

Past, Present and Future of DoD Stationary Fuel Cell Programs

Franklin H. Holcomb
217-352-6511, x7412
f-holcomb@cecer.army.mil
ERDC / CERL

Real-World Solutions for a Secure Future
Wednesday, August 20

- Phosphoric Acid Fuel Cell (PAFC) Demonstration Program
- Residential Proton Exchange Membrane (PEM) Fuel Cell Demonstration Program
- Microturbine Demonstration Program

August 17-20, 2003

www.energy2003.ee.doe.gov

2

- The DoD Energy Infrastructure Is Both Large and Centralized, Making It Very Difficult to Protect From Attacks, Accidents, or Natural Disasters.
- Distributed Generation (DG), Such As Fuel Cells and Microturbines, Can Improve Both Security and Reliability of Power Delivery.
- DG Technology Also Can Employ Newer, Cleaner Fuels That Can Be Produced Domestically.
- These Technologies Can Be Applied for Uses From Back up Power to Combined Heat and Power (CHP), to a Variety of Niche Applications.

August 17-20, 2003

www.energy2003.ee.doe.gov

3

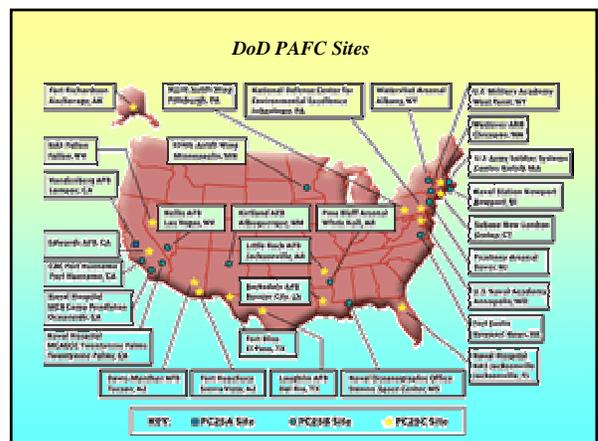


- Demonstrate Fuel Cell Capabilities in Real World Situations
- Stimulate Growth and Economies of Scale in the Fuel Cell Industry
- Determine the Role of Fuel Cells in DoD's Long Term Energy Strategy

August 17-20, 2003

www.energy2003.ee.doe.gov

5



2003 Energy PAFC Facility Applications

- Central Heat Plants
11 Sites



- Hospital Utility Plants
7 Sites



- Pool / Gymnasiums
3 Sites



- Others

Barracks, Dining Facility, Laundry,
NG Armory, Launch Control Bldg.,
Office, Evaporator process

August 17-20, 2003

www.energy2003.ee.doe.gov

7

2003 Energy PC25B Installed at Picatinny Arsenal, NJ



August 17-20, 2003

www.energy2003.ee.doe.gov

8

2003 Energy PAFC Fleet Performance Summary (29 Power Plants) As of 30 June 2003

- Total Run Time **869,334 hrs**
- Availability
 - Model B Fleet **57%**
 - Model C Fleet **77%**
- Energy \$ Saved **\$5,917,008**
- NOx Abated **278.0 tons**
- SOx Abated **589 tons**
- CO Abated **24.0 tons**

August 17-20, 2003

www.energy2003.ee.doe.gov

9

2003 Energy "PEM" Program Requirements / Broad Agency Announcement (BAA)

- "Domestically Produced" 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
– (Minimum 90% Availability)

August 17-20, 2003

www.energy2003.ee.doe.gov

10

2003 Energy FY01 Residential PEMFC Program Sites



August 17-20, 2003

www.energy2003.ee.doe.gov

11

2003 Energy FY01 Residential PEMFC Demonstration Program

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
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	Base Housing	Plug Power	Natural Gas	5	1	No
Ft. McPherson	Base Housing	Plug Power	Natural Gas	5	1	Yes
Coast Guard Station, New Orleans	Administration & Operation Building	Plug Power	Natural Gas	5	1	Yes
Patuxent River NAS	Office Building	H Power	Propane	4.5	1	Yes
Patuxent River NAS	Officer's Quarters	H Power	Natural Gas	4.5	1	Yes
Geiger Field	Maintenance Fac.	Avista Labs	Hydrogen	3	1	No
Waterbury Arsenal	Research Facility	Plug Power	Natural Gas	5	3	No
Waterbury Arsenal	Manufacturing Fac.	Plug Power	Natural Gas	5	3	No
Waterbury Arsenal	Officer's Quarters	Plug Power	Natural Gas	5	4	No

August 17-20, 2003

www.energy2003.ee.doe.gov

12

2003 Energy FY02 Residential PEMFC Demonstration Program

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
Selfridge Air National Guard Base	Fire Station	Plug Power	Natural Gas	5	2	Yes
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

August 17-20, 2003 www.energy2003.ee.doe.gov 13

2003 Energy PEMFCs Installed at Brooks AFB



Base Housing

August 17-20, 2003 www.energy2003.ee.doe.gov 14

2003 Energy Brooks AFB PEMFC Performance Summary

Base Housing (3 units)
February 3, 2003 – June 30, 2003

System No.	Total Run Hours	Total Hours	Availability (%)	Capacity Factor (%)	Total Energy Produced (kWe-hrs AC)	Average Output (kW)	Electrical Efficiency (%)
Tess	3231	3469	93.1%	49.0%	7912	2.45	22.8%
Joe	2694	3469	77.7%	49.7%	6692	2.48	16.8%
Mariah	2943	3469	84.8%	47.2%	6950	2.36	17.0%

August 17-20, 2003 www.energy2003.ee.doe.gov 15

2003 Energy PEMFCs Installed at Watervliet Arsenal

2003 Winner
DOE Federal
Energy Saver
Showcase
Award



Research Facility



Manufacturing Facility



Officers' Quarters

August 17-20, 2003 www.energy2003.ee.doe.gov 16

2003 Energy Watervliet Arsenal PEMFC Program Highlights

- 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

August 17-20, 2003 www.energy2003.ee.doe.gov 17

2003 Energy ERDC/CERL Microturbine Demonstrations -- Field Demo Plans

- All Field units to be installed 2002-2003
- Bench testing at UC-Irvine prior to installation
- Monitoring
 - Fort Drum unit monitored by DOE PNNL
 - One year of field monitoring
- Report / Document



August 17-20, 2003 www.energy2003.ee.doe.gov 18

2003 ERDC/CERL Microturbine Demonstrations
Energy -- Application Matrix

Site	kW	Dual		Comments
		Mode	CHP	
CERL Champaign, IL	30	√	-	Installed, commissioning complete, interconnect pending
Barracks Bldg Fort Drum, NY	30	√	√	PNNL/FEMP project. Installed & Operating
Office Bldg, Presidio of Monterey, CA	30	√	√	Backup power bldg & computer server
Swimming Pool, Port Hueneme, CA	60	-	√	
Hospital Heidelberg, Germany	60	-	√	Expected hardware delivery in Dec 2002
Maintenance Bldg, Fort Bragg, NC	30	√	-	Same bldg site as PEM fuel cell. Possible connect to remote dispatch

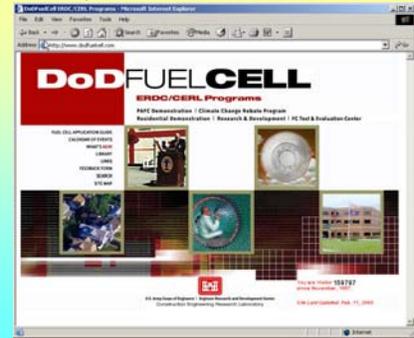
August 17-20, 2003

www.energy2003.ee.doe.gov

19

2003 ERDC/CERL Fuel Cell Demonstrations
Energy -- Application Matrix

www.dodfuelcell.com



- Updated data on each demonstration program.
- Links and Photos pertaining to individual projects

August 17-20, 2003

www.energy2003.ee.doe.gov

20