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Fuel Cell Industry – Quick Overview

INVEST! – Panel Discussion

Hydrogen & Fuel Cell Industry Forum

Photo Credits: FuelCell Energy
Ultra-Clean, Efficient, Reliable Power

November 17, 2016

Special Acknowledgements

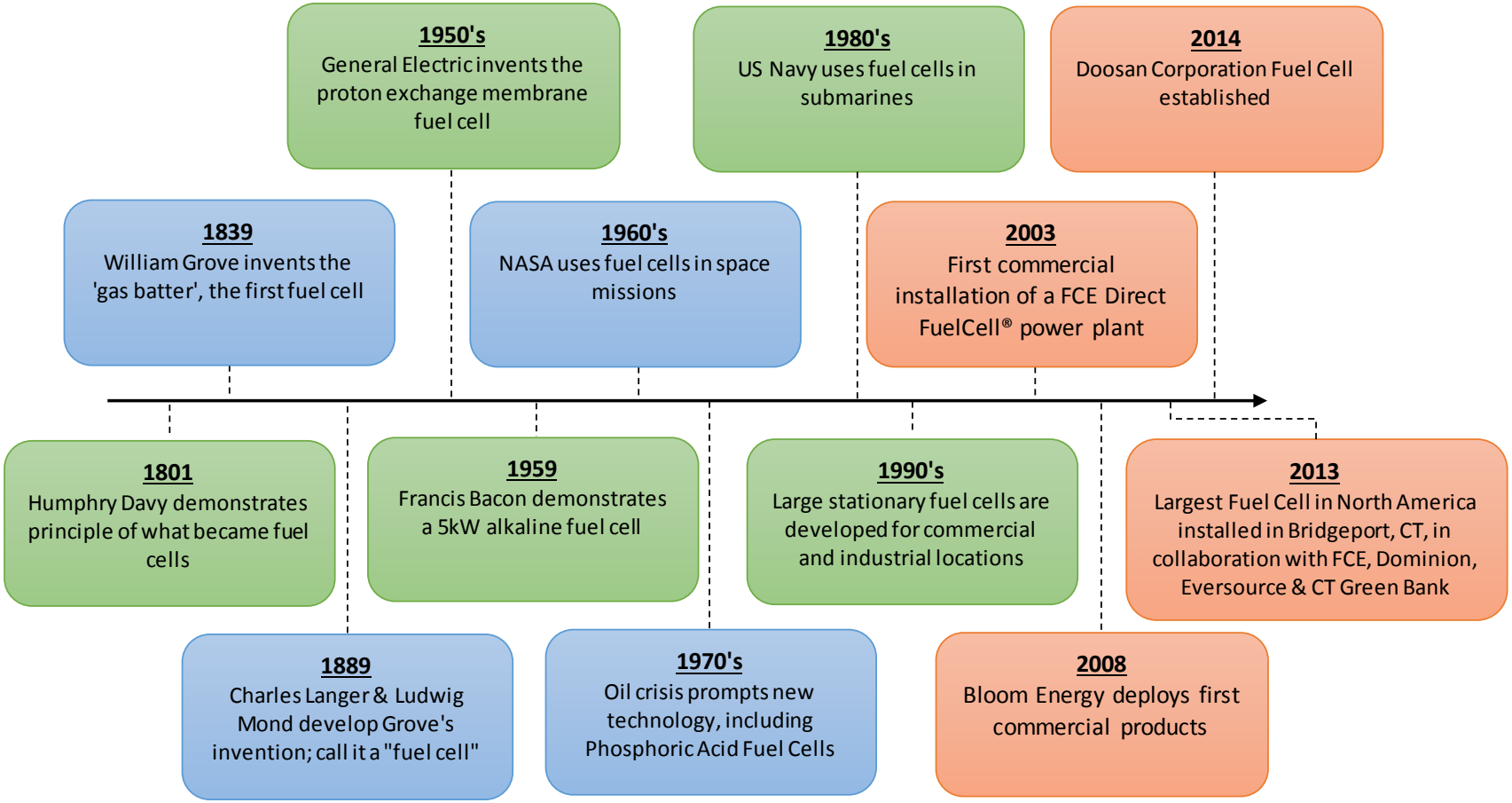
While the Connecticut Green Bank ("Green Bank") created this presentation independently and in its sole discretion, using a variety of data sources, Green Bank would like to announce a special acknowledgement for support from Fuel Cell Energy (NASDAQ: FCEL), with respect to the creation of this presentation, in the forms of certain content and guidance.

Fuel Cell Industry – Overview

1. Industry Background
2. Fuel Cell Commercial Applications & Configurations
3. Benefits, Positioning, & Risk Analysis
4. Fuel Cell Financing Structures
5. Capital Sourcing

Industry Background

"Fuel cells are electrochemical devices that produce electricity and heat from a fuel (often hydrogen) and oxygen. Unlike conventional engines, they do this without burning the fuel and are therefore generally cleaner and more efficient"



Primary Source: "FuelCell Today", http://www.fuelcelltoday.com

Fuel Cell Commercial Applications

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Energy **Production**	Energy **Recovery**	Energy **Resiliency**
• Electricity • Heat/Cooling • Hydrogen • Vehicular power	• Carbon capture • Efficiency recovery	• Hydrogen storage • Distributed & islanding capabilities

Fuel Cell Commercial Configurations

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Fuel Cell Centric Configurations

- Large-scale stacks/plants
  (Commercial / Industrial / Municipal / Critical Facilities)
- Small-scale deployments
  (Residential / Commercial)
- Mobile distributions
  (Transportation / Personal)

System Centric Configurations

- Distributed microgrids
  (sole energy source vs. tandem site generation)
- District heating
  (distributed thermal heating/cooling loops)
- Utility grid support
  (grid-tied renewable baseload)

Fuel Cell Benefits, Positioning, & Risk Analysis

Benefits
· Generally more efficient compared with conventional generation · Generally cleaner compared with conventional generation · Multiple product outputs & applications (heat, power, recovery & resiliency) · Flexible deployment opportunities (individual vs. microgrid deployments) · Reliable/constant power compared with other renewables · Islanding/silo capabilities for resiliency & critical facility needs

Risks	Mitigants
· Performance/Operations Risk	· Remote Monitoring · Asset Management Contracts · Scheduled Re-stacking · Performance Insurance
· Fuel Procurement Risk	· Flexible on fuel inputs (natural gas, biogas, etc..)
· Fuel Price/Cost Risk	· Commodity hedges · Customer "pass-throughs" · Strategic fuel selection/optionality
· Customer/Off-taker Credit Risk	· Various financing structures · Discounted power pricing · "Cross-energy" synergies
· Technology/Innovation Risk	· [?]
· Regulatory Risk	· [?]

Fuel Cell Financing Structures

	Customer Ownership	3rd Party Ownership	Developer Ownership
Who Purchases Completed System?	Customer	External Investors	Developer Retains System
How is Purchase Financed?	Customer Debt/Cash	Equity (sponsor/tax); Leverage	Equity (developer/tax); Leverage
Payback Mechanism	Energy Savings; REC Revenue; Tax Benefits	PPA/Lease to the customer; REC Revenue; Tax Benefits	PPA/Lease to the customer; REC Revenue; Tax Benefits
Who Faces Customer Credit Risk?	Customer's capital Provider(s)	Equity (sponsor/tax); Lender(s)	Equity (developer/tax); Lender(s)
O&M Responsibility	Customer (O&M Subcontract)	External Investors (O&M Subcontract)	Self / O&M Subcontract
Term	System Useful Life	Term of Arrangement	Term of Arrangement

Capital Sourcing

Capital Source	Benefits	Drawbacks
Private Capital – **Equity**	Available, flexible repayment	High Cost
Private Capital – **Tax Equity**	Monetizes otherwise underutilized benefits	Dependent on ITC/policy extension
Private Capital – **Debt**	Lower cost	Fixed repayments, maturity limit, & default risk
Public Capital – **Green Banks**	Flexible, cost-competitive	Limited % of capital requirements
Federal Capital - **SBA**	Low cost, Flexible	Eligibility requirements, personal guarantees
Federal Capital – **USDA**	Low cost	Rural component, eligibility requirements
Federal Capital – **DOE/LPO**	Low cost	Innovative component, eligibility requirements

Webster Bank – CCSU Fuel Cell Project