel Cell Power Plants for testing and evaluating stationary fuel cell installations for residential and commercial buildings. The not-for-profit NES conducts an evaluation program for building materials, products, and systems with respect to the U.S. model building codes and publishes evaluation reports to facilitate the acceptance of new building technologies by the U.S. building regulatory community and by those who design and construct buildings.

Although only one company has a stationary fuel cell power plant commercially available to date, many other sizes and designs are expected in the next few years. The development, adoption, and implementation of new codes and standards for their installation will not be completed and adopted quickly enough to facilitate acceptance of stationary fuel cell power plants for at least the first generation of this new technology. Therefore, until building regulatory acceptance has become "routine," users of fuel cells will have to document and justify the acceptability of the technology to state and local building regulatory authorities on a relatively ad hoc basis.

In effect, the NEP can be viewed as a checklist of items that the manufacturer should consider in preparing to submit documentation to NES that verifies their product complies with the U.S. model building codes (National Codes, Standard Codes, and Uniform Codes) the ICC International Codes, and the extent of reference to standards in these codes. The commensurate tests for safety and performance of specific stationary fuel cell power plants, and subsequent evaluation of those tests and the product(s) pursuant to the NEP, are the responsibility of the manufacturer through NES and result in an evaluation report on their product.

The NEP allows both stationary fuel cell power plant manufacturers and code officials to implement a uniform evaluation process for assessing the safety and performance of fuel cell technologies. The NEP will also help address the frequent inquiries received on product and material acceptability.

History and Current Status of the NEP

Early last year, the NES established a Fuel Cell Advisory Panel to work closely with the NES through the "white paper" and draft development stages of the NEP. The NES released a first draft of the NEP for public comment on its website in November 2000. After comments were received, a special follow-up meeting for manufacturers, representatives of testing and listing agencies, and code organizations was organized in February 2001 to finalize the draft. The final version of the NEP was posted to the NES website March 15 and can be downloaded at no cost (www.nateval.org). The NES fully intends for the NEP to evolve and be revisited periodically as the subject technology dictates.

Development of the NEP has been supported by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, Office of Power Technologies.

[1] NES is a jointly supported effort of Building Officials and Code Administrators International, Inc. (BOCA) and Southern Building Code Congress International, Inc. (SBCCI).

Fuel Cells Summit V: Come Join the Drive for U.S. and International Regulatory Acceptance

The U.S. Department of Energy (DOE) Office of Power Technologies is sponsoring Fuel Cells Summit V, to be held May 30-31 in College Park, Maryland. This fifth annual summit on codes and standards for fuel cell power plants is part of DOE's effort to foster the institutional environment for market-driven adoption of fuel cell technologies for stationary, portable, and vehicular applications. Summit V will:

- ***Provide a brief overview of the status of fuel cell R&D and commercialization***
- ***Identify remaining gaps in the relevant codes and standards for stationary, portable, and vehicular applications***
- ***Present results of a "mini-case study" of code officials in the Tri-Cities, Washington and their level of preparedness for fuel cell installations***
- ***Provide working discussions of remaining barriers and means to address them***
- ***Determine additional needs, roles and responsibilities as new gains toward commercialization are made***

Summit V will emphasize a participatory environment to ensure that the maximum number and variety of ideas are generated and followed up on.

Attendance at each of the summits to date has been held to roughly 100 persons. Those include representatives from virtually all of the major manufacturers, code organizations, building code inspection agencies, government officials, installers of the technology and others. Space may be limited, but anyone potentially interested in attending Summit V can download more information and a registration form from the program website at www.pnl.gov/fuelcells.

For additional information, contact:

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Visit the Fuel Cells website at:
www.pnl.govfuelcells/index.htm

Hydrogen Feedstock Choices: A Primer

Fuel supply is central to any discussion concerning localized or distributed energy production, and although fuel cells operate on hydrogen, their fuel feedstock requirements vary significantly from one technology to another. Molten carbonate and solid oxide fuel cell systems reform hydrogen from a variety of feedstocks internally, and therefore, neither requires an external fuel reformer or suffers from the operational constraints PEM technologies do in the presence of hydrogen contaminants such as sulfur. For PEM fuel cells (and to a lesser degree, phosphoric acid fuel cells), the quality of the hydrogen stream feeding the fuel cell stack bears a direct relationship on the efficiency and operational life of the stack itself, and the supply and storage of each feedstock also varies. For this reason, this article addresses the installation and operation issues surrounding fuel feedstocks for PEM units alone.

Hydrogen

Hydrogen is currently produced in the United States within industrial process and pharmaceutical facilities. As such, the local building inspector is not necessarily the last word on all installations–the insurance underwriter is. Commonly referenced standards for such installations include ASME B31.3 (Process Piping), ASME's Boiler and Pressure Vessel Code, Section VIII, and API regulations concerning the sizing of pressure relief devices or the presence of fire surrounding equipment, and NFPA 70, National Electrical Code.

For residential or commercial installations involving hydrogen, nothing yet exists to address onsite hydrogen production. NFPA 50A, Gaseous Hydrogen Systems at Consumer Sites, allows for the storage and use of hydrogen onsite, if the supply originates off the consumer's premises and is delivered by mobile equipment. It does not cover hydrogen production systems. NFPA 50B covers liquid hydrogen systems.

Sample NFPA 50A Requirements

- ***Hydrogen containers or systems cannot be buried (Chapter 3, 3-1.2)***
- ***Must be designed and constructed in accordance with ASME Boiler and Pressure Vessel Code, Section VIII, "Rules for the Construction of Pressure Vessels" or CFR (U.S. Government Code of Federal Regulations) 171-190***
- ***Must be equipped with pressure relief devices in accordance with DOT or ASME standards***
- ***Installation must be conducted by personnel "familiar with proper practices" (Chapter 2-4.2)***
- ***Hydrogen systems installed indoors must generally be below 15,000 scf (99 meters cubed)***
- ***A wide variety of minimum distances (exposures to access ways, fire hazards, impacts, etc.) have been pre-determined for outdoor installations.***
- ***Indoor installations shall have ventilation outlet openings not less than 1 square foot per 1000 cubic feet of room volume.***

Table 8001.15A of the 1997 Uniform Fire Code outlines the quantity of gaseous substances that may be stored onsite for local use; the maximum allowed for hydrogen is generally 25 cubic feet (enough to make 1kWh of electricity from a small PEM fuel cell unit).

The International Code Council (ICC) has formed a Hydrogen Ad Hoc Committee to address the introduction of hydrogen technologies in buildings and public facilities such as residential garages, refueling stations, and public garages or vehicle repair garages. The committee is initially working towards the introduction of reference language to U.S. building codes, for the onsite storage and use of hydrogen; the production of hydrogen at refueling stations and residential garages will also be addressed.

In the interim, one company has successfully addressed local code inspectors' concerns during direct-hydrogen demonstrations by maintaining the fuel tank outside the building and piping the H_2 inside. An air-H_2 mixture well below explosive concentrations is maintained by using a velocity gauge on the intake pipe and a fan to draw air out of the building at a specified rate.

Onsite Reformation

Ideally, PEM technologies prefer hydrogen with impurities below 1 ppm (some stack developers have indicated sulfur must be maintained below 0.5 ppm). For all known fuel feedstocks, this requires some form of reformation (hydrogen extraction) and "cleansing" of the fuel stream. High sulfur fuels (propane, diesel, odorized natural gas) require an absorbent bed upstream of the reformer, which can add up to 25% to the capital cost of the reformer package and adds another maintenance item to the fuel cell system. No company currently provides absorbent beds commercially; each fuel cell company makes its own for captive use. The Netherlands-based GasTech has a bed available, but it is not intended for commercial-grade propane or diesel. Platinum-group metal catalysts can be used in the reformer; they are more sulfur tolerant but still unable to tolerate 150 ppm.

Other fuels such a***s methanol***, ethanol, or fischer-tropisch processed distillates from natural gas can be scrubbed with a membrane-based purifier downstream of the reformer, integrated into the reformer itself. No additional maintenance is required for this system but capital cost is increased slightly. However, these fuels are either not widely available commercially (fischer-tropisch distillates), are heavily subsidized (ethanol), or tagged with environmental labels (methanol is toxic to humans and great apes, who lack enzymatic protection found in all other animal life, and is therefore determined to be an "environmental hazard." However, methanol can be, and is, stored safely and has a very high evaporation rate, which quickly renders spills harmless).

Propane is currently popular among fuel cell developers due to its widespread distribution and use in the residential market. Its high sulfur content (150 ppm) makes it difficult to reform for use by a PEM technology. Propane tanks and piping are covered by NFPA 58, the Liquid Petroleum (LP) Gas Code.

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2001 Calendar of Events

APR

2-3 **Fuel Cells, the Future of Power: Balance of Plant and Distributed Generation**, San Antonio, TX. Contact: http://www.bccresearch.com/fuel_cells2001/.

9-11 **22nd International Power Sources Symposium: Research & Development of Batteries & Fuel Cells**, Manchester, U.K. Contact: Bob Baily, +44.1892.652.881; fax: +44.1892.653.459; email: ipss@marketdevelopco.demon.co.uk.

12 **A Fuel Cell Technology Forum: Networking Users, Suppliers and Manufacturers for Clean Energy Marketing Alternatives**, Wenatchee, WA. Presented by IEEE Wenatchee Section and the U.S. Department of Energy. Wenatchee Convention Center. Contact: Matthew Davis at matthew.davis@ieee.org.

17-19 **The U.S. Department of Energy Hydrogen Program Annual Review**, Baltimore, MD. Baltimore Hilton & Tower, 20 West Baltimore Street. Contact: Cathy Gregoire, email: cathy_gregoire@nrel.gov.

23-25 **Distributed Power 2001, Intertech's Fifth International Conference on Distributed Power**, Washington, D.C. Washington Marriott Hotel. Contact: (207) 781-9800; info@intertechusa.com; or visit www.intertechusa.com.

23-28 **Hannover Fair 2001: The World Fair for Energy Management and Technology**, Hanover, Germany. Contact: +49-(0)8151-99892-3; fax: +49-(0)8151-99892-43; email: arno@fair-pr.com or visit http://www.h2fair.de/e/hm01/index.html.

MAY

9-10 **The Second International Combined Heat and Power Symposium, "The Growing Market for CHP and Distributed Generation,"** Amsterdam, The Netherlands. Contact: http://www.2ndchpsymposium.com/.

9-10 **West Coast Energy Management Conference**, San Diego, CA. Sponsored by FEMP, organized by AEE. Contact: Drian Douglas, (770) 279-4386; fax: (770) 381-9865 or visit: www.aeecenter.org.

13-16 **The 7th Annual National Clean Cities Conference and Expo**, Philadelphia, PA. Pennsylvania Convention Center. Contact: http://www.ccities.doe.gov/conference.shtml.

30-31 **Fuel Cell Summit V**, College Park, MD. Supported by the U.S. Department of Energy, Office of Power Technologies. Contact: Maude Wickline, (703) 617-4254 or visit www.pnl.gov/fuelcells.

JUNE

3-6 **Energy 2001—Energy Efficiency Workshop & Expo**, Kansas City, MO. Sponsored by the U.S. Department of Energy's Federal Energy Management Program, the U.S. Department of Defense, and the U.S. General Services Administration. Hyatt Regency Crown Center. Contact: JoAnn Stirling,(800) 395-8574; fax (321) 638-1010; email: joann@fsec.ucf.edu, or visit www.energy2001.ee.doe.gov.

3-8 **Seventh International Symposium on Solid Oxide Fuel Cells**, Tsukuba, Ibaraki, Japan. Contact: +81-298-61-4444 / 4476, fax: +81-298-61-4488, email: sofc7@nimc.go.jp.

11 **AEI Fuel Cell Transportation Technology Summit**, San Jose, CA. Hyatt Hotel. Sponsored by Automotive Engineering International (AEI). Contact: Sandra Gadzia gadzia@sae.org.

17-20 1**1th Canadian Hydrogen Conference: Building the Hydrogen Economy**, Victoria, British Columbia, Canada.Victoria Conference Center. Contact: http://www.iesvic.uvic.ca/cha/.

JULY

2-6 **The First European Polymer Electrolyte Fuel Cell Forum**, Luzern, Switzerland. Kultur-und Kongresszentrum Luzern. Contact: email: info@efcf.com or visit www.efcf.com.

9-13 **4th International Symposium on New Materials for Electrochemical Systems**, Montreal, Quebec, Canada. Contact: http://www.newmaterials.polymtl.ca/.

15-19 **IEEE Power Engineering Society (PES) Summer Meeting 2001,** Vancouver, British Columbia, Canada. Information: (614) 473-2731; email: yakout.mansour@bchydro.bc.ca.

Standards Committee Activities Updates

ANZI - Z21.83 - 1998/CSA, Fuel Cell Power Systems

The Z21.83 Standard has been relinquished over to CSA for further processing as an American National Standard under its own accreditation. On March 2, 2001, CSA initiated three new standards projects with ANSI-Residential Fuel Cell Power Generators, Portable Fuel Cell Power Generators, and Fuel Cell Modules. CSA International is now forming a CSA International Fuel Cell Technical Advisory Committee to help oversee the development of the four fuel cells standards mentioned. Contact: Steven E. Kazubski (CSA International), (216) 524-4990 ext. 8303; email: steve.kazubski@csa-international.org.

ASME PTC 50, Performance Test Code for Fuel Cell Power Systems

Wanted: industry reviewers. This committee is compiling a list of potential reviewers of the Performance Test Code and solicits your participation. Assignments will be made and a copy of the draft sent to selected industry reviewers. Contact: Jack Karian (ASME), email: karianj@asme.org; (212) 591-8552.

IEC TC 105, Fuel Cell Technologies

The first meeting of the IEC TC-105 US TAG on Fuel Cell Technologies was held March 13, 2001 in Lake Buena Vista, Florida. Appointments included Kelvin Hecht as TAG Technical Advisor/Chairman, David Conover as TAG Deputy Technical Advisor/Vice-Chairman, and CSA America Inc., as TAG Administrator. Working Groups being formed include: Fuel Cell Terminology, Fuel Cell Modules, Stationary Fuel Cell Power Plants - Safety, Stationary Fuel Cell Power Plants - Performance, and Stationary Fuel Cell Power Plants - Installation. Future working groups include Portable Fuel Cell Systems and Transportation Fuel Cell Systems. The next TC 105 international meeting will be in London this September. Contact: Steven E. Kazubski (CSA International), (216) 524-4990 ext. 8303; email: steve.kazubski@csainternational.org.

IEEE P1547, Distributed Resources Interconnected With Electric Power Systems

The 30-day ballot period for IEEE P1547 Draft 07 has been completed, and the standard is on track for publication in 2001. Discussion on the ballot results will be the first priority at the next Working Group meeting April 18 - 20, 2001, hosted by Entergy Corporation, at the Hyatt New Orleans Hotel. Six new DR project activities for SCC21 are being discussed. For further information visit: http://grouper.ieee.org/groups/scc21/1547/archives/. Contact: Richard DeBlasio (NREL), (303) 384-6452; email: deblasid@tcplink.nrel.gov or Tom Basso (NREL), (303) 384-6765; email: thomas_basso@nrel.gov.

ISO TC 197, Hydrogen Technologies

WI 15916 Basic Considerations for the Safety of Hydrogen Systems: final editorial changes have been approved for circulation to the P-members of ISO TC 197 until May 20, 2001. WI 15869 Gaseous Hydrogen and Hydrogen Blends-Land Vehicle Fuel Tanks: to be circulated as a Draft International Standard for a five-month voting period in the next month or two. WI 17286 Gaseous Hydrogen-Land Vehicle Filling Connectors: still in working group addressing design issues of potential cross-connection. WI 15866 Gaseous Hydrogen Blends and hydrogen Fuel-Service Stations: still at the working group level while issues regarding the baseline document and convener availability are being worked.

The 10th plenary meeting will be in October 2001 in Paris. The 11th plenary meeting will be in conjunction with the 14th World Hydrogen Energy Conference in June 2002 in Montreal. Contact: Karen Miller (NHA), (202) 223-5547; email: kmiller@ttcorp.com.

National Evaluation Service (NES) Protocol, Stationary Fuel Cell Power Plants

See article on page 1 of this newsletter. Contact: Darren Myers (BOCA), (708) 799-2300; email: dmeyers@bocai.org.

NFPA 70 - Article 692, Fuel Cell Systems

At the December meeting of Code Making Panel 3, the article was titled Fuel Cell Systems and renumbered as Article 692. Panel 3 acted upon the five comments received with no further action taken by the TCC. All that remains now is to see if any motions are made at the annual meeting in May. Contact: Jean O'Connor (NFPA) (617) 984-7421; fax: (617) 984-7070; email: joconnor@nfpa.org.

NFPA 853, Installing Fuel Cells

NFPA 853 is available by calling (800) 344-3555, (617) 770-3000, or on the Web at www.nfpa.org. Residential fuel cells could be added to the next edition of NFPA 853 (Annual 2003) if proposals are submitted by December 28, 2001. The committee would meet in the spring of 2002 to take action on those proposals. Contact: Richard Bielen (NFPA), (617) 770-3000; email: rbielen@nfpa.org.

UL 1741, Standard for Inverters Converters and Controllers for Use in Independent Power Systems

UL1741 is being harmonized with IEEE P1547; it is expected to be published in 2001. A group meeting in October or November will review the revised UL1741 draft of this harmonized document. Contact: Tim Zgonena (UL) (847) 272-8800 ext. 43051; email: Timothy.P.Zgonena@us.ul.com.

Diesel is even more widely available to (residential and commercial or institutional) energy users, but its very high and variable sulfur content (up to 300 ppm) makes it unsuitable for current reformation technologies. However, the Tier II Standards established by the State of California are slowly introducing much lower sulfur tolerances for on-highway diesel. By 2010, California diesel will be 15 ppm. Detergents and other additives may still pose a challenge.

Ethanol currently enjoys a price subsidy that makes it an attractive fuel choice in the United States, and installations are already covered under NFPA 30 and 30A (originally written for gasoline storage and fueling stations). Ethanol is corrosive to rubber and some metals and requires conscientious handling. The National Renewable Energy Laboratory maintains an excellent guide to the installation and operation of ethanol fueling stations. See http://www.afdc.nrel.gov/pdfs/ethguide.pdf.

Natural gas is also widely distributed across much of the Eastern, Western, and Southern United States (parts of the Central Mountain and Midwest areas are currently transmission-constrained). Recent price volatility has reinforced the need to develop multi-fuel processors capable of providing fuel hedging to the energy customer. Natural gas systems are covered by NFPA 54, the National Fuel Gas Code (1998). Odorants may be an early problem for reformer technologies, but the technology advances in hydrogen sensing may obsolesce the current dependence on human olfactory sensing.

Fuel Type	Price ($/1,000 Btu)	Comments
Propane	0.015*	High sulfur content (150+ ppm); covered by NFPA 58, LP Gas Code; odorants a problem
Diesel	0.01**	Very high sulfur content (300+ ppm); California Tier II standards moving to 15 ppm; additives (detergents) a problem; covered by NFPA 30, Flammable and Combustible Liquids
Methanol	0.012***	Lack of code official familiarity, EPA Clean Water Act 40 CFR, 116-117, and OSHA CFR 29, 1910.12 declares it “hazardous”
Ethanol	0.008****	Falls under NFPA 30 & 30A (gasoline); corrosive to rubber and some metals; price subsidy through 2008
Natural Gas	0.05*****	Readily available; no oustanding code issues (NFPA 54, National Fuel Gas Code); odorant additives may be a problem
Direct H_2	0.15******	No NFPA standards for onsite production of H_2; NFPA 50A & B (onsite storage and use of gaseous & liquid hydrogen) relates to industrial H_2 production

Btu per gallon equivalent; prices indicate delivery per 5,000-gallon tank

* 90,500/$1.40

** 140,000/$1.40

*** 64,300/$0.80

**** 85,000/$0.70

***** $5/Mcf standardized at 1,000 Btu/cu.ft.

****** $15/Mcf standardized at 1,000 Btu/cu.ft., assuming central steam reformation of natural gas at $5/Mcf.

Methanol and Code Inspectors: A Case Study

By Gordon Gregory, IdaTech Communications Director

The importance of clear installation standards was driven home to IdaTech last year as we placed six 3-kilowatt methanol fuel cell systems in Montana, Washington, and Oregon for testing. Those units are part of an alpha-testing program conducted with the Bonneville Power Administration, the federal agency best known for operating hydroelectric dams on the Columbia River and other Northwest rivers. The fuel cell units are being installed in participating public and municipal utilities.

The oversight and rules set by local fire marshals and other regulators involved with placing these systems varied greatly between locations. In some jurisdictions, for example Montana’s Fergus and Lincoln counties, the process was fairly quick and simple. In others, the process was more involved. The fire marshal’s office in Oregon’s Lane County only recently approved a fuel tank design and siting standards for the Eugene Water & Electric Board’s fuel cell system. The siting process there started in early 2000.

> ***“Our testing program calls for locating 106 beta units in the field beginning in July 2001, so the need for consistent, clear and reasonable codes and standards is immediate for us. The need will only intensify as testing expands and commercialization approaches.”***

Alan Mace, IdaTech’s Engineering Field Services Manager, said the absence of codes and standards adds layers of difficulty in some jurisdictions. For example, design, placement and safety features for the methanol storage tank varied tremendously. “They [inspectors] aren’t trying to make things difficult,” Mace noted. “There’s just a big gray area out there and everyone has to interpret the rules.”

Continued on page 6

DOE Publicaton RL-P00-006

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This fuel cell unit operated in the auditorium of the Central Electric Cooperative building in Redmond, Oregon from June through September 2000. The cogeneration module at the left captured heat that was used for showers in the exercise facility.

Continued from page 5

Rod Wade, a senior engineer with the Eugene Water & Electric Board, said they struggled for almost a year to get final approvals. The requirements, especially for the methanol tank, turned out to be very expensive according to Wade. Although originally designed for gasoline products, NFPA 30 and 30A address all combustible liquids within a range of flashpoints and boiling temperatures. Both ethanol and methanol fall within the ranges established by the standards. Because of a general absence of familiarity about methanol fuels and storage, some local fire marshals have made additional requests such as additional setbacks from walls, doors, windows, etc.; an automatic shut-off valve during periods of no demand; welding of all pipes entering a building and all invisible joints; a 12-foot ventilation stack on the tank; an emergency relief venting system; seismic calculations; a secondary containment system; a static electricity management system; a pressure test while the fire marshal observes, and more. Meeting all the requirements for a 300-gallon methanol tank costs the utility about $20,000. This figure will decline significantly with continued education and outreach to code inspectors.

Mace noted that the codes for the more traditional residential fuels such as oil and propane are clear, reasonable, and cost-effective. He credits that, in part to, the involvement of fuel suppliers years ago in the development of those siting rules. He said the fuel cell industry likewise must get involved in designing the appropriate codes for its systems and fuels. "There's a big responsibility on us to help get this established," he said.

DOE's Hydrogen Program Targets New Standards

By Russell Hewett, National Renewable Energy Laboratory

The U.S. Department of Energy's (DOE's) Hydrogen Program is working to incorporate hydrogen, regardless of how it is used, into existing and proposed national and international building, fire safety, and transportation codes and standards.

Much work has been done regarding codes and standards for stationary fuel cell power plants. However, addressing codes and standards for vehicular and portable applications and the impact of hydrogen within the supporting infrastructures (e.g., service stations, parking garages, loading areas, etc.) has only just begun. The Hydrogen Program supports activities within the International Code Council (ICC) and the NFPA. The DOE also participates in the development of international standards for hydrogen energy applications, especially the efforts of the International Standards Organization Technical Committee 197 (ISO/TC 197).

In August 2000, the ICC established the Hydrogen Ad Hoc Committee (HAHC) to address how future building codes will manage safety issues related to hydrogen-fueled vehicles and portable power generators. The nine-member committee includes three code officials, three industry representatives, and three designers. 1. 1. 1. In two meetings, the HAHC has addressed the

- ***Hydrogen flexible connector standard***
- ***Portable fuel cell appliance standard***
- ***Need for harmonizing between ANSI Z21.83 and NFPA 853 regarding the definitions of stationary, portable, and residential fuel cell power plants***
- ***Need to resolve differences between ANSI Z21.83 and NFPA 853 relating to the scope of their respective standards regarding stationary fuel cells available today and anticipated concepts of new technologies.***

The result of HAHC efforts will be proposed changes, as necessary, to the ICC International Codes. The HAHC plans to complete its efforts by November 2001.

Meanwhile, the NFPA Standards Council formally approved the establishment of a project to develop a complete set of consensus codes for the built environment, including an NFPA building code (NFPA 5000). This effort, begun in FY2000 and intended to include hydrogen, is independent of the codes and standards work the ICC HAHC is conducting.

The Hydrogen Program is also identifying internationally acceptable criteria for confining hydrogen under pressure. A project is under way to formulate recommendations to ISO/TC 197 to resolve differences among national codes and standards. The results from this effort will also be made available to the ICC HAHC and those involved in NFPA 5000 codes and standards development.

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