FuelCell Energy

FuelCell Energy, Inc.
NASDAQ: FCEL

Product / Hydrogen RD&D Briefing

HTAC Annual Meeting - Hartford

July 15, 2009

reliable, efficient, ultra-clean

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Corporate Overview

- **Background**
  - Connecticut based – two operations, Danbury and Torrington
  - 500 Employees - R&D, Manufacturing Engineering, Plant Service and Corporate Corporate
- **Timeline**
  - 1969 – Predecessor company, Energy Research Corporation (ERC) founded by to founded by to conduct research into fuel cells and advanced battery chemistries chemistries
  - 1980's – ERC focuses on high-temperature carbonate fuel cell research
  - 1992 – ERC successfully demonstrates a 120 kilowatt high-temperature carbonate carbonate
  - fuel cell power system. ERC stock goes public
  - 1996 – A 2-megawatt ERC fuel cell system goes online in Santa Clara, California, California,
  - costing $20,000 per kW
  - 1999 – ERC splits off battery division into Evercel, Inc., and renames the company company
  - FuelCell Energy (NASDAQ: FCEL)
  - 2003 – FCE ships first commercial Direct FuelCell unit to Kirin Brewery in Japan Japan
  - 2003 to 2007 – Over 60 units at over 40 installations worldwide

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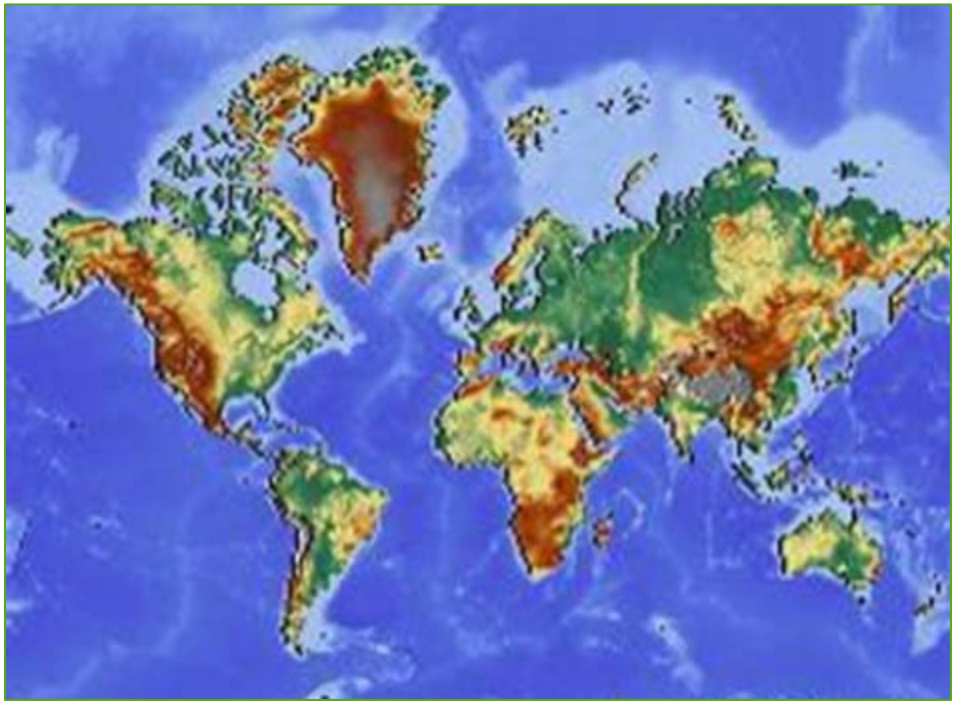
Worldwide Installations

Markets

- 65 MW installed/backlog
  - California/West Coast: 15 MW
  - Japan/Korea: 42 MW
  - Northeast/Canada: 4 MW
  - Europe: 2 MW
- Targeted applications
  - Grid Support: 39 MW
  - Renewable/Wastewater: 9 MW
  - Manufacturing: 6 MW
  - Hotels: 3 MW
  - University & Hospitals: 2 MW
  - Government: 3 MW
  - DFC-ERG 2 MW



Multi-MW and RPS Markets

- Connecticut Project 150
- POSCO Power agreement targets multi-MW potential in South Korea

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Typical Applications

Small Commercial/Industrial, 300-Bed Hotels

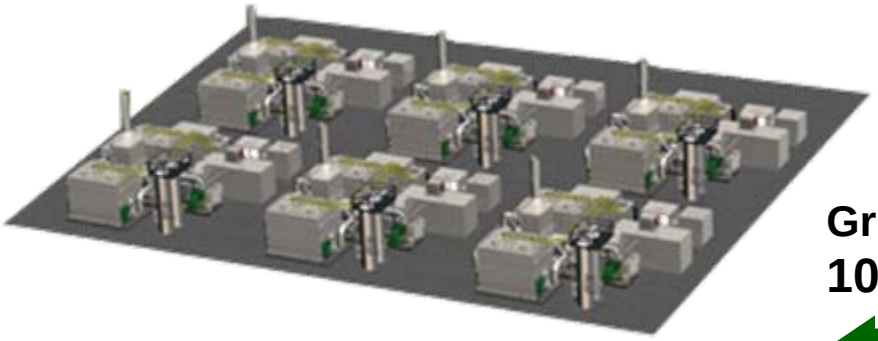
300 kW

1.4 MW

1000-Bed Hotels, Wastewater Treatment, Food and Beverage Processors

300-Bed Hospitals, Manufacturing, Universities

2.8 MW



Grid Support, RPS

10 MW +

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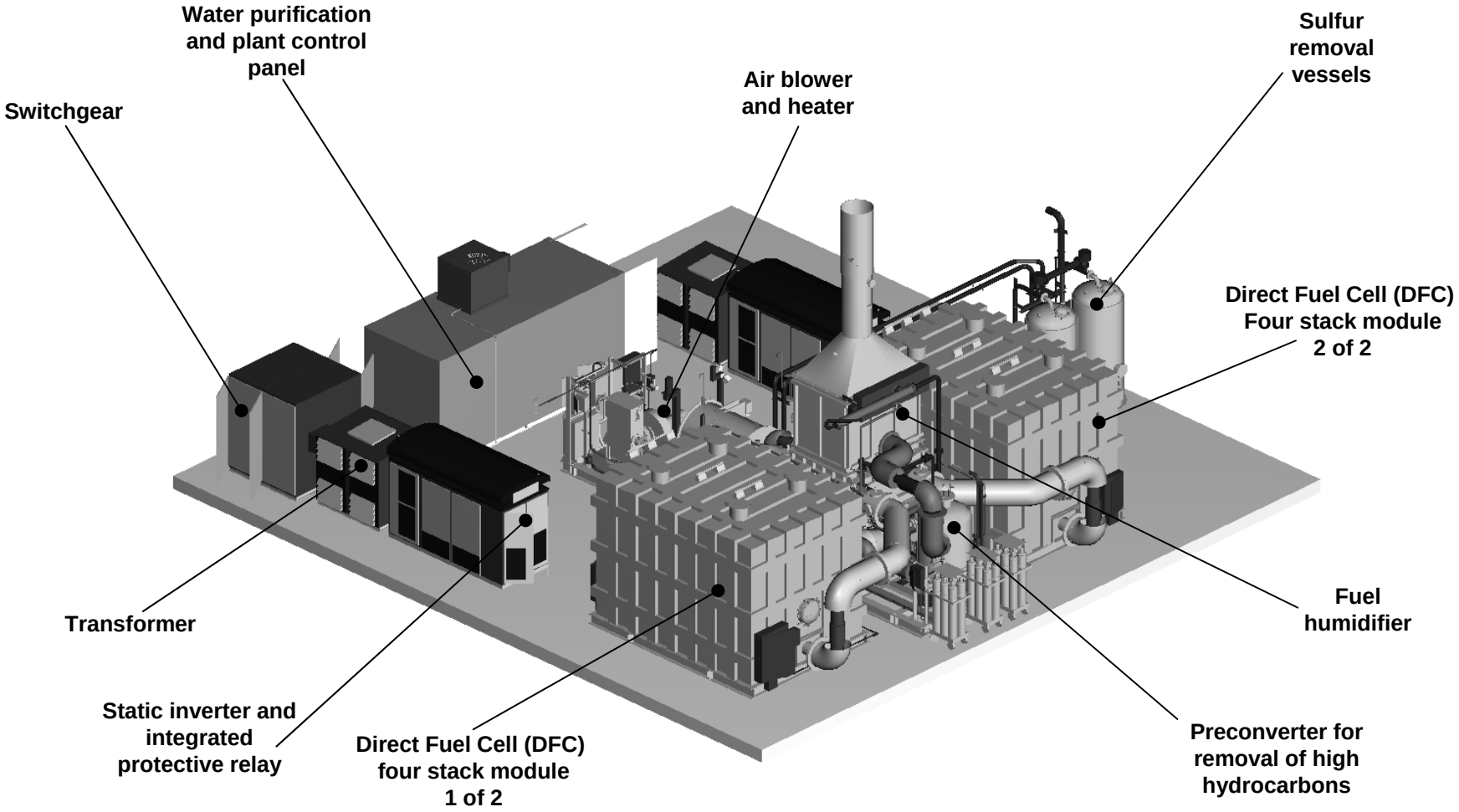
DFC 3000

2.8 MW

DFC3000 - General Powerplant Overview



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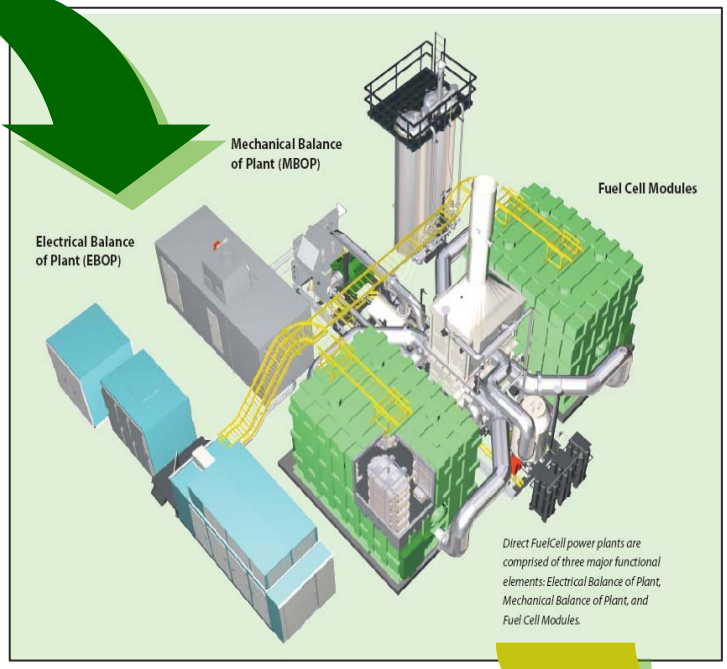
Application Diversity

FUEL RESOURCES

- NATURAL GAS
- METHANOL
- ETHANOL
- PROCESS METHANE
- BIOGAS
- COAL GAS



INTEGRATED SYSTEMS IMPROVE EFFICIENCY

- DFC – $(47\%)_e$
- DFC – ERG $(55\text{-}60\%)_e$
- DFC/T – $(55\text{-}60\%)_e$
- DFC H2 $(50\text{-}60\%)_e$
- DFC – CHP (60-80%)

Diversity of Fuels plus High Efficiency – High Sustainability

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On Site Applications

- Combined Heat and Power
- Hotels, universities, hospitals, manufacturing manufacturing
- Wastewater treatment facilities on biogas

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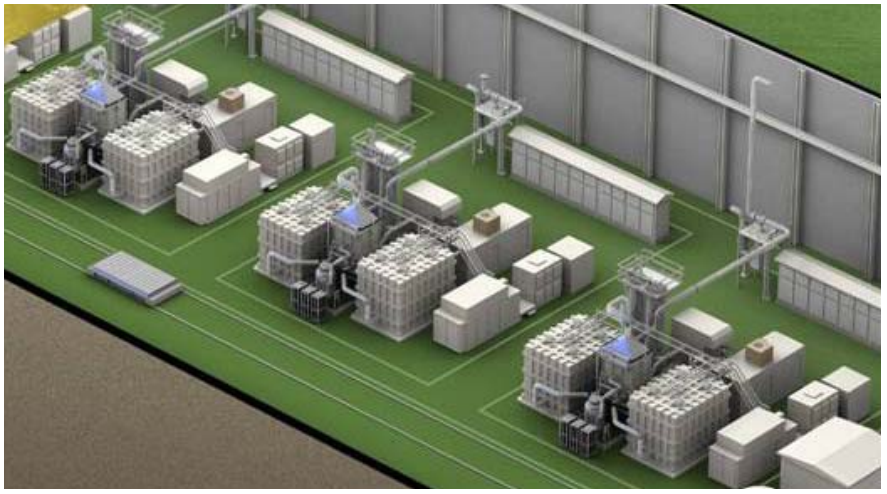
CT Grid Side Applications

- Utility-side of the meter
- MW-Scale
- Renewable Portfolio Standards application, e.g. CT Project 150
- Heat uses not always available
  - –Waste heat can be used to produce produce more power
    - DFC-ERG™ - waste heat supports pressure letdown power generation generation in gas distribution system, >60% efficiency
    - Organic Rankine Cycle generation generation with waste heat from from DFC exhaust
    - Ultra high efficiency DFC/T systems systems



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Cal State Northridge Northridge

1.0 MW CHP >80% Total Efficiency

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Newest Fleet Member

DFC 3000 (2.4 MW) - Gold Star Electric Power Station - Korea

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Hydrogen Development and Demonstration

reliable, efficient, ultra-clean

DFC-H_2 Power Plant: Trigeneration System

DFC-H_2 POWER PLANT

Commercial/Industrial Building

kWs to electric load: 50%

Heat to buildings
thermal load: 15%

Hydrogen: 20%

H_2 – REFUELING STATION

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Ultra-Clean, Efficient, Reliable Power

Submegawatt DFC-H_2 PSA – Testing at FCE (APCI-DOE Project)

PSA

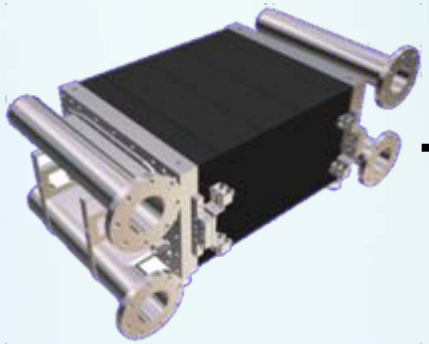
Compressor

Anode Exhaust Processing and H_2 Purification System: Has been separating 200+ lb/day Hydrogen for >2,000 hrs

On-site Co-production of Hydrogen and Electricity

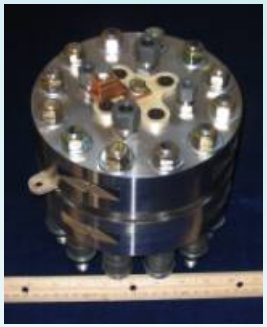
DFC Power Plant

(Electricity + Hydrogen)



Electrochemical Hydrogen Separator

(EHS)



Electrochemical Hydrogen Compressor

(EHC)

H_2

FC Car

FC Bus

MO3145

The Modularity of DFC-H_2-EHC System is Uniquely Suitable for Hydrogen Refueling Applications

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EHS System Demonstration at Univ. of CT

- Demo Unit separated 1200 liters/hr H_2 (up to 2700 lit/hr demonstrated) – can refuel approx. one car per day
- >10,000 hours of operation
- Reliable operation, no EHS-related shutdowns

Energy Secretary Bodman visited the Unit at UConn in June 2006

US Army Corps of Engineers
Engineer Research and Development Center

Connecticut Clean Energy Fund

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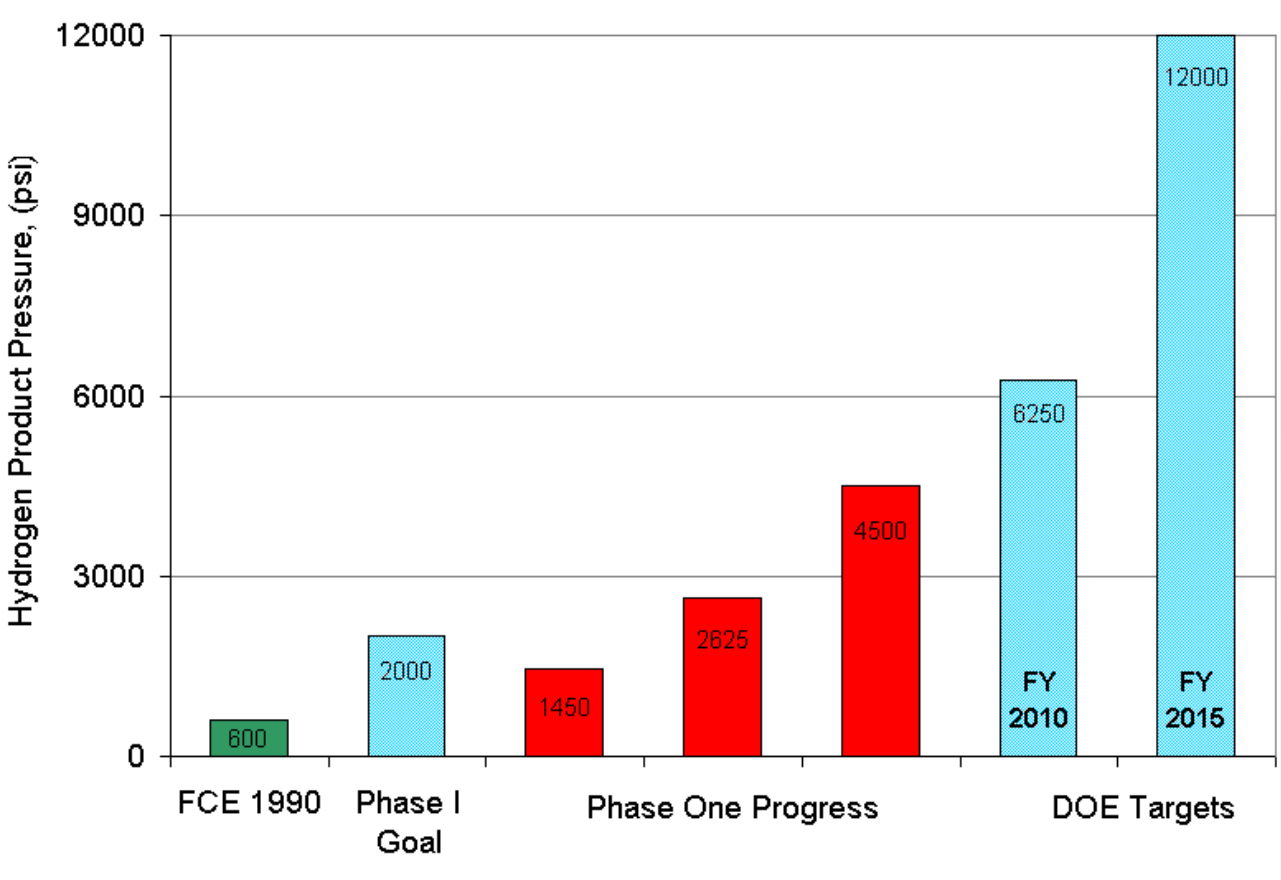
Electrochemical Hydrogen Compressor Dev.



- **Scaled up from single cell to 3-cell stack**
- **Tested 3-cell stack for >1,000 hrs at up to 3,000 psi**

Sustainable Innovations

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