



**FuelCell Energy**

World Leader in Ultra-Clean Power

## **High Efficiency Direct FuelCells®**

Expanding Markets, Driving Growth

**Presentation to the Fuel Cells and  
Hydrogen Joint Undertaking (FCH JU)**

**3<sup>rd</sup> Stakeholders General Assembly**

**Dan Brdar, CEO**

**9 Nov. 2010**

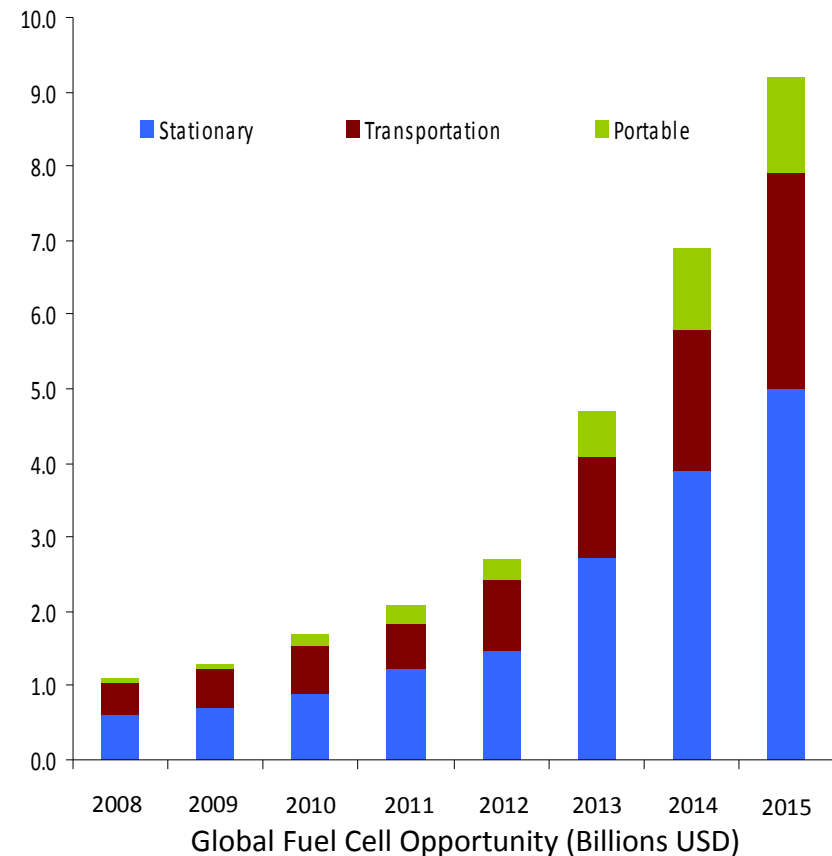
**reliable, efficient, ultra-clean**



# Stationary Fuel Cells: A Global Opportunity

***Global demand for electric power expected to grow to 28.9 trillion kWh by 2025 from 18.0 trillion kWh in 2006***

- Fossil fuels remain dominant, at 68% of electricity in 2006
- Abundant, inexpensive, reliable, familiar – *but when burned have environmental impact*
- **Fuel Cells** preserve the advantages of fossil fuels, without the impact
- Fuel Cells do what intermittent technologies (solar and wind) cannot
- Reliability and production-readiness have been demonstrated
- A wide range of customers across many segments to drive volume



*Tradition Equities, April 2010*



# FCE Company Overview

- Founded 1969, began shipping commercial MCFC products in 2003
- FY2009 revenue \$88 million
- 482 people dedicated only to fuel cells
- 100 MW installed or in backlog, at 52 sites
- Industry-standard warranty terms and conditions offered on all products
- State-of-the-art manufacturing in Torrington, CT
- 70 MW production capacity
- Expansion plan to achieve 150 MW capacity



***Torrington, CT***



***Danbury, CT***



FuelCell Energy

# Product Line Based on Stack Building Block



Cell Package and Stack



Single-Stack Module



Four-Stack Module



**DFC300**  
Single Module  
Powerplant  
300 kW



**DFC1500**  
One 4-Stack  
Module  
1.4 MW

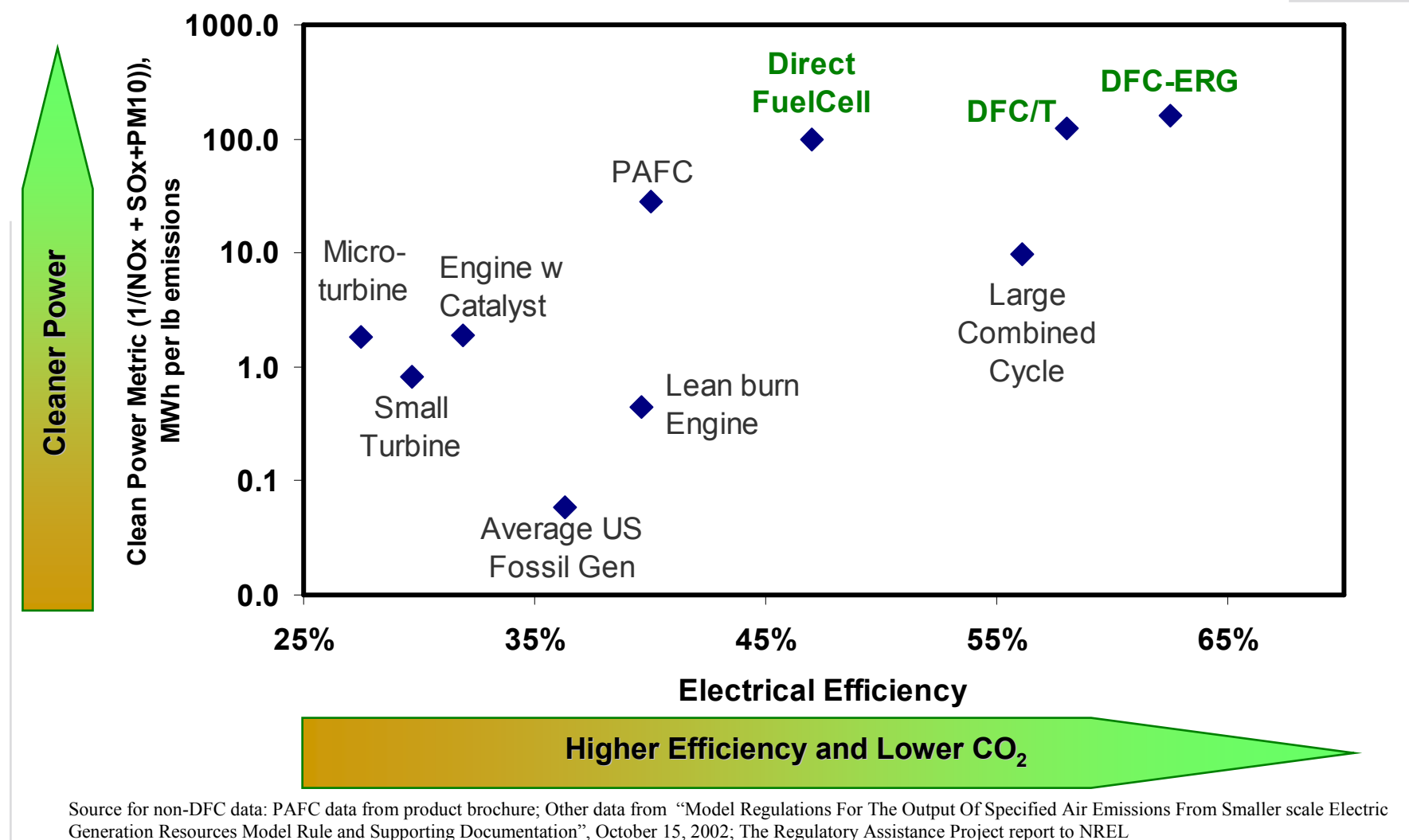


**DFC3000**  
Two 4-Stack  
Modules  
2.8 MW



FuelCell Energy

# Direct FuelCells: Clean, Efficient Decentralized Power Generation



FuelCell Energy, the FuelCell Energy logo, Direct FuelCell and "DFC" are all registered trademarks (®) of FuelCell Energy, Inc.



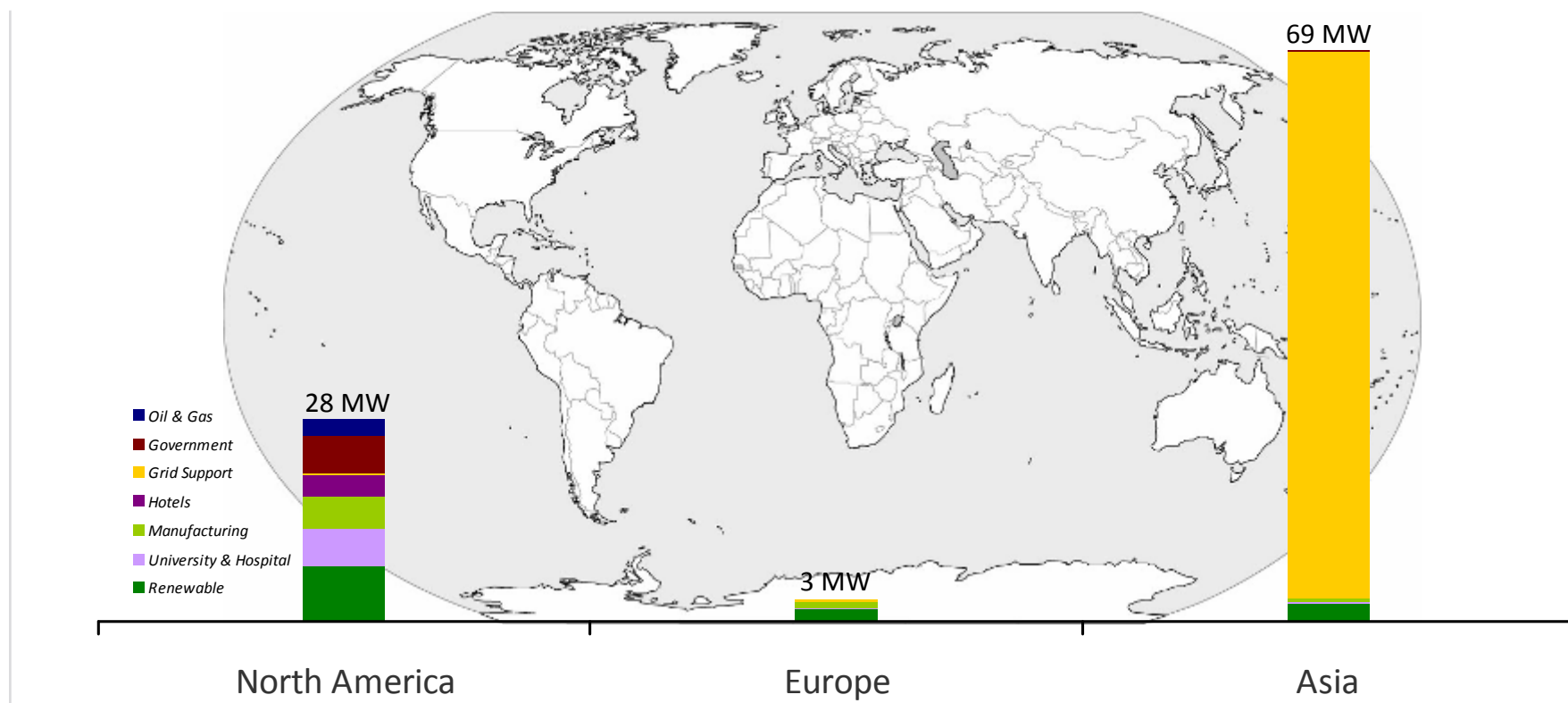
# Market Progress to Date

## *Through July 2010:*

- 100 MW installed and backlog
- 52 sites (average site 1 MW)
- 562 million kWh generated

## *Goals through 2011:*

- Expand European market presence
- Grow North American orders
- Capture growth from new Korea RPS





# Key Market: Northeast U.S.

Connecticut RPS requires 20% electricity from “Tier 1” sources by 2020 – including wind, solar, biomass, and fuel cells on natural gas

- Total 43.5 MW of project awards to FCE  
DFC-ERG, DFC with organic rankine cycle, DFC/Turbine
- Projects eligible for subsidy programs  
\$0.055/kWh premium, fuel pass-through, U.S. federal ITC
- MW-class distributed energy relieves grid congestion

## Highlights:

- Fuel cell manufacturing state
- FC on natural gas are Tier 1
- Similar to FIT

## Challenges:

- Availability of project financing
- Small state / market size
- Time intensive process



*Pepperidge Farm Bakery, Bloomfield CT*



*Yale University, New Haven CT*





# Key Market: California

California's power crisis in 2001 led to the enactment of the Self Generation Incentive Program (SGIP) to promote distributed generation

- Capital cost rebates for qualifying self-generation
- Strict air quality permitting requirements
- New nuclear and coal not desired
- 20 MW of Direct FuelCell plants installed so far

## Highlights:

- Strong incentive program
- New FIT for CHP & Renewable
- Fuel cells in utility rate base



*Sheraton  
San Diego*

## Challenges:

- MW limit for incentives
- Utility resistance to DG



*City of  
Riverside  
Waste Water  
Plant*



*Cal State University, Northridge*



*Santa Rita Jail*





South Korea's economy is 97% dependent on imported energy, and on exports – government-industry cooperation is key to growth

- Focused energy innovation policy

Four “national growth engines”: PV, wind, hydrogen & fuel cells, IGCC

- New RPS program in 2012

1,400 MW New and Renewable Energy (NRE) in 2012, increasing to 7,000 MW in 2022

- Fuel Cells on natural gas and bio gas qualify

- Public Buildings Compulsory program

New or renovated public buildings >1000 m<sup>2</sup> must install 5% NRE

- FCE-POSCO Power partnership

40+ MW installed or under contract, including 11.2MW at Daegu City



*DFC3000 at Incheon, South Korea*

*2.4 MW DFC1500  
Pohang, South  
Korea*



## Highlights:

- FIT for FC at \$0.28/kWh
- Low interest loans, tax deductions
- Localization strategy

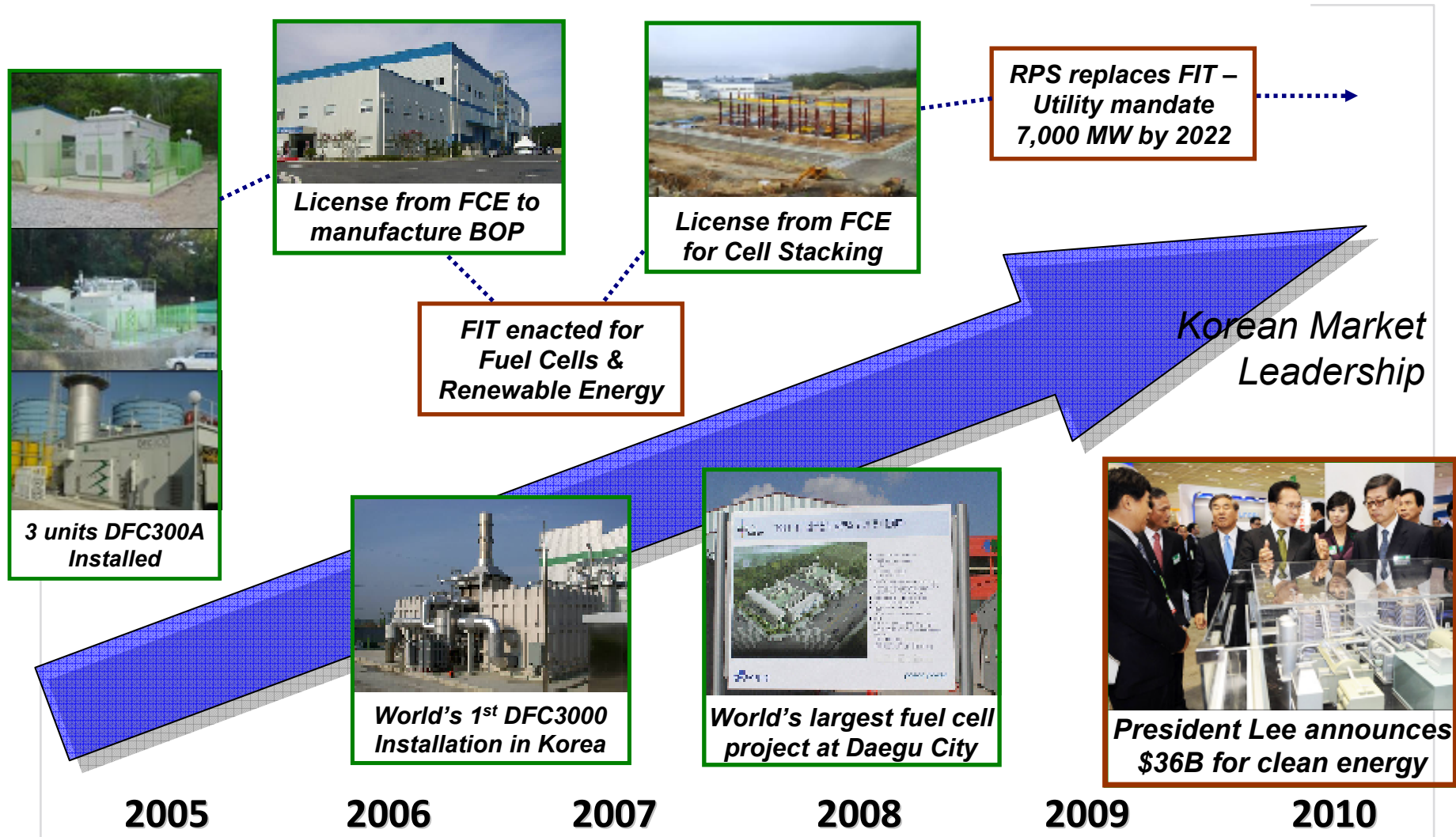
## Challenges:

- RPS: higher potential, variable renewable energy credit value
- Requires strong local partner



FuelCell Energy

# POSCO-FCE Market Development Model

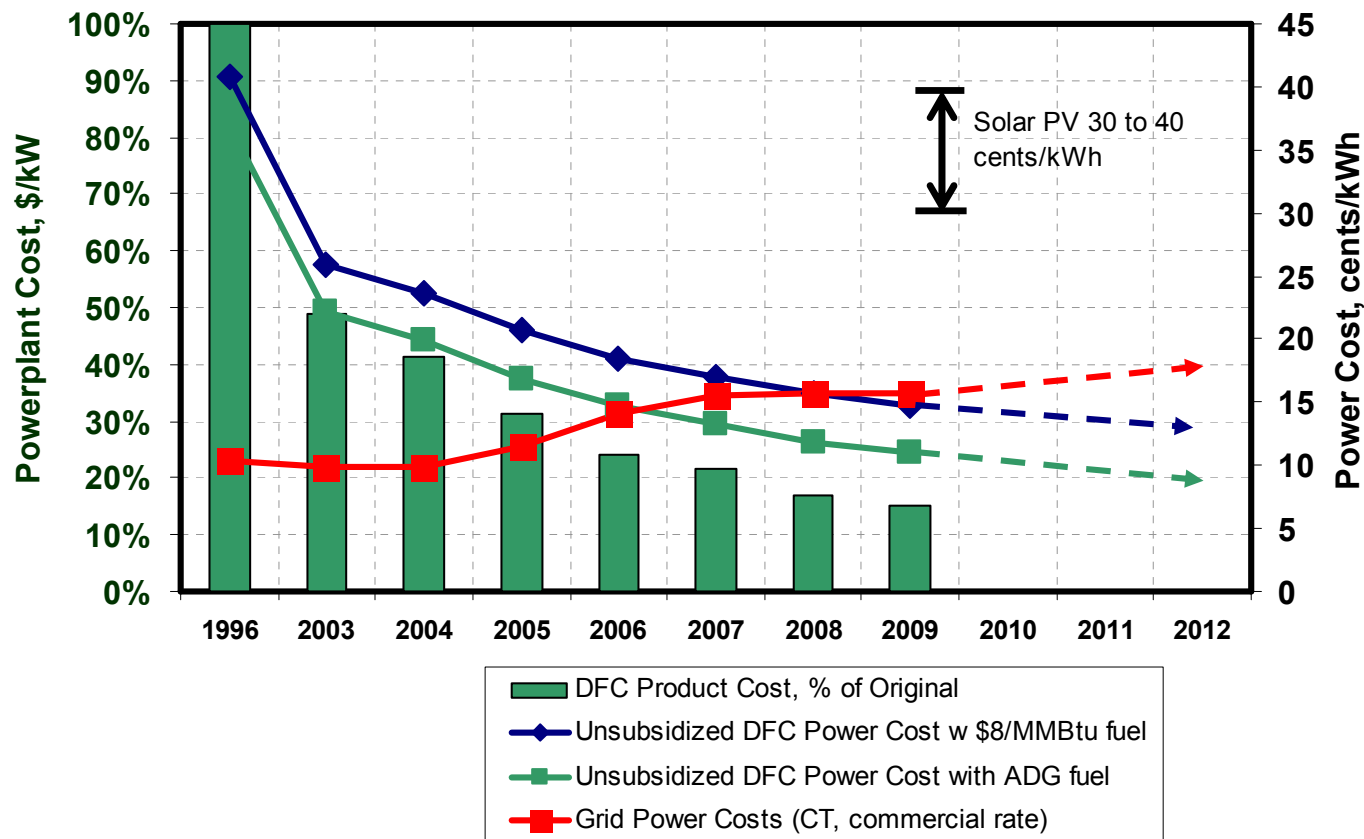


FuelCell Energy, the FuelCell Energy logo, Direct FuelCell and "DFC" are all registered trademarks (®) of FuelCell Energy, Inc.



# Cost Reduction Progress

*Product costs reduced by >60% while grid power costs are increasing*



# Advanced Applications – Renewable Hydrogen

- Remaining H<sub>2</sub> after electricity production (~30%) can be separated
- On-site cost advantage versus industrial reforming and electrolysis
- H<sub>2</sub> provides energy storage for Smart Grid or Vehicles
- Bio-gas as feedstock provides a reliable source of **Renewable Hydrogen**

## FCE Status

- Second generation DFC-H<sub>2</sub> operating in renewable H<sub>2</sub> vehicle filling station in California
- Developing Electrochemical Hydrogen Separation technology
- Developing commercialization channels

### DFC-H<sub>2</sub>: First System (2008)



### DFC-H<sub>2</sub>: Second System (2010)



Energy Efficiency & Renewable Energy





# Advanced Applications – Carbon Capture & Storage (CCS)

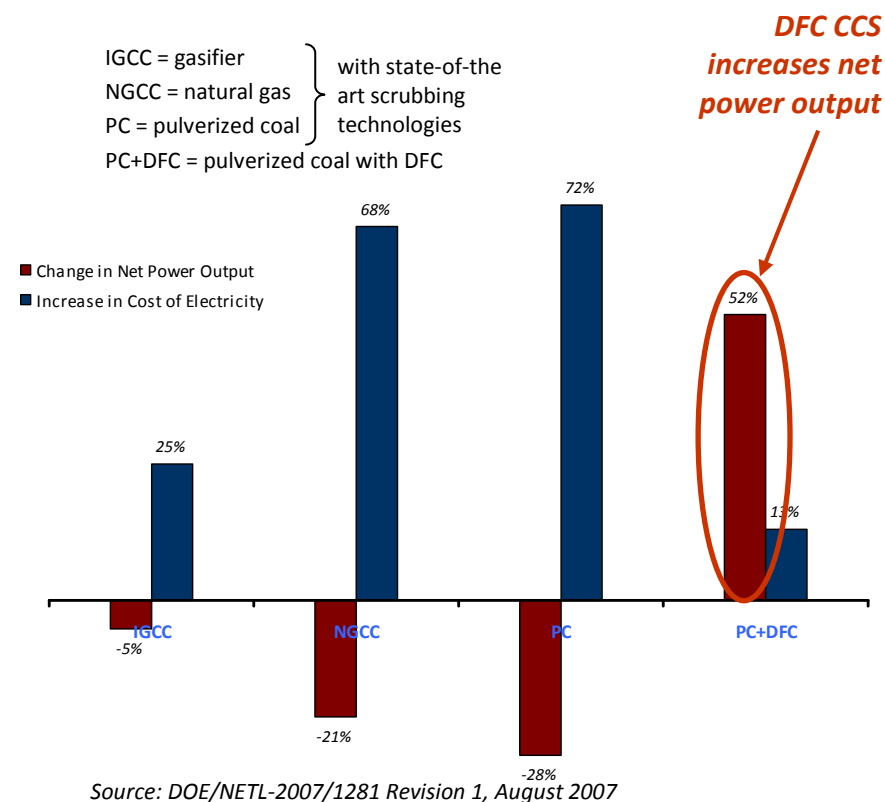
- Carbon capture and sequestration is actively pursued as a means to mitigate the greenhouse gas emissions impact of coal-burning power generation
- DFC can separate 90+% of CO<sub>2</sub> from fossil fuel power plant exhaust

## *FCE Approach:*

- Carbonate electrochemical process transfers CO<sub>2</sub> from Air Electrode (Cathode) to Fuel Electrode (Anode)
- CO<sub>2</sub> is easily separated from Fuel Electrode exhaust gas because it is no longer diluted with air
- Other CO<sub>2</sub> capture technologies which reduce net electric power, while DFC increases the power generated

## *Next Steps:*

- Investigating enhanced oil recovery (EOR) as a near-term application
- Partnership for development and widespread deployment of DFC CCS products







- Continued cost reduction is critical to overcoming entrenched competition
  - Subsidized central grid, recip engines are 100+ year-old solutions
- Great progress has been made in cost reduction, with more to come
- 100+ MW sales pipeline is in place → financing is the key
- FIT and RPS markets will drive order volume
- FCE business model can bring localization and green job creation through partnerships
- Order volume will enable further cost reduction and profitability

***Ultra-clean, reliable and highly efficient – FCE's Direct FuelCells are part of the solution.***





**FuelCell Energy**

World Leader in Ultra-Clean Power

**Thank you**

reliable, efficient, ultra-clean