Product / Hydrogen RD&D Briefing
HTAC Annual Meeting - Hartford
July 15, 2009
• **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

2007 FCE d t d f j t t t li 16 MW t f CT P j t 150
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
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, 2.8 MW
Manufacturing, Universities

Grid Support, RPS
10 MW +
DFC3000 - General Powerplant Overview

- Switchgear
- Water purification and plant control panel
- Transformer
- Static inverter and integrated protective relay
- Direct Fuel Cell (DFC) four stack module 1 of 2
- Direct Fuel Cell (DFC) four stack module 2 of 2
- Air blower and heater
- Fuel humidifier
- Preconverter for removal of high hydrocarbons
- Sulfur removal vessels

DFC 3000
2.8 MW
INTEGRATED SYSTEMS

IMPROVE EFFICIENCY

- DFC – (47%) e
- DFC – ERG (55-60%) e
- DFC/T – (55-60%) e
- DFC H2 (50-60%) e
- DFC – CHP (60-80%)

APPLICATION DIVERSITY

Diversity of Fuels plus High Efficiency - High Sustainability

FUEL RESOURCES
- NATURAL GAS
- METHANOL
- ETHANOL
- PROCESS METHANE
- BIOGAS
- COAL GAS
On Site Applications

- Combined Heat and Power
- Hotels, universities, hospitals, manufacturing
- Wastewater treatment facilities on biogas
• 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 more power
    - DFC-ERG™ - waste heat supports pressure letdown power generation in gas distribution system, >60% efficiency
    - Organic Rankine Cycle generation with waste heat from DFC exhaust
    - Ultra high efficiency DFC/T systems
1.0 MW CHP  >80% Total Efficiency
Newest Fleet Member

DFC 3000 (2.4 MW) - Gold Star Electric Power Station - Korea
Hydrogen Development and Demonstration

reliable, efficient, ultra-clean
DFC-H₂ Power Plant: Trigeneration System

- DFC-H₂ POWER PLANT
- Heat to buildings thermal load: 15%
- kWs to electric load: 50%
- Hydrogen: 20%

Commercial/Industrial Building

H₂ - REFueling Station

FuelCell Energy Confidential Information
Ultra-Clean, Efficient, Reliable Power

Submegawatt DFC-H₂ PSA – Testing at FCE (APCI-DOE Project)

Anode Exhaust Processing and H₂ Purification System:
Has been separating 200+ lb/day Hydrogen for >2,000 hrs
On-site Co-production of Hydrogen and Electricity

The Modularity of DFC-H₂-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 H₂ (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
• Scaled up from single cell to 3-cell stack
• Tested 3-cell stack for >1,000 hrs at up to 3,000 psi