

# 2017 OHIO FUEL CELL SYMPOSIUM:

DOE Hydrogen and Fuel Cell Supply Chain Development Session



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This presentation contains forward-looking statements, including statements regarding the Company's plans and expectations regarding the development and commercialization of fuel cell technology. All forward-looking statements are subject to risks and uncertainties that could cause actual results to differ materially from those projected. The forward-looking statements speak only as of the date of this presentation. The Company expressly disclaims any obligation or undertaking to release publicly any updates or revisions to any such statements to reflect any change in the Company's expectations or any change in events, conditions or circumstances on which any such statements are based. The Company may refer to non-GAAP (generally accepted accounting principles) financial measures in this presentation. The Company believes that this information is useful to understanding its operating results and the ongoing performance of its underlying business.

- >50 sites operating on 3 continents
- > 5 billion kWh's ultra-clean power generated
- Global manufacturing
- Robust intellectual property portfolio



**Design & Manufacture**



**Project Development**



**Turn-key Project Delivery**



**Plant Operation**

## Energy Supply



**Micro-grid CHP**

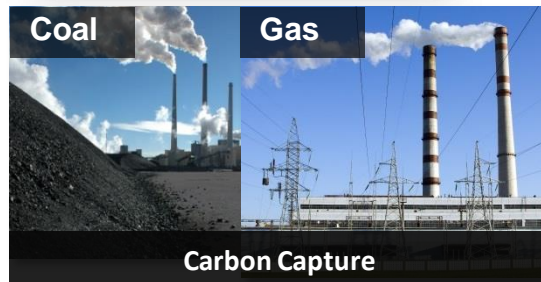


**Utility Grid Support**



**Distributed Hydrogen Tri-Gen**

## Energy Recovery



**Carbon Capture**



**Gas Pipeline**



**H<sub>2</sub> Recovery (EHS)**

## Energy Storage



**Long duration storage**



**Power-to-Gas**

NASDAQ: FCEL  
www.fuelcellenergy.com





## Partners

### North America



#### Market Development / Project finance

- Largest IPP in N. America
- \$40 million project finance facility to FCE
- Owns 4% FCEL stock
- FCE-developed projects to yieldco

### Asia



#### Market Development Asian Manufacturing

- Largest IPP in S. Korea
- POSCO 2015 sales: ~\$48 billion
- Owns 7% FCEL stock
- License/royalty for Asia
- Asian manufacturing

### Europe



#### Market Access Leveraging R&D

- Providing gov't & industry introductions
- Multi-million Euro R&D projects
- Near-term opportunities in Germany, UK, and Italy

## Utility & IPP customers



## On-site Power (behind the meter)



## CO<sub>2</sub> capture & H<sub>2</sub>



## North America

### Manufacturing Torrington, CT

- Module Assembly & Stacking
- 65,000 ft<sup>2</sup> facility (*pre-expansion*)
- Opened 2001



### Corporate Danbury, CT

- Research labs
- Engineering design
- Global Service center



### SOFC Research Calgary, Canada

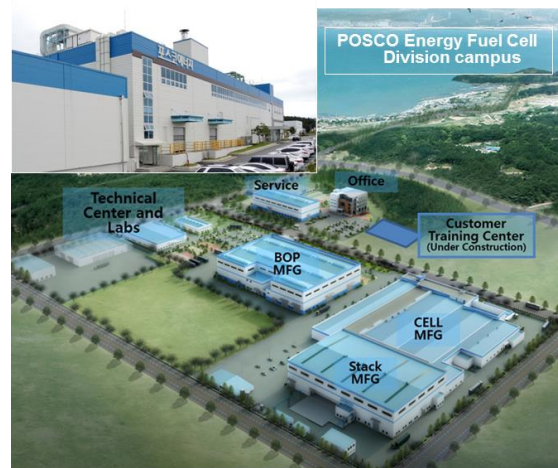
- Research labs
- Pilot manufacturing



## Asia & Europe

### Manufacturing Pohang, South Korea

Capacity for Asian  
market via partner,  
POSCO Energy



### Manufacturing Taufkirchen, Germany Capacity for European market





Individual fuel cell  
&  
350 kW fuel cell stack



Four-Stack Module  
1.4 megawatts



Completed module  
1.4 megawatts



**1.4 MW  
DFC1500®**

- Utilizes one module
- 47% Electrical Eff,  
up to 90% Total Eff.



**2.8 MW  
DFC3000®**

- Utilizes two modules
- 47% Electrical Eff,  
up to 90% Total Eff.



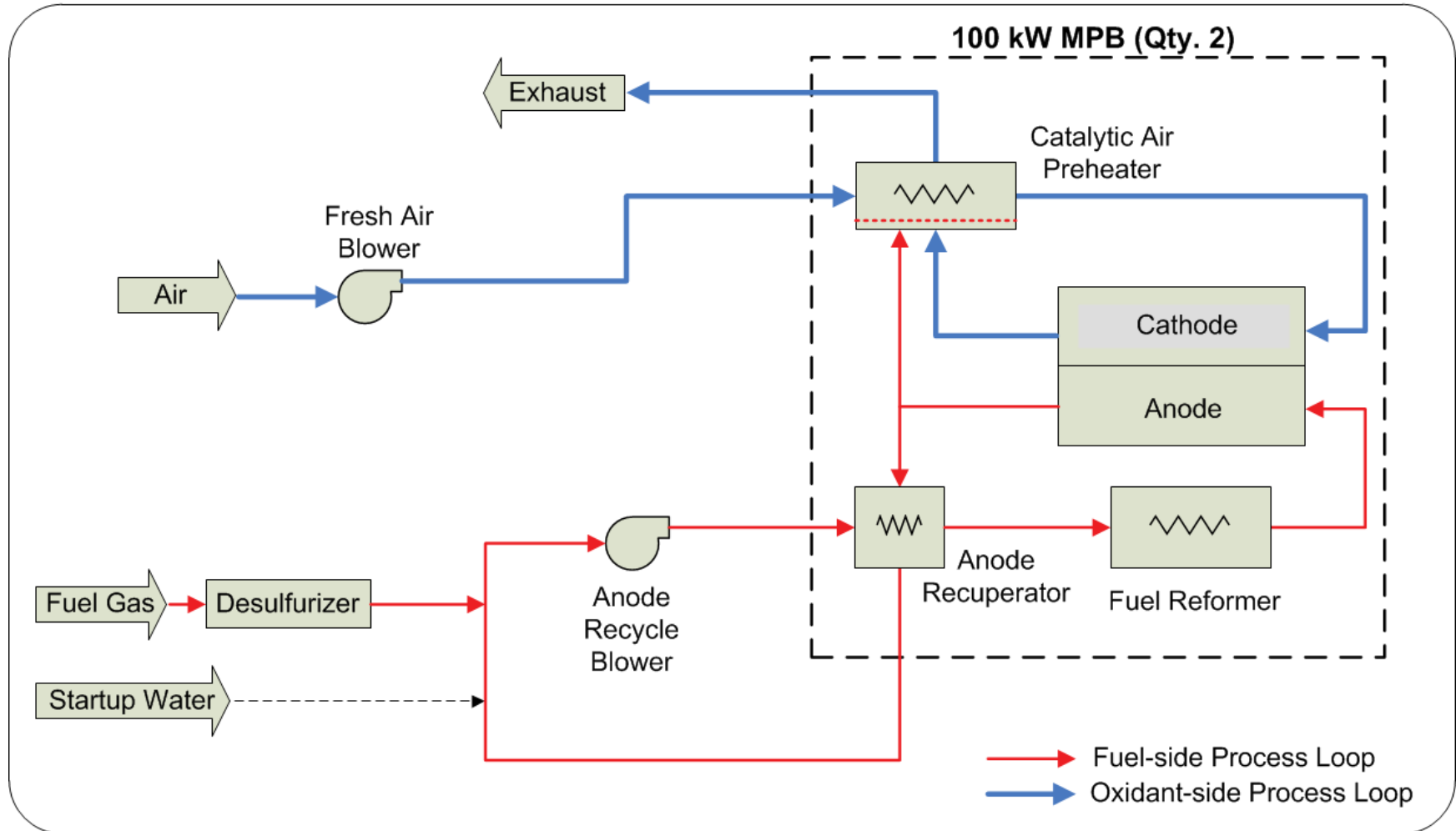
**3.7 MW  
DFC4000®**

- Utilizes three modules
- 60% Electrical Eff.  
Up to 80% total Eff

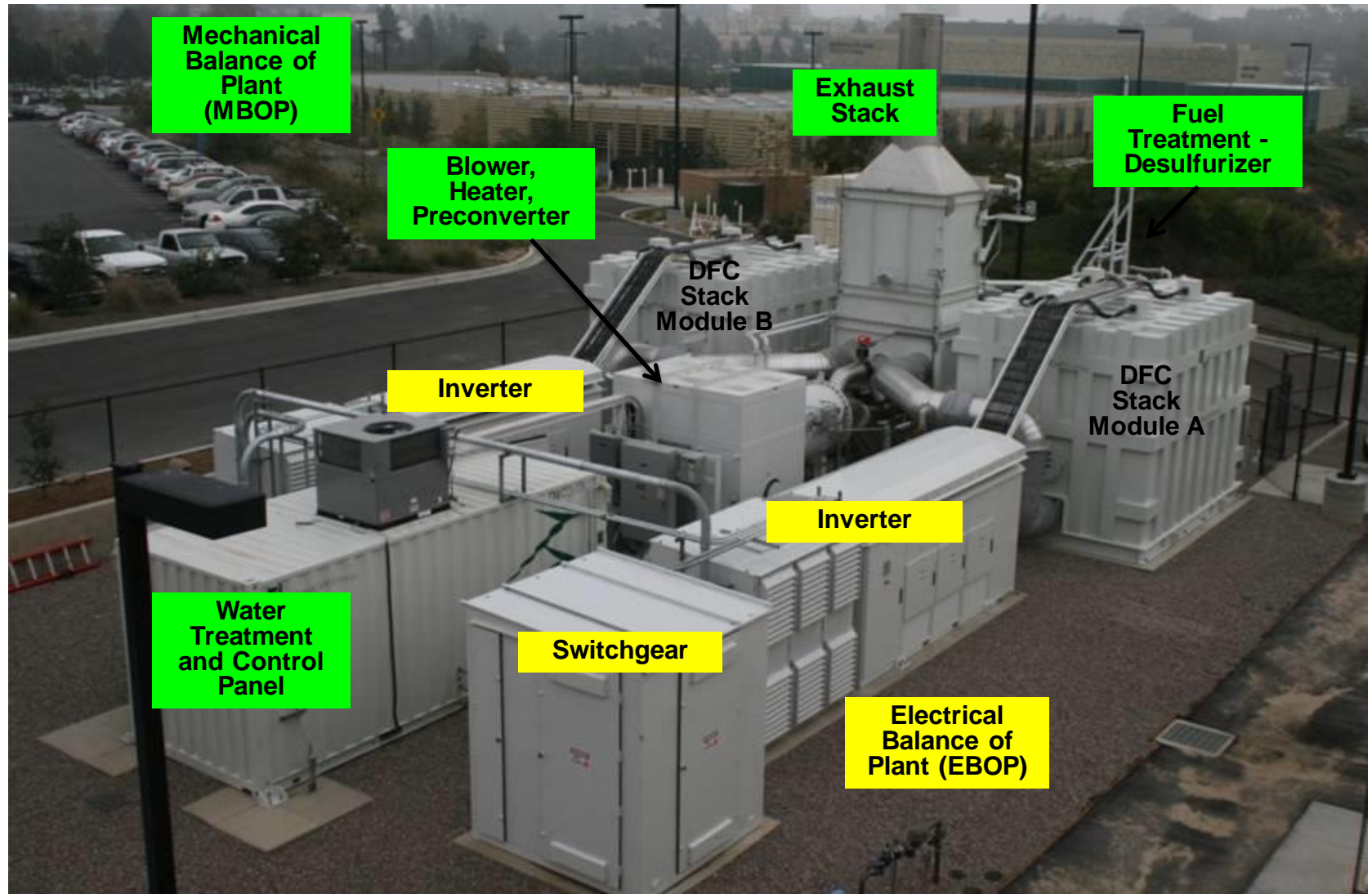


**59MW fuel  
cell park**

# What's a high temperature fuel cell PFD look like?









## DFC® carbonate fuel cells

### Distributed Generation

#### On-site CHP



#### Multi-MW grid support



Supply and emissions reduction

### Distributed Hydrogen

#### Industrial



#### Transportation



#### Compression



Supply, Recovery & Compression

### Carbon Capture

#### Natural Gas

#### Combined cycle plant



#### Coal-fired



Emission reduction / Power & CO<sub>2</sub>

## Solid Oxide fuel cells

### Distributed Generation & Storage

#### Power Generation



#### Electrolysis & Storage



Power & Energy Storage

**Common Technology Platforms - Expanding Market Opportunities**

- Needs and supply chain gaps for Stationary applications: customized balance of plants unit operations –
  - DC/AC inverters suitable for fuel cell systems
  - Inexpensive control hardware (e.g. Automotive based)
  - High temperature anode recycle Blower (200 C- 800 C)
  - Low cost Heat exchangers (high temperature/highly packaged)
  - Fuel Cleanup components
- Explore common ground for manufacturing and strengthening the BOP supply chain
  - The Problem: some of these items are “fixed at volume” -- this approach is problematic because it falls prey to the “valley of death” issue
    - Development costs are high, repeat costs are high until “volume” is reached
    - Most companies never reach “volume”
  - Some unit operations will remain “solid oxide-specific.”
    - E.g., for SOFC - Anode recycle blower
- But others, need not be just a fuel cell problem– continue to seriously assess the feasibility of “enabling synergies:”
  - Cross-industry approach leveraging advances, and manufacturing volume- the intersection between the Fuel Cell industry and other industries.
  - Automotive (e.g., a water pump on a pickup costs \$100 and will last at least 5 years in the worst environment)
  - Solar (grid-tie inverters; “Little Box Challenge”)
  - Batteries
  - Electronics

***Thank You!***