



FuelCell Energy

Ultra-Clean, Efficient, Reliable Power

Stationary Fuel Cell Technology

US Energy Association

June 21, 2010

ultra-clean, efficient, reliable



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www.fuelcellenergy.com

Agenda for Today – Building recognition for the value of Stationary Fuel Cells

- **Fuel Cell Technology Overview**
- **International Adoption and Regulatory Drivers**
- **State Regulatory Policies**
- **Fuel Cells - a new means to invest in efficient electric/natural gas infrastructure**
- **Fuel Cells - adaptable to US power development models**



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FuelCell Energy, Inc.

- Premier developer of stationary fuel cell technology — founded in 1969
- 70 installations in N. America, Europe, and Asia
- Industrial, commercial, utility products
- 300 KW to 50 MW and beyond

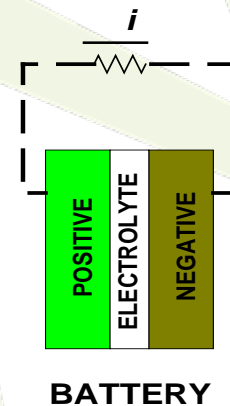




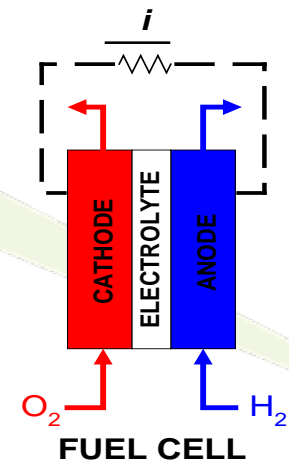
Fuel Cell Technology 101

Stationary Fuel Cells are the Power Generation Cousins of the Batteries intended for Smart Grid Bulk Electricity Storage – Key Difference Fuel Cell Technology is Ready Today

- *Electrochemical Power vs Combustion (Elegant vs Primitive)*
- *Continuous Battery (Fuel In > Power Out)*
- *No Burning >> No Smoke, No Noise*



BATTERY



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Stationary Fuel Cell Technology 2010

Well Beyond R&D and Demonstration – *Poised to be part of Mainstream Resources to serve Modernized US Electricity Grid*

- *US Technology - Developed with investment from US DOE, DOD and NASA and Private Capital*
- *Hundreds of systems in operation worldwide*
- *US Manufacturing Base and Supply chain in place*
- *Designed to standards for Commercial, Industrial and Utility duty*
- *Per kWh costs that are far less than other clean and renewable options being considered*

The Appropriate Technology for US Needs

 Good Solution  Possible or Partial Solution  Poor Solution			Capacity Factor	24/7 Power	Peaking Power	Central Generation	DG or On-Site Power	SOX, NOX Particulate Matter	CO2 Reduction	Avoid Siting, NIMBY Issues
CONVENTIONAL COMBUSTION		Up to 95%								
WIND		25-35%								
SOLAR		15-25%								
FUEL CELLS		Up to 95%								

Stationary Fuel Cells offer a better balance of solutions than more commonly discussed resources



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Fuel Cells and US Energy Policy

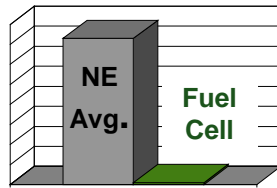
- **American developed and manufactured**
- **Stationary fuel cells were developed by the US/DOE to solve the clean, efficient power generation challenge.**
- **Uses diverse domestic fuel resources.**
- **Improves domestic energy security**
- **Improves reliability of grid**
- **Cost effective complement to wind, solar**
- **Technology use growing faster in Asia than US**





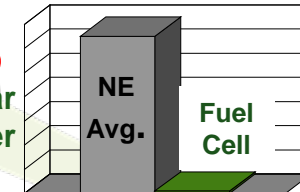
Environmental Benefits are Tangible

- **Emits virtually zero pollutants (NO_x , SO_x)**
- **Significantly reduced CO_2**
- **Quiet operation suitable for almost any location**



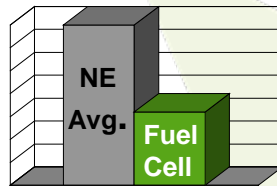
- 99.94%

Reduction of 1,240 tons per year of NO_x per 100 MW of power



- 99.999%

Reduction of 3,250 tons per year of SO_2 per 100 MW of power



- 55%

Reduction of 387,000 tons per year of CO_2 per 100 MW of power

Average emissions from New England fossil fueled plants
Source: US EPA

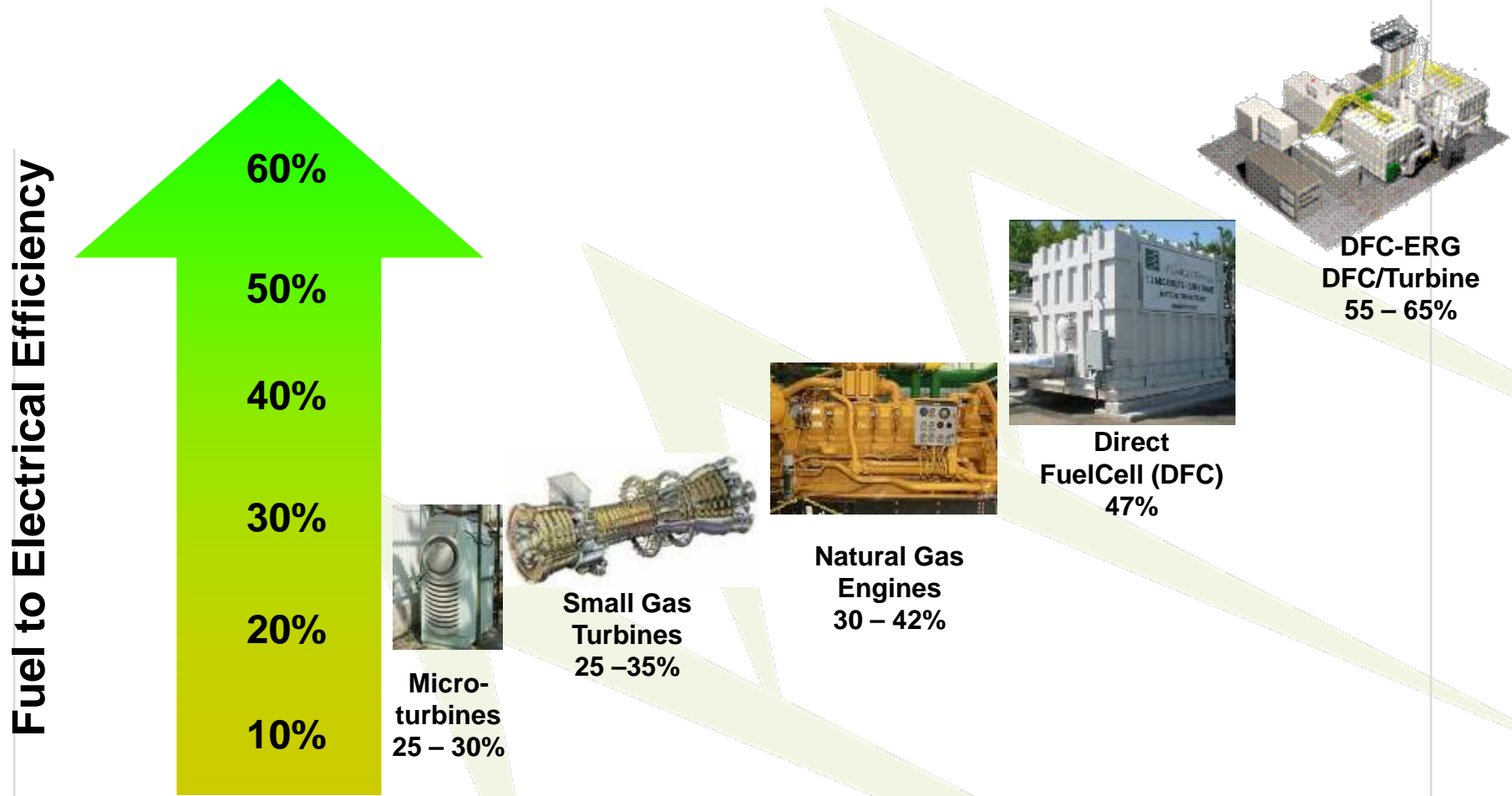


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Efficiency Differences Among Technologies are Sizeable



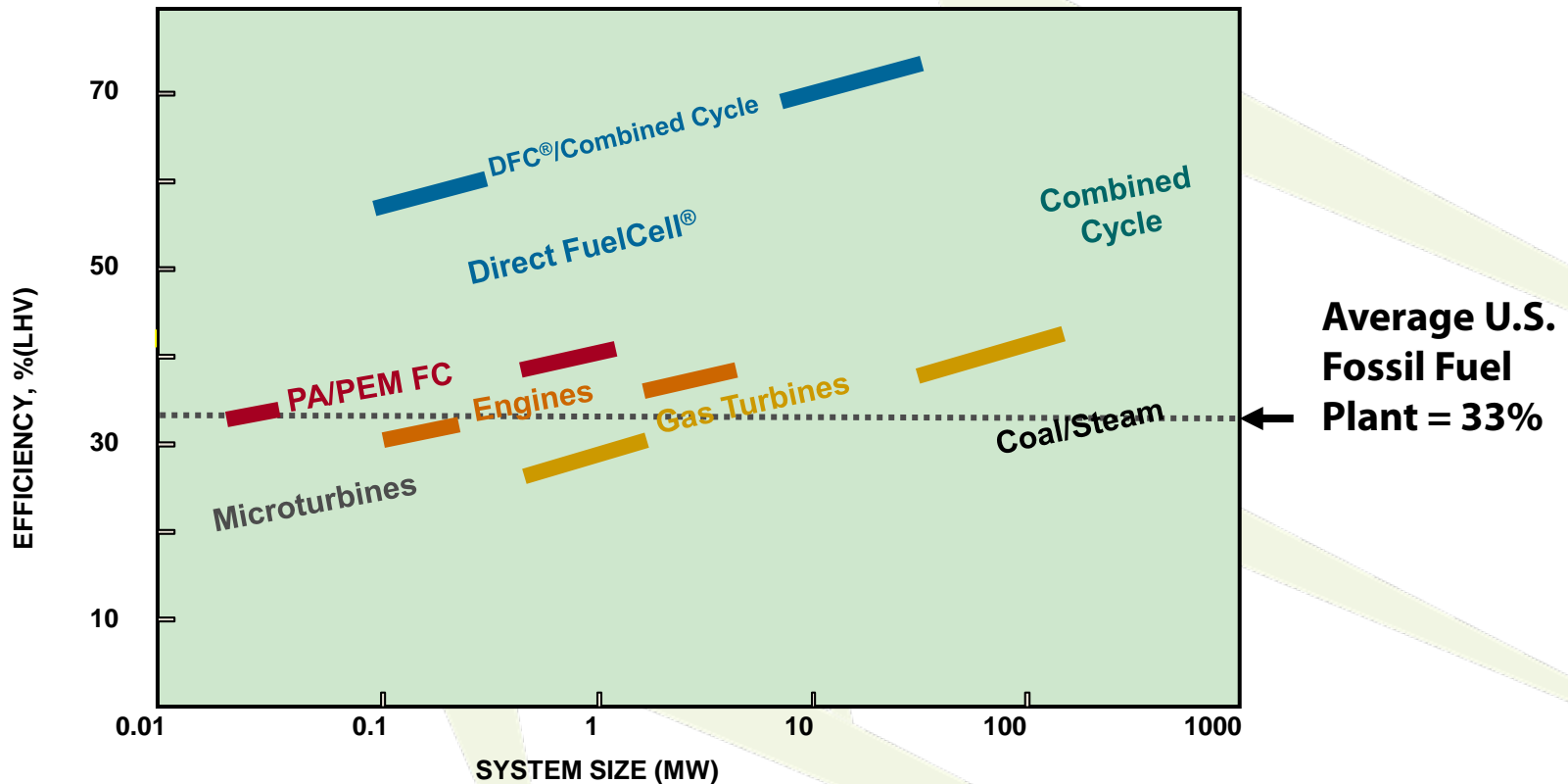


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Efficiency Gains for US Grid are Material





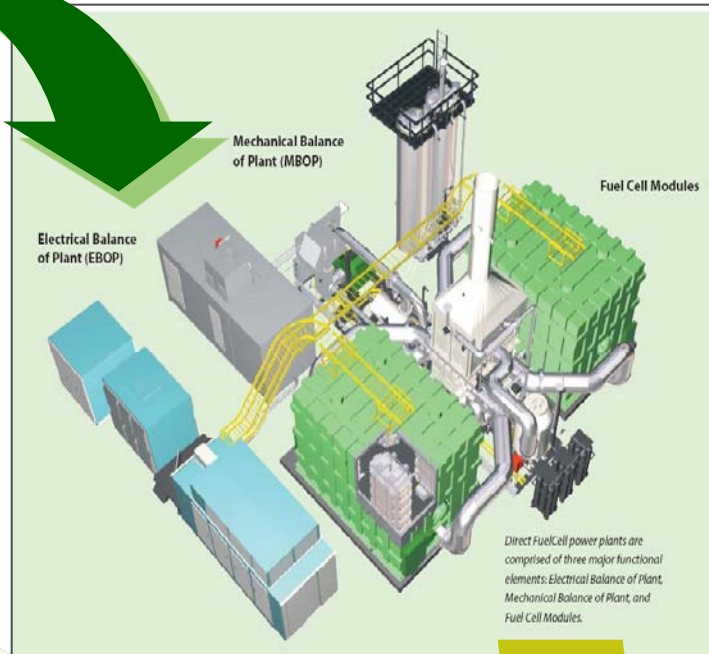
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FUEL RESOURCES

- NATURAL GAS
- ETHANOL
- PROCESS METHANE
- BIOGAS
- COAL GAS



INTEGRATED SYSTEMS IMPROVE EFFICIENCY

- DFC – (47%)
- DFC – CHP (60-80%)
- DFC – ERG (55-60%)
- DFC/T – (55-65%)
- DFC H₂ (50-60%)

Basic Fuel Cell Plants offer a platform of diversity for US applications – multiple fuels, multiple accessory systems offer enhanced efficiency



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Fuel Cells offer Combined Heat and Power.. “Plus”



*High electrical efficiency, Near zero emissions, near zero noise, low profile
California State University, Northridge*



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Clean Power for Urban Infrastructure Revitalization

- **Bridgeport, CT**
- **15 MW Fuel Cell Power Plant with Organic Rankine Cycle**
- **1.5 Acre Remediated Brownfield Site along congested I-95 and New York City rail corridor**
- **Under Power Contract, in process of Sec. 1703 DOE Loan Guarantee program**



If we really wanted to “Green the Capital”, replace the Capitol Power Plant with an American Stationary Fuel Cell based plant



OK – So where do Fuel Cells fit in the US scheme of things

- **Best power solution at the sub transmission level between the Wholesale Power Plant and the retail consumer**
- **Why - production efficiency at the point of use is the next best thing to consumption efficiency at the point of use**
 - Efficiency is cumulative, but local efficiency is better
 - All other constraints, line losses, upstream congestion, are reduced
 - But – siting near that point of use becomes harder
 - Urban congestion, esthetics, scale, noise become factors.
- Smart people hang out with smart people (**make the smart grid work better by placing resources within and among the smart grid**)



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US Energy and Climate Policy– Factors Required to foster robust adoption of this excellent technology

- 1. Recognize Economic Development Value – American Technology = American Jobs – manufacturing plus installation offers 3.5x Job growth of just installation**
- 2. Reward the combination of efficiency and cleanliness and US Technology with incentives that motivate adoption**
- 3. Reward the ability to combine high efficiency and domestic fuels (renewable and natural gas)**



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Conclusion

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