

ERDC/DoD Stationary Fuel Cell Demonstration Program

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Controls for Fuel Cells Workshop

University of California - Irvine

April 3-4, 2003

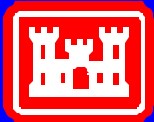


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DoD PAFC Demonstration Program

- DUECC Request for CERL Assistance
- FY93 Congressional Appropriation - \$18M
- FY94 Congressional Appropriation - \$18.75M
- Specify “...natural gas fuel cells in production in the United States...”

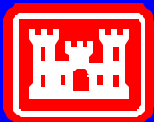


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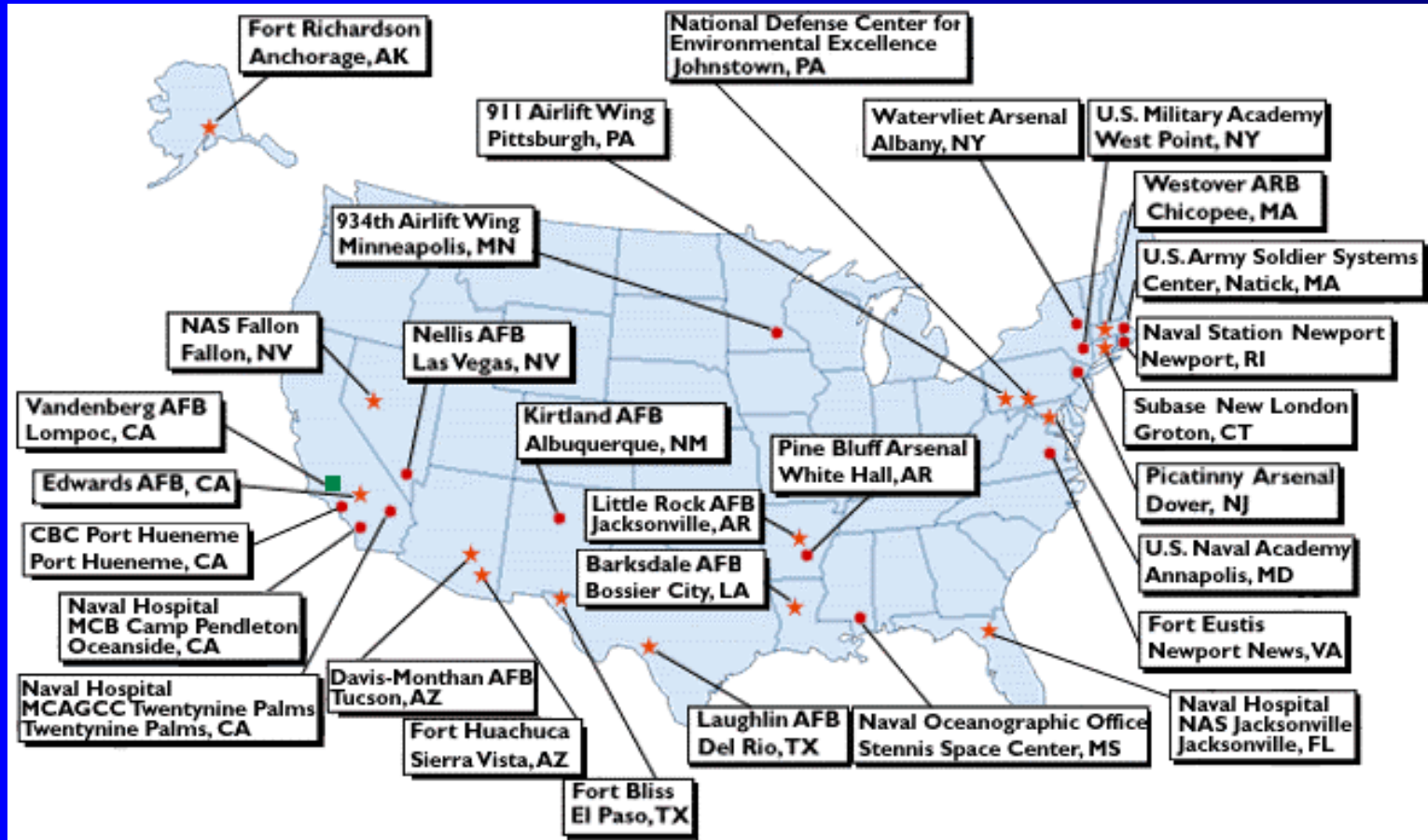
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Turn-key Package

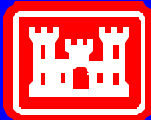
- IFC PC25 Fuel Cell Power Plant
 - Fy93 - 1 ea. Model A, 11 ea. Model B
 - Fy94 - 3 ea. Model B, 15 ea. Model C
- Engineering Design / Installation
- Training for Site Personnel
- 60 Months Maintenance
- Diagnostic / Remote Monitoring Computer



DoD PAFC Program Sites



- PC25A SITE
- PC25B SITE
- ★ PC25C SITE



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Fleet Performance Summary

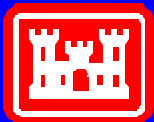
(29 Power Plants)
As of 31 January 2003

- Total Run Time 819,428 hrs
- Availability
 - Model B Fleet 57%
 - Model C Fleet 75%
- Energy \$ Saved \$5,724,196
- NOx Abated 266.0 tons
- SOx Abated 566.2 tons
- CO Abated 23.0 tons
- CO₂ Abated 34,074.6 tons



Climate Change “Rebate” Program Objectives

- Reduction of Fuel Cell Prices via Economy of Scale
- Proactive Approach for DoD Involvement



“Rebate” Program Highlights

- Grant Money Available / Fiscal Year

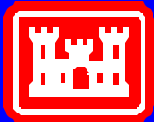
FY03	~\$6.0M
FY02	\$ 2.8M *
FY01	\$ 0.0M
FY00	\$ 2.0M
FY99	\$ 2.3M
FY98	\$ 4.2M
FY96/97	\$10.6M
FY95	\$ 8.2M

- Cost-Shared Program Incentives

\$1,000 / kW up to 1/3 of the total cost

*Solicitation No. DE-PS26-03Nt41463 available at

<http://e-center.doe.gov>



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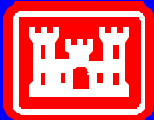
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Application Rating Criteria

- Firmness of Financial Commitment (15%)
- Site Information (15%)
- DoD Relationship (40%)
- Project Merit (30%)



US Post Office - AK

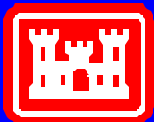


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Participants

- **Chugach Electric Association, Inc.-- Largest Utility in AK; Owner of Power Plants**
- **US Postal Service -- End-use Customer / Site**
- **US Department of Defense -- Technology and Grant Resources**
- **ONSI Corporation**
- **Cooperative Research Network of the National Rural Electric Cooperative Association (NRECA)**
- **Electric Power Research Institute (EPRI)**



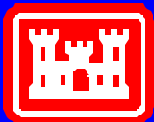
Customer Needs

- **U.S. Postal Services Main Processing Center in Anchorage Experienced Frequent Momentary Outages**
 - **Caused Shutdown of Mail Sorters**
 - **Elapsed Time to Clear and Restart-- 2 Hours**
 - **Lost Productivity and Time**
- **Concurrently, Facility Needed to Replace Back-up Diesel / Generator and Inadequate Ups System**



Controls Problem !!

- Individual PC25 units lacked the controls to operate collectively as a single unit



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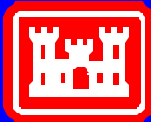
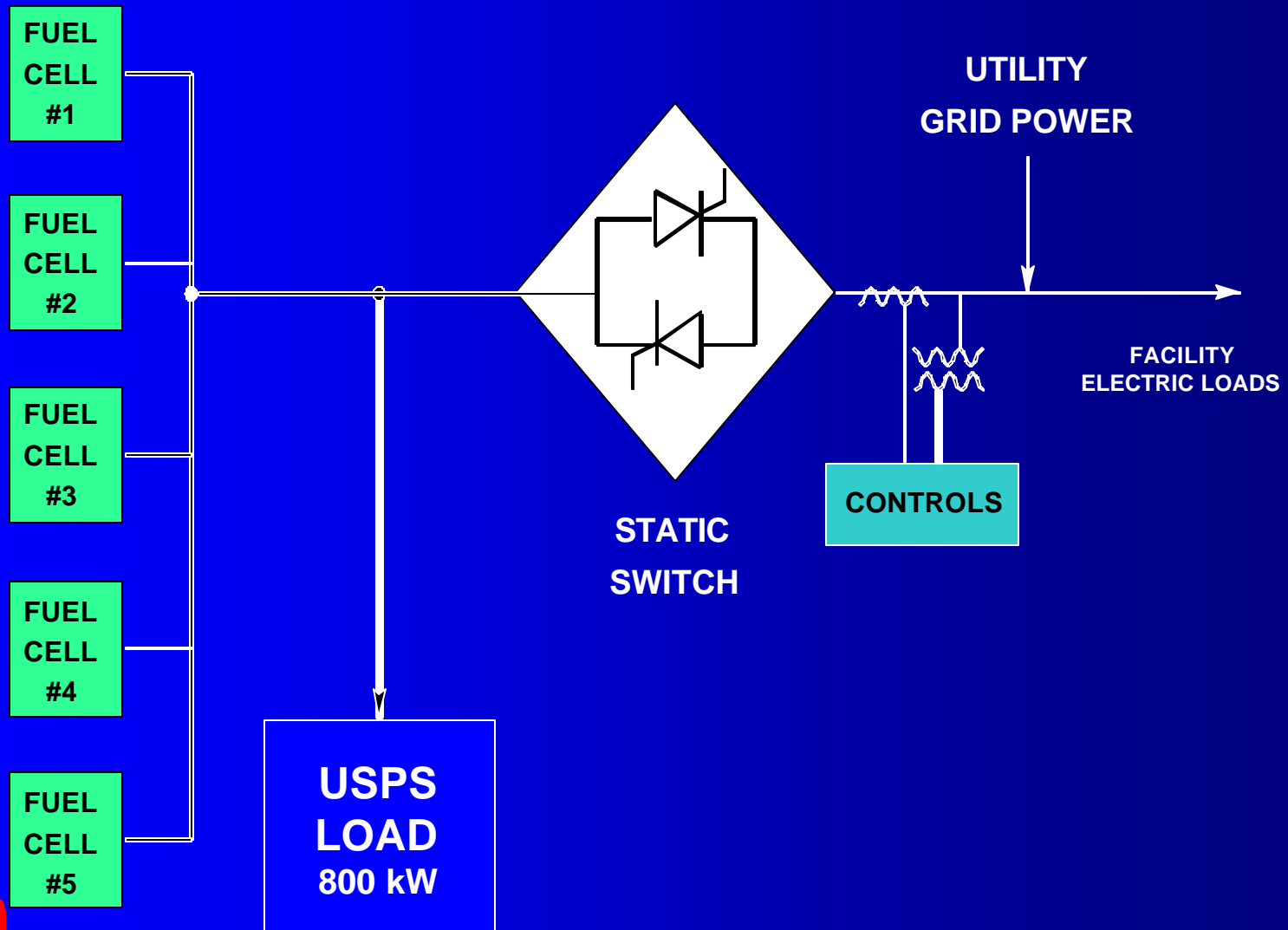
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Site Management System (SMS)

- **Multi-Unit Load Share**
 - ✓ Parallel Fuel Cell Installations
- **Seamless Transfer Capability**
 - ✓ Instantaneous Backup Support for Critical Loads
- **Field Demonstration - U.S. Post Office, Anchorage, AK**
 - ✓ Five ONSI PC25 Fuel Cell Power Plants

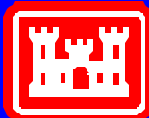
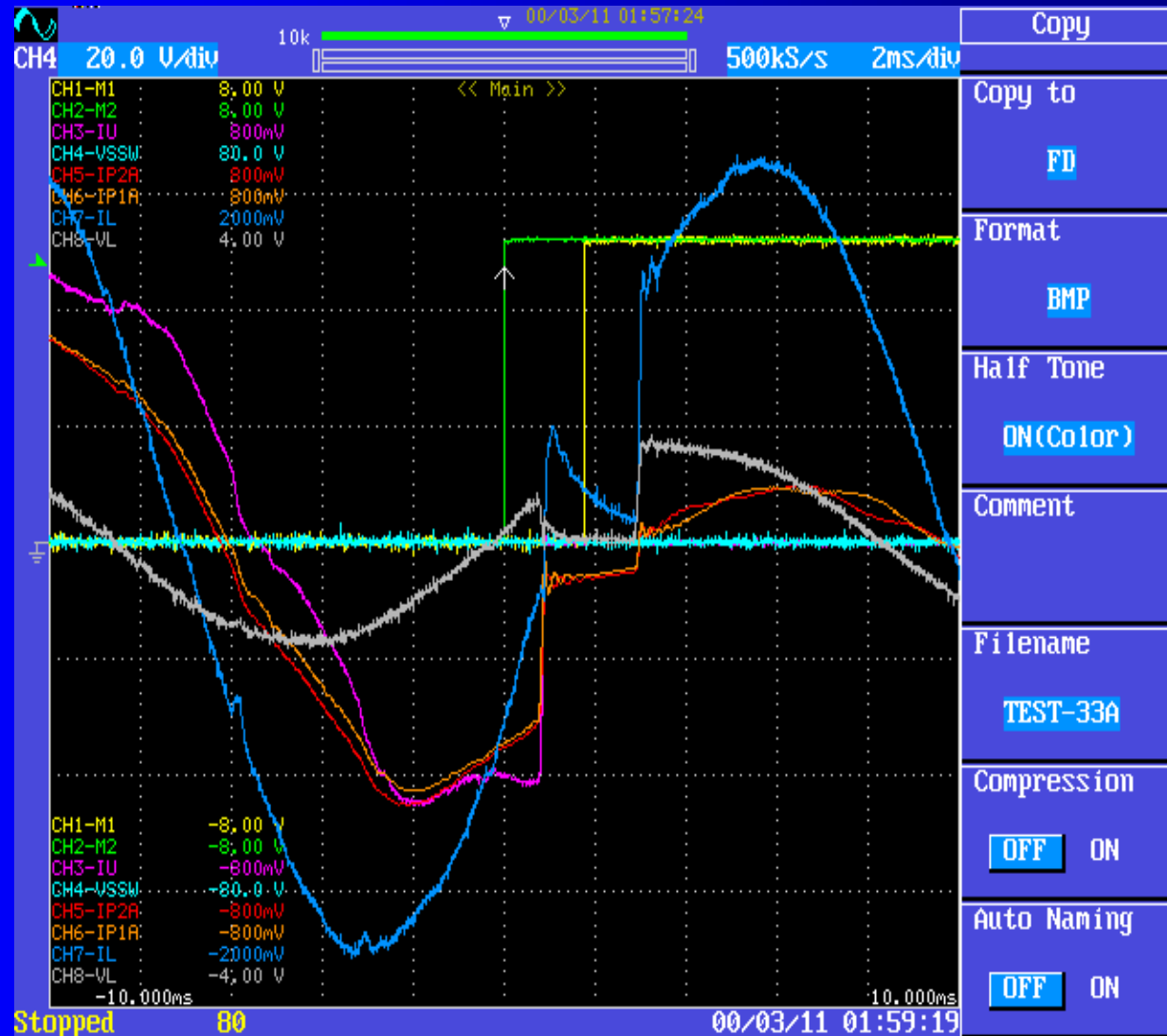


MULTIPLE UNITS ASSURED POWER / GRID CONNECT / SEAMLESS TRANSFER



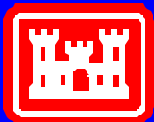
LOSS OF GRID TRANSITION

Test Results



Project “Firsts”

- 5 PC25 Unit Installation at Single Site
- Multi-unit Load Share and Site Management System (SMS) for Control
- Use of Fuel Cell Installation As Distributed Generation Asset by Local Utility
- Power Continuity to Load Using Seamless Transfer (1/4 Cycle Transition)
 - Grid Parallel to Grid Independent, and
 - Grid Independent to Grid Parallel





Ribbon Cutting -- 09 AUG 2000



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DoD Fuel Cell Test & Evaluation Center (FCTEC)



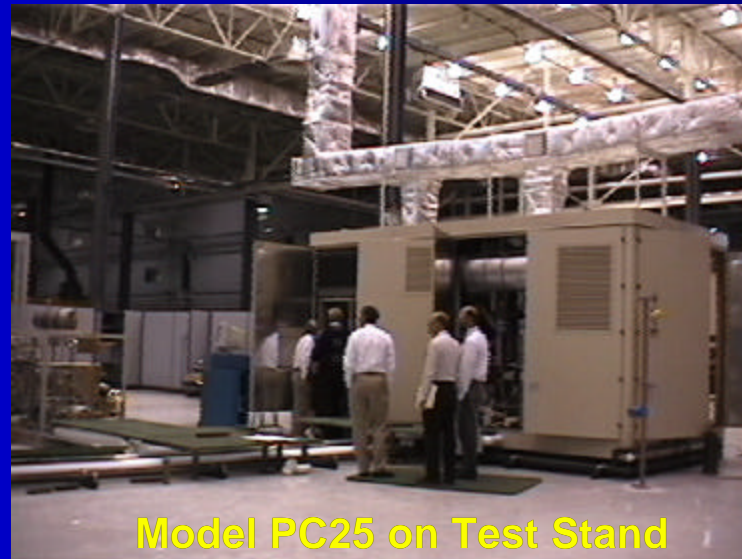
FCTEC Site - Johnstown, PA



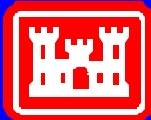
Simulated Loads Capability



Automated Data Acquisition



Model PC25 on Test Stand



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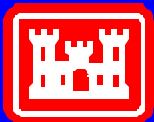
FCTEC Description

- The FCTEC is located in Johnstown, PA at Concurrent Technologies Corporation's (CTC's) Environmental Technology Facility.
- The FCTEC is a National Resource for the independent, unbiased testing and validation of fuel cell power plants for military and commercial applications.
- FCTEC's primary goal is to significantly accelerate the development and commercialization of fuel cell power plants.



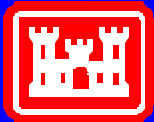
FCTEC Services

- **Independent Demonstration and Validation of Fuel Cell Power Plants Up to 300 kW**
- **Testing Fuel Cells Continuously, 24 Hours a Day, 7 Days a Week**
- **Providing Computerized Process Control and Data Acquisition Capability Including Protected, Internet Data Access**
- **See Brochure for Specific Testing Capabilities**



FCTEC - Benefits

- **Accelerated Development of Fuel Cell Power Plants**
- **Access to Both Government & Industry Clients**
- **Designed for Simple Operation, Maximum Flexibility**



FCTEC Additional Info

- www.fctec.com
- **Mike Binder**
Ph. (217) 373-7214
michael.j.binder@erdc.usace.army.mil
- **Bob Unger**
Ph. (814) 269-2721
ungerb@ctc.com



Residential Fuel Cell Demonstration Program

- PEM Units, 1 kW to 20 kW
- US Military Facilities/Embassies, etc.
- Turn-key Packages Requested
- Maximum Diversity Desired
- 1 Year of “Fuel Cell Power” Required
 - (90% Availability)



“PEM” Program Highlights

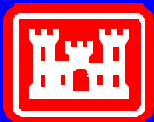
- **Grant Money Available / Fiscal Year**

FY03	~\$3.5M *	
FY02	\$ 3.0M	(24 Units)
FY01	\$ 3.0M	(21 Units)

- **No Cost-Share Required**

***Solicitation and Broad Agency Announcement (BAA) available at**

<http://www.dodfuelcell.com/res>



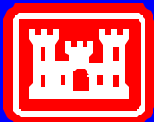
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FY01 Residential PEMFC Demonstration Program

SITE APPLICATION MATRIX

Site Name	Building Application	Fuel Cell Manufacturer	Input Fuel	Size (kW)	No. Units	Cogen. Y/N
Sierra Army Depot	Barracks	H Power	Propane	4.5	1	Yes
Brooks AFB	Base Housing	Plug Power	Natural Gas	5	3	No
MCB Kaneohe Bay	TBD	TBD	TBD	TBD	1	TBD
Ft. Bragg	Office Building	Plug Power	Natural Gas	5	1	No
Ft. Jackson	Officer's Quarters	Plug Power	Natural Gas	5	1	Yes
Barksdale AFB	Office Building	Plug Power	Natural Gas	5	1	No
Patuxent River NAS	Office Building	H Power	Propane	4.5	1	Yes
Patuxent River NAS	Office Building	H Power	Natural Gas	4.5	1	Yes
Geiger Field	Office Building	Avista Labs	Hydrogen	3	1	No
Watervliet Arsenal	Research Facility	Plug Power	Natural Gas	5	3	No
Watervliet Arsenal	Manufacturing Facility	Plug Power	Natural Gas	5	3	No
Watervliet Arsenal	Officer's Quarters	Plug Power	Natural Gas	5	4	No



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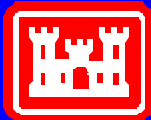
(x) Indicates output setpoint of unit

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FY02 Residential PEMFC Demonstration Program

SITE APPLICATION MATRIX

Site Name	Building Application	Fuel Cell Manufacturer	Input Fuel	Size (kW)	No. Units	Cogen. Y/N
Saratoga Springs NSU	Base Housing	Plug Power	Natural Gas	5	8	Yes
West Point Military Academy	Officer's Quarters	Plug Power	Natural Gas	5	3	Yes
USCG Aids to Navigation Team	Maintenance Facility	Nuvera	Natural Gas	5	2	No
Fort Belvoir	Office Building	H Power	Hydrogen	0.5	3	No
Naval Surface Warfare Center	Portable Test Facility Buildings	H Power	Propane	4.5	2	No
Robins AFB	Fire Station	Plug Power	Natural Gas	5	1	Yes
North Carolina Agricultural & Tech (NCA&T)	Reserve Officer Training Corps (ROTC) Facility	Plug Power	Natural Gas	5	1	Yes
Shaw AFB	Base Housing	Plug Power	Natural Gas	5	1	Yes
McChord AFB	FAA Radio Transmitter	Avista Labs	Hydrogen	0.5	6	No



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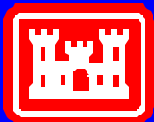
Installed PEMFC Geiger Field Spokane, WA



Building 401



Avista Labs 3kW Fuel Cell



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Geiger Field Performance Summary

March 29, 2002 – January 31, 2003

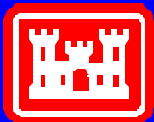
- Total Run Time 6,222hrs
- Availability 93.3%
- Capacity Factor 24%
- Total Electric Output 5,318 kWh
- Avg. Output for Site 0.71 kW
- Electrical Efficiency 25%



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PEMFCs Installed at Watervliet Arsenal



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Watervliet Arsenal Program Highlights

January 18, 2002 – January 21, 2003

- 10 Plug Power Units - 5kW PEMFC
 - 93.7% Total Availability
 - > 83,000 Run Hours
 - > 214,500kW-hrs
- System B103
 - 100% Availability Final 4.5 Months
 - 98.8% Availability Final 11.5 Months
- System B98
 - 6742 Cell Stack Run Hours
- System B104
 - 7056 Cell Stack Run Hours



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