

## Development of Fuel Cell Power Connecticut Power and Energy Society June 10, 2015



## Ultra-Clean, Efficient, Reliable Power



### Integrated Fuel Cell Company



#### **Research & Development**

Design megawatt-class distributed power generation solutions

- Global fuel cell platform
- Robust intellectual property portfolio
- Leveraging core technology for opportunities in new markets



Project development – Direct Sales

Global manufacturing profile

Engineering, Procurement and Construction

#### **Services**

- **Operate & Maintain power plants**
- Over 100 DFC<sup>®</sup> plants operating at more than 50 sites in 9 countries
- >3 billion kWh ultra-clean power produced
- > 300 MW installed/backlog







Providing turn-key distributed power generation solutions NASDAQ: FCEL



### **Range of Markets**



**Common Technology Platforms - Expanding Market Opportunities** 



### **Carbon Capture**

# Added Feature from Core DFC Technology

- Carbonate process transfers CO<sub>2</sub> from Cathode to Anode
- This aspect can be exploited for CO<sub>2</sub> separation in anode, allowing for easy capture
- Capture feature supported by DOE Fossil R&D and Industrial validation

#### Attractive Market Solution

- Affordable compliance
  mechanism
- Scalable / Rapid installation
- Multiple Applications



#### FuelCellEnergy Efficient and Affordable Carbon Capture with Fuel Cells



### **Distributed Hydrogen**





### Largest Development 59 MW - Korea

#### • 59 MW fuel cell Installation

- 21 power plants: 2.8 MW each
- 5.2 Acres
- 14 Month construction
- Largest Fuel Cell Installation in the world
- Electricity to grid & steam to district energy system
- US Fuel Cell technology
- Owned by a consortium
  - KHNP (electric utility)
  - Samchully (gas utility)
  - Investors
  - POSCO Energy





In Operation				
Site	MW	Location	Program	Highlights
Bridgeport Fuel Cell Park	14.9	Bridgeport	Project 150	Largest in North America
Carla's Pasta	0.3	South Windsor	CEFIA	Savings supported CDA loan for facility expansion
CCSU	1.4	1 New Britain	CEFIA	Privately Financed PPA at a State Facility
Hartford Hospital	1.4	1 Hartford	LREC	Savings to Hospital and additional power supply to Campus
Pepperidge Farms	1.2	2 Bloomfield	CEFIA	Savings enhanced new baking operation
Tota	l 19.2	2		

#### In Process

Site	MW	Location	Program	Highlights
University of Bridgeport	1.4	Bridgeport	LREC	Savings to UB plus integration to Microgrid
Pepperidge Farms	1.4	Bloomfield	LREC	Savings and Power reliability augment initial unit
Torrington H2	0.3	Torrington	LREC	LREC complements DOE funding for Industrial H <sub>2</sub> and Power
SeaSide Bridgeport	2.8	Bridgeport	UI Connections	First CT Utility power plant under Section 127
New Haven Harbor	2.8	New Haven	UI Connections	Substation interconnect for power in Harbor area
Glastonbury ERG	3.4	Glastonbury	Project 150	High Efficiency system supports gas expansion
Tota	12.1			



### Projects Combine Development , Fuel Cell Applications and Enabling CT Policies

• Dominion Bridgeport Fuel Cell

Wholesale Power Delivery

• Seaside Green Energy

Utility-Owned Clean Energy

• University of Bridgeport

Customer-Sited Combined Heat and Power



### **Rationale for Urban Applications**

- Achieves compliance with RPS objectives
- Provide ancillary services such as VAR support, frequency regulation
- Can serve microgrids and critical circuits in the event of power outages
- Near-zero NOx, SOx and particulates
- 47-55% electrical efficiency, 65% or greater with CHP
- Limited Land Use and Scalable, Distributed Generation



**1.4 MW Commercial Site** 



2.8 MW Renewable Biogas Plant



14.9 MW Grid/Utility Supply



### **Clean Energy in Bridgeport**

#### Fuel Cell Plants Integrated in City Green Planning



## **Dominion Bridgeport Fuel Cell**





#### Revitalizing an Industrial Area

- 15 MW Fuel Cell Plant
- 1.5 Acre Remediated Brownfield
- Serves three substations in Storm Sandy Impact area
- 1 year to construct
- No emissions permits required

#### **Enabling CT State Policies**

- Project 150 (PA 03-135)
- Bilateral Utility Contracts for Class 1 Resources
- CT Green Bank (Loan and Grant)
- CT Siting Council







### Seaside Green Energy

UIL HOLDINGS CORPORATION

#### Landfill to Energy Landscape

- 2.8 MW Fuel Cell/2.2 MW PV Array
- 9 acre use (½ acre Fuel Cell, 8½ acre 9000 panel PV)
- Utility Owned, Competitive Bid
- 20+ Year Energy Resource

#### **Enabling CT State Policies**

- UI Renewable Connections
- 30 MW of Utility Class 1 Resources
- PA 11-80 Section 127
- CT Siting Council





### **University of Bridgeport**

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#### University Sustainable Power

- 1.4 MW Fuel Cell CHP
- To be integrated with Campus Microgrid
- 80 % of power to 4800 student Campus
- Long Term PPA for power and heat

#### **Enabling CT State Policies**

- LREC Program (PA 11-80)
- CT Micro-grid Program (PA 11-80)
- DG Gas Distribution Rider
- CT Siting Council





### Thank You !



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