FUEL CELL SUMMIT

Volume 4, Issue 3

A quarterly newsletter from the U.S. Department of Energy to supply information on U.S. regulation of fuel cells and hydrogen.

California's Rule 21 Certifies Molten Carbonate Fuel Cell

The molten carbonate fuel cell is the latest of eight distributed generation technologies to receive approval under California's Rule 21 since it became effective in 2001. Rule 21 aims to significantly reduce the time, cost, and complexity of utility approval with prescriptive requirements jointly developed and accepted by the state's utilities. This Rule 21 standard could serve as a model for utilities and utility commissions in other states seeking to streamline their distributed generation application processes.

The rule, a wholesale replacement of the old Rule 21, was written by a working committee including representatives from the California Public Utilities Commission (CPUC), the California Energy Commission (CEC), Pacific Gas and Electric Company (PG&E), San Diego Gas & Electric Company (SDG&E), and Southern California Edison Company (SCE). (See *Fuel Cell Summit* newsletter Volume 3, Issue 1 at www.pnl.gov/fuelcells.)

The new version specifically encourages the use of distributed generation by establishing more uniform standard interconnection, operating, and metering requirements for DER generators, streamlining the process, minimizing the uncertainties, and reducing evaluation costs for generators with straight-forward applications. The rule now requires utilities to approve an interconnection request or provide a cost estimate for an interconnection study within 20 days of receiving a completed application and the $1,400 fee. Equipment tested and certified by an accredited, nationally recognized testing laboratory is considered certified for purposes of interconnection.

The series of tests required under Rule 21 are primarily based on UL 1741, IEEE 929-2000, and New York Standardized Interconnection Requirements and are consistent with national standards being developed by IEEE.

California Certifies FCE's Direct FuelCell®

Rule 21 Applications Requirements and Criteria

Rule 21 streamlined the application process for interconnecting DER devices to the grid and established a set of standardized steps and criteria. First, the generator contacts the serving utility for an application and is assigned a utility point of contact. Once the generator turns in the application, the utility has 20 days to determine if the requestor meets the criteria for simplified interconnection and approve the request or to determine supplemental review is needed and request a study.

If the applicant meets the following criteria, no supplemental study is needed:

- The applicant is not on a networked secondary system.
- The applicant does not plan to export power.
- The generation equipment is already certified.
- The aggregate capacity is less than 15% of line section peak load.
- The starting voltage drop screen is met.
- It meets the short circuit current contribution screen.
- It meets the line configuration screen.

The first two criteria help the utility determine if the generator is likely to have an impact on the distribution

(cont'd on page 5)

DG Equipment Certified under Rule 21

Manufacturer	*Model*	*Capacity*	*Technology*
Capstone Turbine	330	30 kW	Microturbine generator with integral protective relay
Capstone Turbine	60	60 kW	Microturbine generator with integral protective relay
Fuel Cell Energy	DFC300A	250 kW	Molten carbonate fuel cell (MCFC)
Plug Power	SU1PCM-05962	5 kW	Proton exchange membrane (PEM) fuel cell
Tecogen	CM60H CM60L CM75H CM75L	60 kW 60 kW 75 kW 75 kW	Natural gas-fired internal combustion engine (ICE) with induction generator

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Distributed Generation: The Interconnection Journey Continues

Courtesy of Lisa Potter, Plug Power Inc., Senior Electrical Engineer

An increasing number of progressive energy organizations, including utilities, government agencies, and the military, are supporting the commercialization of fuel cell systems, but many issues remain.

Among the issues, the distributed generation (DG) community is concerned that DG is being unfairly penalized by imposed exit fees or departing load charges. Additionally, while DG owners are routinely charged standby rates for remaining connected to the grid, they are not recognized for the benefits-such as load reduction-that DG brings to the grid.

Another concern is that fuel cell systems are not recognized for their clean technology and for providing a bridge toward hydrogen-based energy systems. Fuel cell systems fueled by natural gas are generally recognized as environmentally advantageous because they produce negligible harmful emissions. In some states, such as New York, fuel cells, even those fueled by natural gas, are treated as "renewable" because of their ultra-low emissions. However, other states do not consider fuel cells as renewable. And even in states such as New York, fuel cells do not enjoy the full benefits of net metering, exemption from standby rates, and no-cost interconnections that recognized renewable energy sources such as photovoltaics receive. Plug Power[1], along with many others in the DG community, is working toward transformation of these restrictive regulations through rulemaking committee participation and government advocacy.

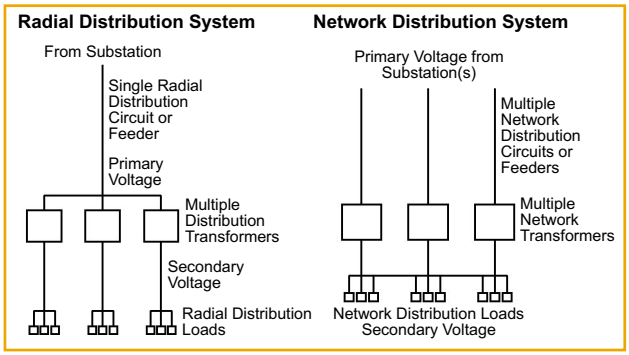
Fuel cell system manufacturers find it extremely important to participate in interconnection rulemaking as well as codes and standards development to ensure that current technology is represented and fairly assessed. We have been involved with Institute of Electrical and Electronic Engineers (IEEE) P1547 Standard for Distributed Resources Interconnected with Electric Power Systems; Underwriters Laboratories (UL) 1741 Standard for Inverters, Converters, and Controllers for Use in Independent Power Systems; New York's Standardized Interconnection Rules; California's Rule 21; Massachusetts' interconnection proposed rulemaking; the Federal Energy Regulatory Commission's (FERC) proposed rulemaking; the National Association of Regulatory Utility Commissioners' procedures (NARUC); and the National Fire Protection Association's (NFPA) 70-National Electrical Code requirements, among others.

There are several model interconnection standards, some of which were featured in a recent *Fuel Cell Summit* article [Vol. 4, Issue 1]. New to the list is a draft proposal for interconnection rules[2] from the Massachusetts Department of Telecommunication and Energy. It was collaboratively developed by government organizations, utilities, concerned public groups, DG industry stakeholders, and others. Several model interconnection standards were evaluated including those from California, FERC, NARUC, New York, and Texas. Similar to the New York and Texas standards, an important feature of the Massachusetts proposal makes it relatively easy for small-scale, inverter-based technologies to interconnect on radial systems with no application or study fees. This is an important step toward making the interconnection process simpler and less expensive in Massachusetts, thereby promoting the installation of DG systems, at least on radial systems.

A recent fuel cell system installation in New York took less than three weeks for interconnection approval with no interconnection fees. This successful interconnection experience immediately followed a period of hands-on oversight and rule-making activity by the New York State Public Service Commission. Successful interconnection experiences like this are helping rule makers gain confidence in the fuel cell industry to simplify interconnection procedures.

Among the many hurdles remaining is the area of secondary distribution network interconnection. Interconnection on secondary networks-where high-density urban areas could most benefit from DG-is being considered cautiously by utilities. Network protective devices generally are not set up to handle generation or current flow from the load side. However, when the DG capacity is small compared to the facility load where it is installed, inverter-based systems can be readily used without affecting network system reliability.

Radial distribution systems are generally installed in overhead configurations, whereas network systems have major equipment installed underground. The typical circuit configuration for each system is shown in the figures below. Radial systems have small utility pole-mounted secondary distribution transformers, while network systems have underground vaults for large distribution transformers. Additionally, radial systems are generally fed from one source, while network systems often have several sources. One final note: network systems have all loads fed from one common secondary bus, while radial systems do not.



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Standards Committee Activity Updates

- **Codes & Standards Support**. In March the Department of Energy held the first of a planned five-year series of meetings for Standard Development Organizations to determine how the DOE could help speed up the process of developing codes and standards, make the codes and standards readily available, and assist SDOs to ensure consistency among the different codes. Contact: Neil Rossmeissl (DOE) (202) 586-8668, neil.rossmeissl@ee.doe.gov.

- **ICC Codes**. The 2003 *International Codes* are now available. To order I-Codes call (800) 214-4321 ext. 371, or see www.iccsafe.org or www.ecodes.biz. July 3 is the tentative publication date of "Proposed Changes to the I-Codes." Public hearings will be Sept. 5-14 in Nashville, TN. Changes approved will be published in August 2004 in the 2004 Supplement. Contact: Eric Stafford (SBCCI) (205) 591-1853, (205) 592-7001 (fax), estaffor@sbcci.org.

- **ICC Ad Hoc Committee for Hydrogen Gas**. The next ICC AHC H2G meeting will be May 7-8 hosted by NREL at their facilities in Golden, CO. Security badging required—contact Russ Hewett. This committee is working on general clarification and improvements to ICC codes including the International Fire Code, International Building Code, and International Fuel Gas Code regarding hydrogen and hydrogen storage systems. Contact: Darren Meyers (ICC) (800) 214-4321 ext. 307, dmeyers@iccsafe.org or Russ Hewett (NREL) (303) 384-7463, Russell_Hewett@nrel.gov. See: http://www.iccsafe.org.

- **NFPA 5000, Building Construction and Safety Code**. The public proposal period for the 2006 edition of NFPA 5000, Building Construction and Safety Code is open through October 17, 2003. Technical committees will take action in early 2004 on public proposals; the Report on Proposals will be issued subsequent to these meetings for public review and comment. Proposal forms are available at http://www.nfpa.org/Codes/index.asp. Contact: Karen Stein (NFPA) (617) 984-7263, kstein@nfpa.org.

- **NFPA 55, Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks**. NFPA 50, 50A, and 50B are now consolidated into the 2003 Edition of NFPA 55, which includes storage and utilization requirements for all gases and covers both consumer and manufacturer sites. Copies of the 2003 NFPA 55 are now available. Contact: Carl Rivkin (NFPA) (617) 984-7418, crivkin@nfpa.org.

- **NFPA Hydrogen Coordinating Group**. NFPA formed the group to coordinate the development of hydrogen requirements at NFPA. Codes and standards text is developed to form proposals to NFPA documents. At the March 25 teleconference task groups identified the NFPA code or standard that would contain material developed by the group. The next teleconference will be May 12. Contact: Carl Rivkin (NFPA) (617) 984-7418, crivkin@nfpa.org or see: http://www.nfpa.org/ECommittee/hcgroup/hcgroup.asp.

- **ISO TC 197, Hydrogen Technologies**. Current activities include WG 1 Liquid Hydrogen–Land vehicle fuel tanks; WG 5 Gaseous Hydrogen–Land vehicle filling station connectors; WG 6 Gaseous Hydrogen and Hydrogen Blends–Land vehicle fuel tanks; WG 8 Hydrogen generators using electrolyzer technology (last met in February); WG 9 Hydrogen generators using fuel processing technologies (meeting April 14-16); and WG 10 Transportable gas storage devices–Hydrogen absorbed in reversible metal hydrides. Contact: Karen Miller (NHA) (202) 223-5547, kmiller@ttcorp.com.

- **IEC TC 105, Fuel Cell Technologies**. WG#1 draft is out for review; WG#2 draft is out for comments; WG#3 draft will go out soon; WG#4 draft is out for comments; WG#7-Portable Power will handle micro fuel cells through a Task Force led by Harry Jones; update provided for distribution to WG. U.S. TAG will meet to consolidate a US position prior to the June Plenary Meeting in San Diego. Contact: Steve Kazubski (CSA America) (216) 524-4990 ext. 8303, steve.kazubski@csa-america.org or steve.kazubski@csa-international.org.

- **ASME PTC 50, Performance Test Code on Fuel Cell Power Systems**. PTC 50 provides test procedures for performance characterization of all components of fuel cell power systems. The code is available in hardcopy or .pdf format at (800) 843-2763 or http://www.asme.org/catalog. Contact: Jack Karian (ASME) (212) 591-8552, karianj@asme.org.

- **NFPA 853, Installation of Stationary Fuel Cell Power Plants**. The Report on Comments will be presented in May 2003 for adoption by the Standards Council. No other Technical Committee meetings are planned for CY2003. Contact: Don Drewry (Hartford Steam Boiler) Don_Drewry@hsb.com; or Carl Rivkin (NFPA) (617) 984-7418, crivkin@nfpa.org.

- **NFPA 70, National Electrical Code - Article 692, Fuel Cell Plant**. The 12 proposals received for Article 692 for the 2005 NEC were acted on by Code-Making Panel 13 at their January meeting in Hilton Head, SC. Proposals and final results of actions taken on them will appear in the NEC Report on Proposals that will be available in mid-July of 2003. Contact: Jean O'Connor (NFPA) (617) 984-7421, (617) 984-7070 (fax), joconnor@nfpa.org.

- **IEEE P1547, Draft Standard for Interconnecting Distributed Resources with Electric Power Systems**. The final P1547/D11 ballot closed February 2003 with 91% affirmatives and is being prepared for the IEEE Standards Board June 2003 meeting for approval as an IEEE standard. The next meeting of all P1547-Series of Standards (P1547.1, P1547.2, and P1547.3) Work Groups is scheduled for June 3 - 5 in Denver, CO. Contact: Richard DeBlasio (NREL) (303) 275-4333, ddeblasi@tcplink.nrel.gov; or Tom Basso (NREL) (303) 275-3753, thomas_basso@nrel.gov.

- **UL Web site for Distributed Generation Equipment**. UL Site www.ul.com/dge/ offers timesaving tools to aid regulators in confirming evaluated DG equipment. Information is provided for DG manufacturers considering UL and for current customers already undergoing a UL investigation. Contact: Regarding UL 1741-Tim Zgonena (UL) (847) 664-3051, Timothy.P.Zgonena@us.ul.com; regarding fuel cells-Harry Jones (UL) (847) 664-2948, Harry.P.Jones@us.ul.com.

- **CSA America Fuel Cell Standards**. CSA America FC 1 and FC 3 proposed ANSI Standards 90-day Canvass Ballot closes May 15 and 60-day ANSI Public Review closes May 13. The CSA America Fuel Cell Technical Advisory Committee will meet May 27, 2003, in Adelphi, MD, prior to Fuel Cell Summit VII. Contact Steve Kazubski (CSA America) (216) 524-4990 ext. 8303, steve.kazubski@csa-america.org or steve.kazubski@csa-international.org.

2003 Calendar of Events

MAY

1 **Distributed Energy Road Show**. Chicago Center for Green Technology, Chicago, IL. DOE-sponsored one-day workshop for building inspectors, fire marshals, utility interconnection engineers, and others on installation, interconnection, and operation of new energy technologies. Contact: Antonia Ornelas (312) 744-8222.

5-7 **Interconnecting Distributed Generation to Utility Distribution Systems**. The Pyle Center, University of Wisconsin-Madison, Madison, WI. Contact: (800) 462-0876, (800)442-4214 (fax).

5-7 **12th Annual North American Natural Gas & Electricity Market Conference/Trade Show**. Westin Harbour Castle Hotel and Convention Centre in Markham, ON, Canada. Contact: Melodie Zarzeczny (905) 470-0117, (905) 479-2515 (fax). See: http://www.enerdata.com/conferences.htm.

6 **Distributed Energy Road Show**. We Energies Public Service Building-auditorium, Milwaukee, WI. DOE-sponsored one-day workshop for building inspectors, fire marshals, utility interconnection engineers, and others on installation, interconnection, and operation of new energy technologies. Contact: Amy Winkler (414) 221-2541.

7-9 **5th Annual Small Fuel Cells 2003**. Hyatt Regency New Orleans, New Orleans, LA. Contact: custserv@knowledgefoundation.com.

8 **Distributed Energy Road Show**. Madison Area Technical College, Madison, WI. DOE-sponsored one-day workshop for building inspectors, fire marshals, utility interconnection engineers, and others on installation, interconnection, and operation of new energy technologies. Contact: Tracy La Haise (608) 458-3946.

12-14 **ASME International Combustion Engine (ICE) Division Spring Technical Conference**. Salzburg, Austria. Contact: (212) 591-7055.

12-13 **Distributed Generation**. The Westin St. Francis Hotel, San Francisco, CA. Contact: (800) 817-8601, cbireg@cbinet.com. See: http://www.cbinet.com/events/PB320/index.html.

13-15 **Distributed Generation and Combined Heat and Power Workshop**. Radisson Hotel, Newport Beach, CA. In conjunction with the 3rd annual DOE/UN Hybrid Power Systems Conference. Contact: Kimberly Yavorsky (412) 386-6044, (412) 386-4604 (fax), kimberly.yavorsky@netl.doe.gov.

14-16 **NAESCO Mid-Year Conference**. Loews Coronado Bay Resort, San Diego, CA. Presented by National Association of Energy Services Companies. Contact: (202) 822-0954, (202) 822-0955 (fax).

15-16 **Power Distribution, Power Quality and Reliability Workshop**. The New England Center, University of New Hampshire, Durham, NH. Presented by Energy Council of the Northeast. Contact: Joyce Fishwick (603) 898-4345, (603) 898-4682 (fax).

18-22 **NFPA World Safety Conference & Exposition** and the **6th World Congress of the World Organization of Building Officials**. National Fire Protection Association and World Organization of Building Officials. Dallas Convention Center, Dallas, TX. Contact: Margie Coloian or Julie Reynolds (617) 984-7275. See: http://www.nfpa.org/PressRoom/NewsReleases/WOBO/WOBO.asp.

19-22 **Hydrogen, Fuel Cells & Infrastructure Technologies Program Review and Peer Evaluation**. Claremont Resort Hotel, Berkeley, CA. The U.S. Department of Energy. Contact: Catherine Grégoire Padró (303) 275-2919, cathy_padro@nrel.gov. See: http://www.eere.energy.gov/hydrogenandfuelcells/2003_merit_review_event.html.

22 **Special Joint Seminar, Building, Electrical, Plumbing/Gas and Fire Prevention Inspectors**. Sturbridge Host Hotel, Sturbridge, MA. DOE-sponsored one-day workshop for building inspectors, fire marshals, utility interconnection engineers, and others on installation, interconnection, and operation of new energy technologies. Contact: Leslie (617) 349-6100.

28-29 **Fuel Cell Summit VII**. University of Maryland Inn & Conference Center, Adelphi, MD. Hosted by the U.S. Department of Energy–Energy Efficiency & Renewable Energy. Contact: Maude Wickline (703) 617-4254, maude.wickline@pnl.gov. See: http://www.pnl.gov/fuelcells.

JUNE

1-6 **1st International Conference on Polymer Batteries and Fuel Cells**. Shilla Hotel, Jeju Island, Korea. The Electrochemical Society, Inc. Contact: http://pbfc.kaist.ac.kr.

8-11 **Hydrogen and Fuel Cells 2003 Conference and Trade Show**. Westin Bayshore Resort and Marina, Vancouver, BC, Canada. Canadian Hydrogen Association, Fuel Cells Canada, and the National Research Council. Contact: (604) 688-9655 or hfc2003@advance-group.com/ See: http://www.hydrogenfuelcells2003.com.

16-18 **APPA National Conference**. Gaylord Opryland Hotel, Nashville, TN. American Public Power Association. Contact: (202) 467-2976.

16-19 **ASME Turbo Expo 2003: Power for Land, Sea and Air**. Georgia World Congress Center, Atlanta, GA. ASME Summer Annual Meeting and International Joint Power Generation Conference (International Gas Turbine Institute). Contact: (212) 591-7795.

30-04 **Fuel Cell World 2003 and 2nd European PEFC Forum**. Kongresszentrum Luzern at Lucerne, Switzerland. Two parallel conferences and fuel cell product exhibition. The Fuel Cell World and the 2nd European Polymer Electrolyte and Direct Methanol Fuel Cells. Contact: See http://www.efcf.com/conferences/index.shtml.

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Distributed Generation: The Interconnection Journey Continues (cont'd)

Fortunately, utilities are moving beyond outright bans of generation on networks to allowing installation with specific terms and requirements (including capacity limits based on facility and feeder peak loads and limits on network protector cycling). However, requirements that include expensive engineering studies and additional metering, such as reverse power relays, are hindering the growth of DG where it is needed the most.[3]

Another hurdle complicating the interconnection process is the issue of export versus non-export. Many interconnections have been accomplished with little concern by utilities that small inverter-based DG systems will create problems generating to the grid. However, an industrial client recently experienced excessive demands for documentation and study of system impacts when interconnecting with the utility. The systems were installed at very large facilities with no possibility of generation to the grid. It is important for utilities to know how much generation is connected to the grid but when the inverter-based generator is a tiny fraction of the facility load, the grid will never see it. Again, more experience will encourage the adoption of more simplified interconnection procedures.

What the best interconnection rules have in common is: 1) precertification of equipment and testing; and 2) simplified review of system impacts.

Many interconnection standards include a process that allows preapproved or precertified equipment to be interconnected faster, easier, and less expensively. Preapproved equipment must be certified by a nationally recognized testing laboratory to a standard such as UL 1741. Typically, the manufacturer works with the regulator to provide equipment specifications and certification proof such as test reports. This can save much time and effort in trying to convince every utility that the DG equipment is safe and will not harm the distribution system. Precertified DG equipment can be interconnected without extensive review of system impacts.

Recently, we worked with the New York State Public Service Commission to list a new inverter as an approved type-tested interconnection device.[4] The procedure and time to gain approval varies widely from state to state but implementation has improved significantly over the last few years. In the past, and currently in some states, it can take several months. In the New York case it took one week, an incredibly short time period. A few interconnection standards including FERC and Massachusetts allow state-to-national or state-to-state reciprocity for approved equipment. In most cases, reciprocity does not exist and the preapproval process has to be repeated with every regulator. This practice further underscores the need for a national interconnection standard.

A national interconnection standard is closer to reality with FERC's rulemaking process moving ahead and the IEEE P1547 standard nearing completion. Adoption of the IEEE P1547 standard is a key to consistency of interconnection rules. The benefits from DG are being realized and support for the industry is increasing. The DG rules, codes, and standards are now significantly improved and continued efforts are helping to eliminate the barriers to DG commercialization. The light at the end of the tunnel is approaching but there remains some distance to cover. The DG community must continue its efforts to improve existing standards and work toward making a national interconnection standard a reality.

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[1] For more information on Plug Power, link to http://www.plugpower.com/index.cfm

[2] To view the Mass. document, link to http://www.state.ma.us/dpu/electric/02-38/33pusicd.pdf

[3] For more information on DG and networks see Dugan, Roger C., et al. *Electrical Power Systems Quality*. 2nd ed. New York: McGraw-Hill, 2002.

[4] To view the NY PSC website, link to http://www.dps.state.ny.us/distgen.htm

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California's Rule 21 Certifies Molten Carbonate Fuel Cell (cont'd)

system to which it is connected. Generators who are networked to other utility customers and who plan to add power back to the grid could cause harm to utility workers or equipment in the event of a power outage.

If some of the criteria are not met, the application could still get approval; however, supplemental review will be required. The Rule 21 Interconnection Working Group is developing the Supplemental Review Guideline (SRG) as an informational document, not a formally adopted rule to address applications that failed one or more of the initial review process screens. The draft is available at http://www.energy.ca.gov/distgen/interconnection/guideline.html and comments are welcome.

For the utility engineer, the SRG gives guidance in performing supplemental reviews in a manner consistent with other engineers and other utilities, and helps the engineer focus efforts on the primary issues of concern.

For the applicant, the SRG can act as a primer on the topics addressed by the initial review process, as a guide to possible solutions when initial review process failure is anticipated, and as a basis for understanding the utility's decision as a result of a supplemental review.

For more information visit the CEC DG website (www.energy.ca.gov/distgen) or contact Scott Tomashefsky (stomashe@energy.state.ca.us.)

DOE Publicaton RL-P00-006

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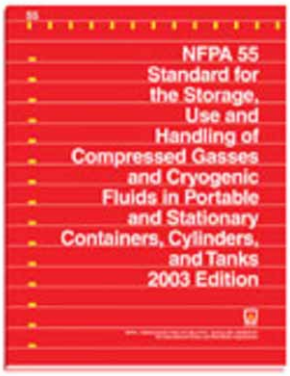
NFPA 55: Consolidating 50, 50A and 50B

The *2003 National Fire Protection Association (NFPA) 55: Standard for the Storage, Use, and Handling of Compressed Gases and Cryogenic Fluids in Portable and Stationary Containers, Cylinders, and Tanks*, incorporates as individual chapters the requirements of *NFPA50A: Standard for Gaseous Hydrogen Systems at Consumer Sites (1999), NFPA 50B: Standard for Liquefied Hydrogen Systems at Consumer Sites (1999),* and *NFPA 50: Standard for Bulk Oxygen Systems at Consumer Sites (2001).* Standards NFPA 50, 50A, and 50B are withdrawn.



NFPA 55 represents a major expansion of the 1998 edition and covers most areas of compressed gas and cryogenic fluid safety. The purpose of the standard is to provide fundamental safeguards for the installation, storage, use, and handling of compressed gases and cryogenic fluids in portable and stationary containers, cylinders, and tanks in all occupancies. The requirements apply to users, producers, distributors, and others involved with the storage, use, or handling of compressed gases or cryogenic fluids.

The standard does not apply to all conditions of offsite transportation, radioactive gases, welding gases, onboard vehicle fuel, liquefied petroleum gas or liquefied natural gas.

“Placing the requirements of NFPA 50, 50A, and 50B in a single document will increase the ease of use and reduce the potential for conflicts between documents and the process of making this transition has started with the 2003 edition of NFPA 55. The 2003 edition document has been restructured with reserved chapters to contain the requirements of NFPA 50A, 50B, and 50 and has been put on an expedited revision cycle to move the requirements into the reserved chapter of the document. This transition will be complete in the 2005 edition of NFPA 55,” said Carl Rivkin.

Copies of 2003 NFPA 55 (item# 5503 for $28) should be available after April 15.

Navy Tests Fuel Cell on the 3 Rs: Renewable, Regenerative, and Remote

Integrating a PV subsystem, an electrolyzer, and a PEM fuel cell, a new Navy project will generate electricity day and night to support a remote radar or telecommunications site. Grid-independent, the system uses sunlight to produce electricity to power both the load and the hydrogen-generating electrolyzer. When solar power is insufficient, the PEM fuel cell uses the stored hydrogen gas to produce electricity and recycles the water to be used in the electrolyzer.

The U.S. Naval Air Weapons Station at China Lake, California, is set to begin 6 months of testing of Proton Energy Systems’ 1-kW UNIGEN® regenerative solar/fuel cell system as phase 1 of a 5-year program. The program’s goal is to develop a 5-kW portable power package for deployment wherever there is a need to support a remote radar or telecommunications site.

The system demonstrates use of a grid-independent power plant that generates electricity in a closed-loop system from renewable, non-polluting resources. Integrated subsystems include a hydrogen generator, hydrogen storage tanks, a Proton Exchange Membrane (PEM) fuel cell, and a Navy-supplied solar photovoltaic (PV) array. The hydrogen generator’s renewable interface is capable of producing hydrogen from water using electricity directly generated by the solar array.

During its six-month test program, the system’s solar panels will supply power during daylight hours, while simultaneously using some of the solar electricity to generate hydrogen for tank storage. During nighttime hours, the system will utilize the tank-stored hydrogen produced from sunlight as an input to the PEM fuel cell.

According to John Speranza, Proton Energy System’s renewable program engineering manager, the goal of the project is to demonstrate grid-independent, constant power output using a renewable energy system capable of remote operation. “By combining the UNIGEN® Regenerative Fuel Cell system with the Navy’s PV array, the project’s goal is to eliminate batteries or other bridging devices for a seamless transition from solar to fuel cell power. The project will also continually recycle water-a byproduct of the fuel cell and feedstock for the same unit’s hydrogen generator.”

“This project will demonstrate a truly sustainable energy system. In the near term, it could solve the vexing challenge of providing electrical power to remote locations.” said Proton Energy Systems President and CEO Walter “Chip” Schroeder. The fuel cell’s advantages-minimum noise, minimum heat signature, and zero fuel or battery resupply logistics-are highly desired traits for military applications.