

DOE Hydrogen & Fuel Cell Overview

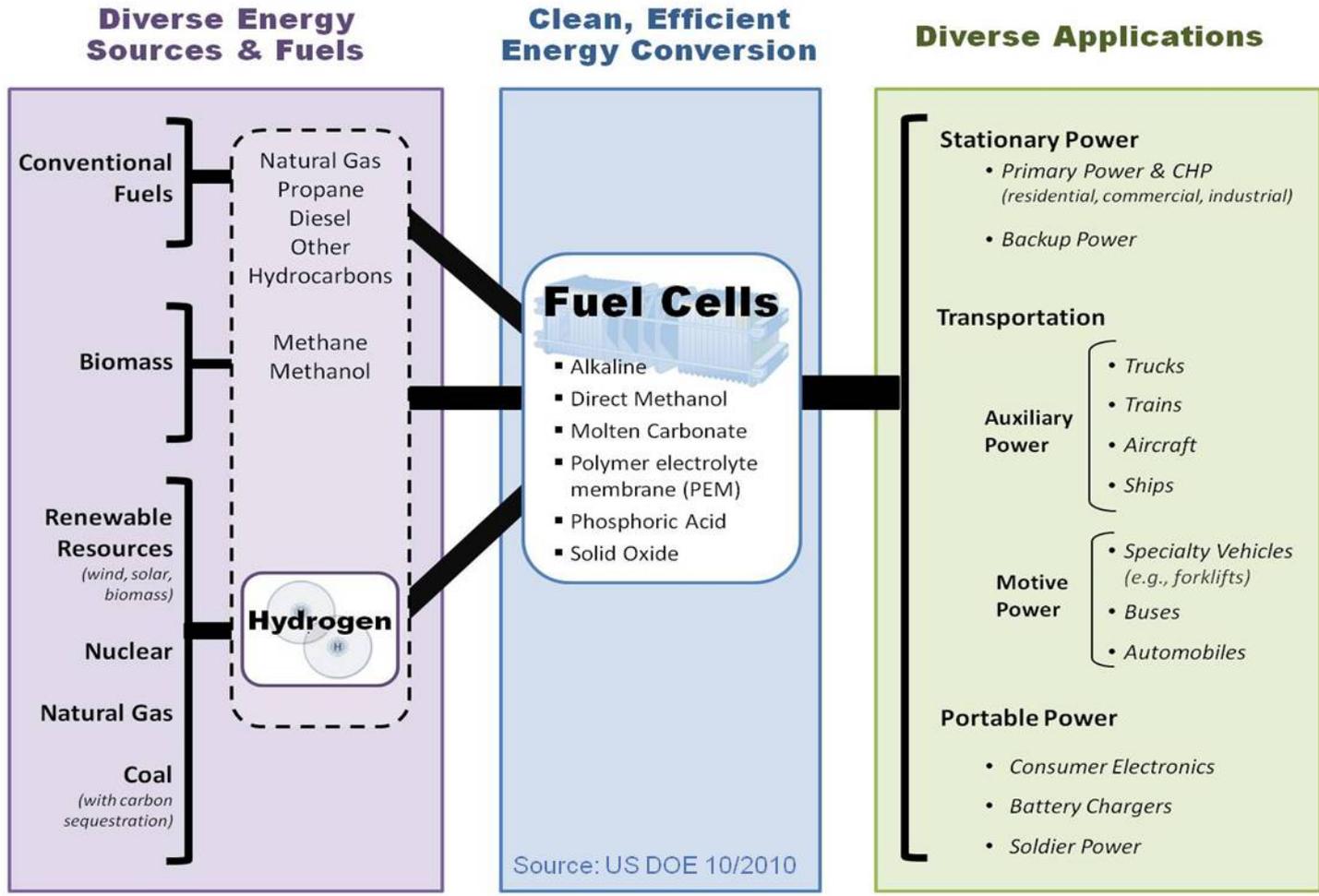
Dr. Sunita Satyapal
Program Manager
U.S. Department of Energy
Fuel Cell Technologies Program

DOE/CESA/TTC Hydrogen and Fuel Cells Webinar
December 14, 2010

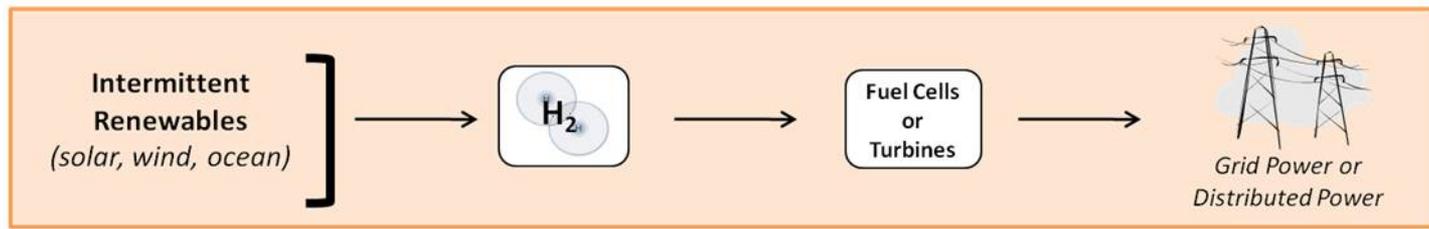
Examples of DOE-funded Partners and Locations – Fuel Cell Technologies Program



Source: US DOE 12/2010



Energy Storage for Renewable Electricity



Fuel Cells for Stationary Power, Auxiliary Power, and Specialty Vehicles



The largest markets for fuel cells today are in stationary power, portable power, auxiliary power units, and forklifts.

~75,000 fuel cells have been shipped worldwide.

~24,000 fuel cells were shipped in 2009 (> 40% increase over 2008).

Fuel cells can be a cost-competitive option for critical-load facilities, backup power, and forklifts.



Fuel Cells for Transportation

In the United States:

> 200 fuel cell vehicles

> 20 fuel cell buses

~ 60 fueling stations

Several manufacturers—including Toyota, Honda, Hyundai, Daimler, GM, and Proterra (buses) — have announced plans to commercialize vehicles by 2015.



Production & Delivery of Hydrogen

In the U.S., there are currently:

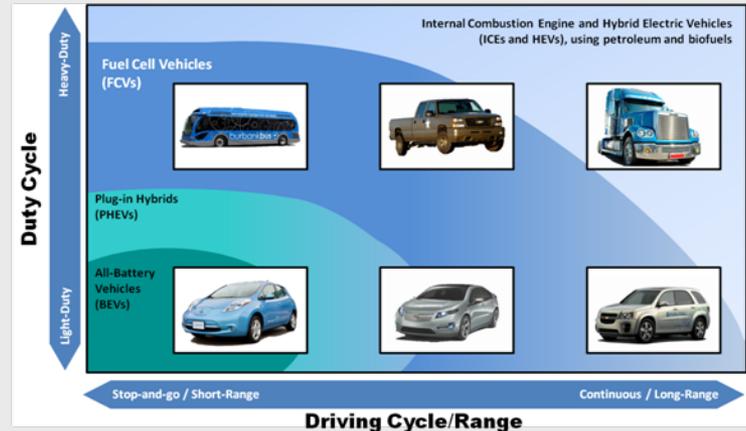
~9 million metric tons of H₂ produced annually

> 1200 miles of H₂ pipelines



Source: US DOE 09/2010

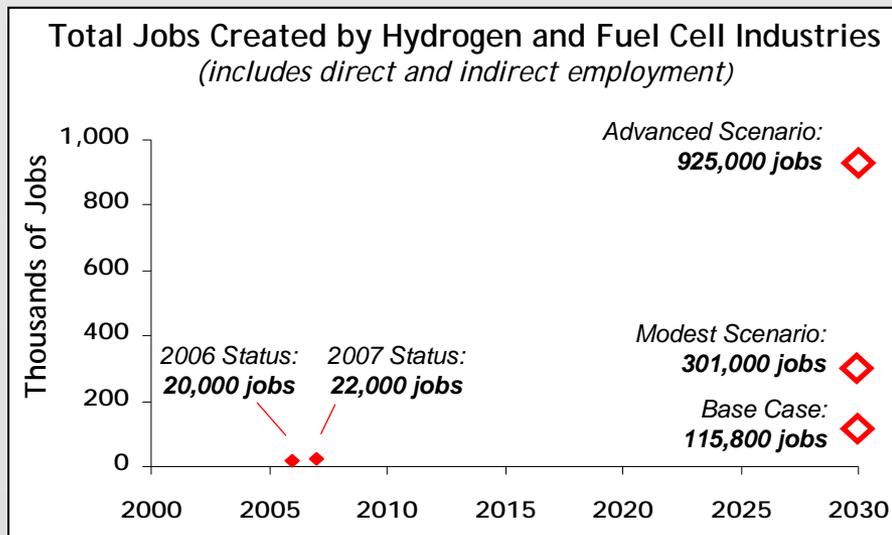
The Role of Fuel Cells in Transportation



The fuel cell and hydrogen industries could generate substantial revenues and job growth.

Renewable Energy Industry Study*

- **Fuel cells are the third-fastest growing renewable energy industry** (after biomass & solar).
- Potential U.S. employment from fuel cell and hydrogen industries of **up to 925,000 jobs** (by 2030).
- Potential gross revenues **up to \$81 Billion/year** (by 2030).



*Study Conducted by the American Solar Energy Society
www.ases.org/images/stories/ASES/pdfs/CO_Jobs_Final_Report_December2008.pdf

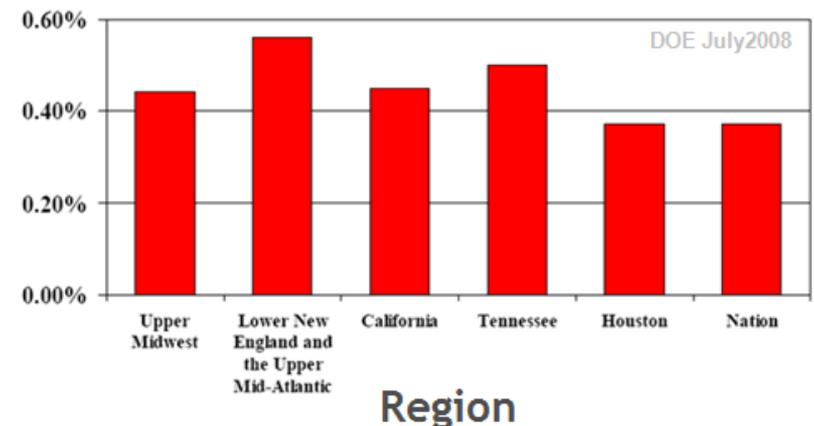
Source: US DOE 09/2010

DOE Employment Study

- Projects net increase of **360,000 – 675,000 jobs**.
- Job gains would be distributed across up to 41 industries.
- Workforce skills would be mainly in the vehicle manufacturing and service sectors.

Employment Growth Due to Success of Fuel Cell & H₂ Technologies

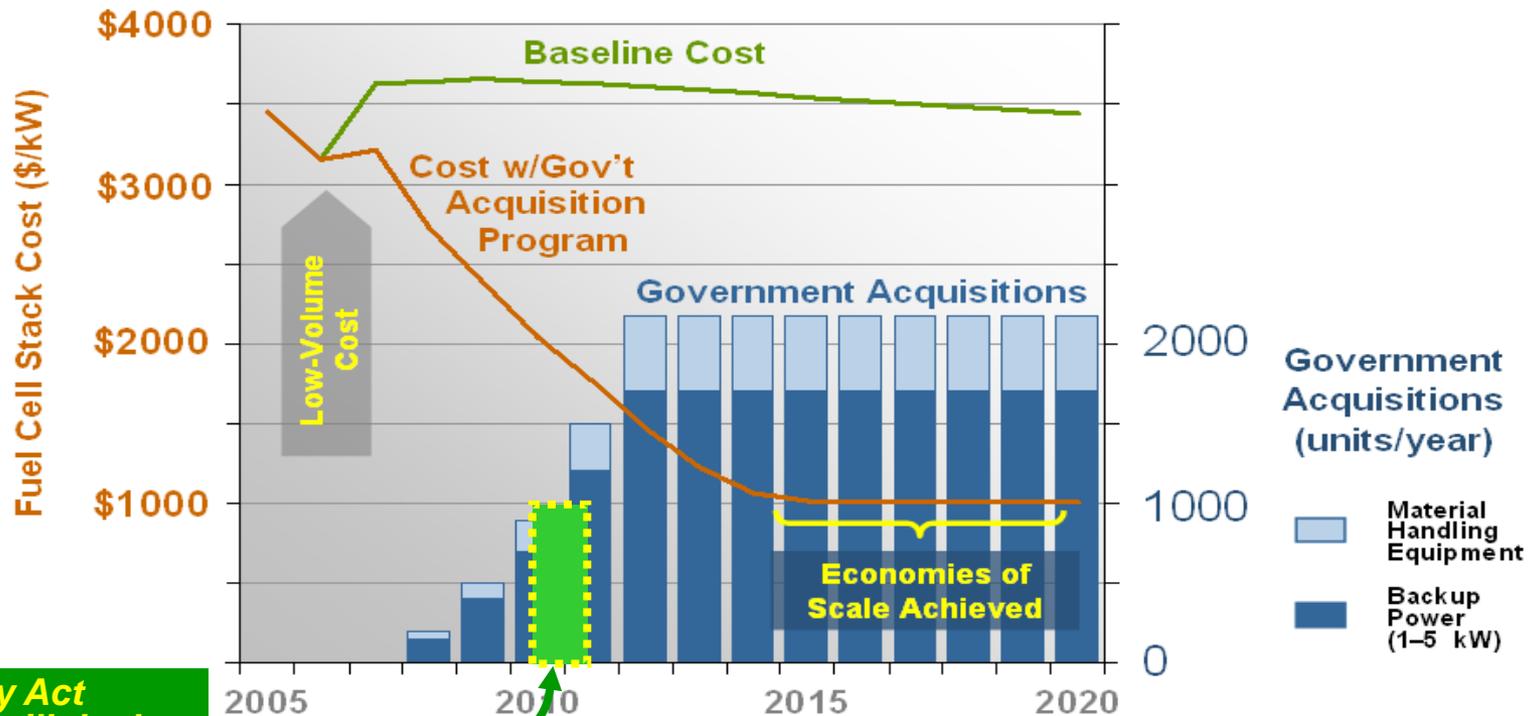
(as percent of base-case employment in 2050)



www.hydrogen.energy.gov/pdfs/epact1820_employment_study.pdf

Government acquisitions could significantly reduce the cost of fuel cells through economies of scale, and help to support a growing supplier base.

Impact of Government Acquisitions on Fuel Cell Stack Costs (for non-automotive fuel cells)



Recovery Act funding will deploy up to 1000 fuel cells, in the private sector, by 2012.

Source: ORNL

We are facilitating the adoption of fuel cells across government and industry:

- 100 fuel cells are being deployed, through interagency agreements.
- More interagency agreements under development.

Examples of Early Market Applications

Fuel Cells for Backup Power ...

- Provide longer continuous run-time, greater durability than batteries
- Require less maintenance than batteries or generators
- *May provide substantial cost-savings over batteries and generators*



*A 1-kW fuel cell system has been providing power for this FAA radio tower near Chicago for more than three years.
(Photo courtesy of ReliOn)*

Fuel Cells for Material Handling Equipment ...

- Allow for rapid refueling — much faster than changing-out or recharging batteries
- Provide constant power without voltage drop
- Eliminate need for space for battery storage and chargers
- *May provide substantial cost-savings over battery-powered forklifts*



Photo courtesy of Hydrogenics

Fuel Cells for Data Centers ...

- Provide high-quality, reliable, grid-independent on-site critical load power
- Improve the effectiveness of data center power use by 40%, with combined heat-and-power (for cooling and heating)
- Produce no emissions
- Have low O&M requirements
- Can be remotely monitored

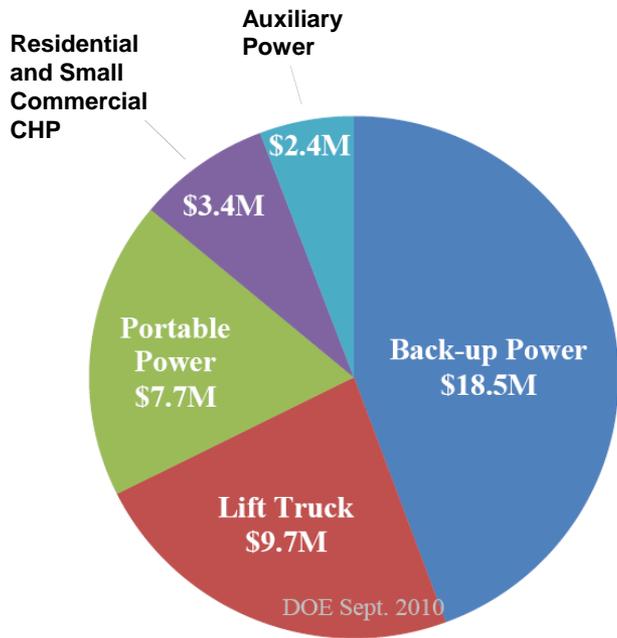


Recovery Act Funding for Fuel Cells

More than \$40 million from the 2009 American Recovery and Reinvestment Act to fund 12 projects to deploy up to 1,000 fuel cells

FROM the LABORATORY to DEPLOYMENT:

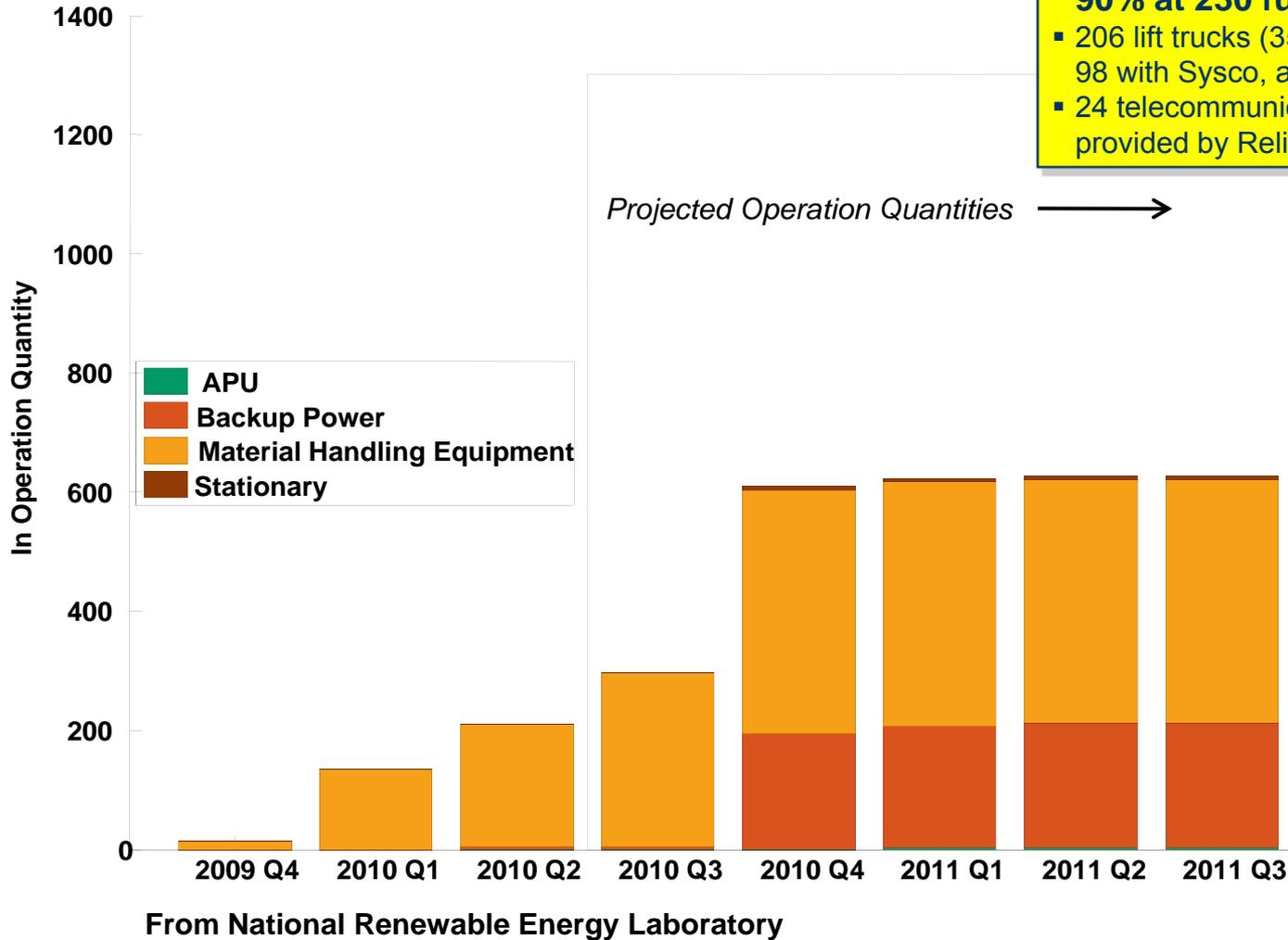
DOE funding has supported R&D by all of the fuel cell suppliers involved in these projects.



Approximately \$54 million in cost-share funding from industry participants—for a total of about \$96 million.

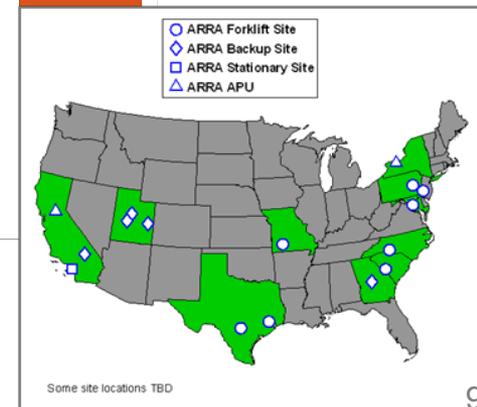
COMPANY	AWARD	APPLICATION
Delphi Automotive	\$2.4 M	Auxiliary Power
FedEx Freight East	\$1.3 M	Lift Truck
GENCO	\$6.1 M	Lift Truck
Jadoo Power	\$2.2 M	Portable
MTI MicroFuel Cells	\$3.0 M	Portable
Nuvera Fuel Cells	\$1.1 M	Lift Truck
Plug Power, Inc. (1)	\$3.4 M	CHP
Plug Power, Inc. (2)	\$2.7 M	Back-up Power
Univ. of N. Florida	\$2.5 M	Portable
ReliOn, Inc.	\$8.5 M	Back-up Power
Sprint Nextel	\$7.3 M	Back-up Power
Sysco of Houston	\$1.2 M	Lift Truck

DOE ARRA-funded Early Market Fuel Cell Installations (actual and projected)



Exceeded 2010 target for Recovery Act fuel cell installations by more than 90% at 230 fuel cells installed:

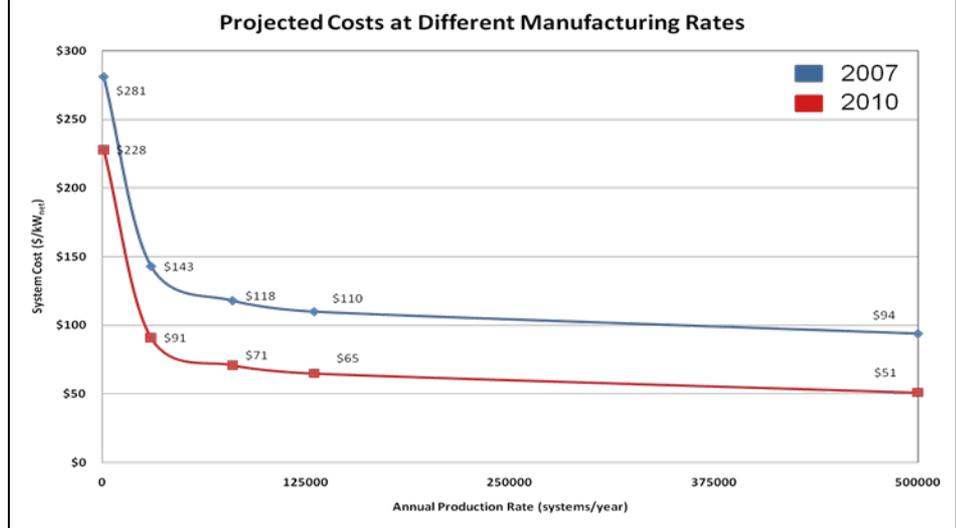
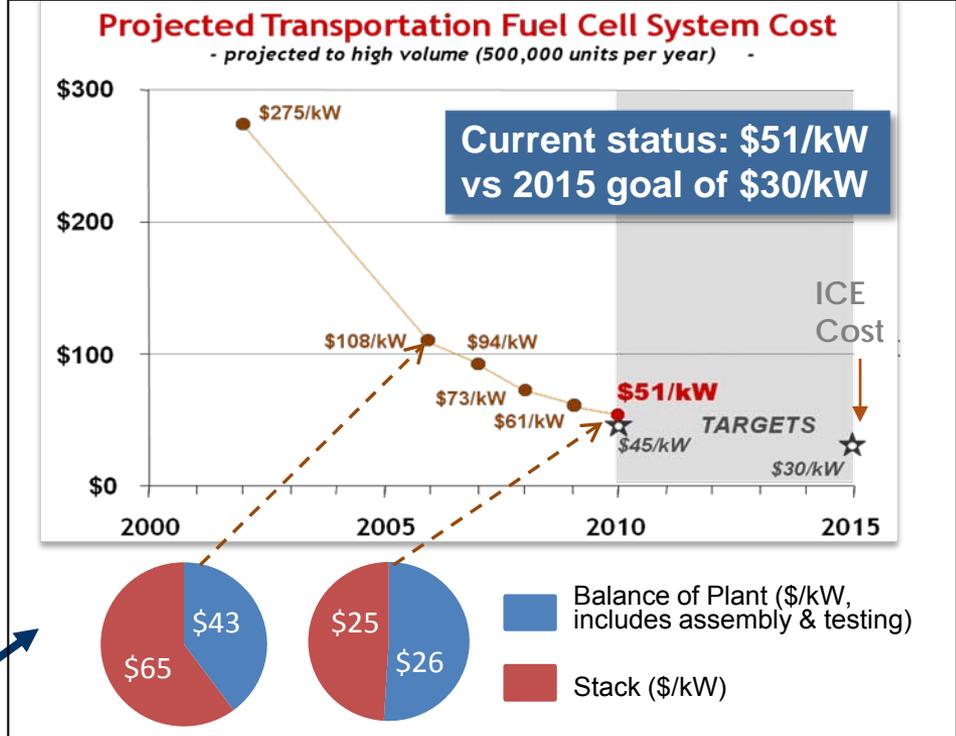
- 206 lift trucks (35 with FedEx, 14 with Nuvera, 98 with Sysco, and 59 with GENCO)
- 24 telecommunication backup power units provided by ReliOn for AT&T.



Projected high-volume cost of fuel cells has been reduced to \$51/kW (2010)*

- **More than 15% reduction since 2009**
- **More than 80% reduction since 2002**
- **2008 cost projection was validated by independent panel****

As stack costs are reduced, balance-of-plant components are responsible for a larger % of costs.



*Based on projection to high-volume manufacturing (500,000 units/year).

**Panel found \$60 – \$80/kW to be a “valid estimate”: http://hydrogenodev.nrel.gov/peer_reviews.html

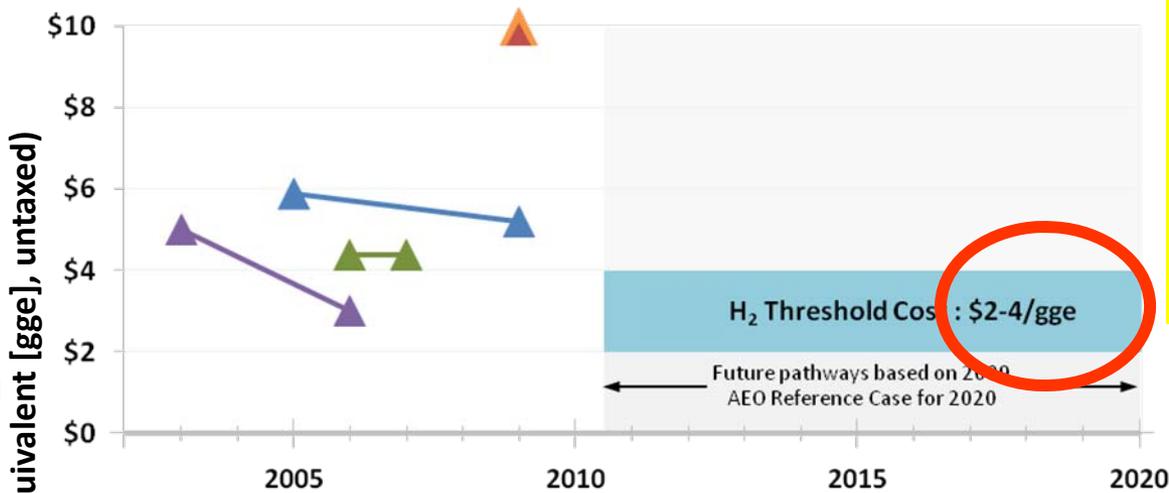
Hydrogen Threshold Cost Analysis

Revising the hydrogen threshold cost will result in an assessment of Hydrogen Production and Delivery R&D priorities. Projections of high-volume / nth plant production and delivery of hydrogen meet the targets for most technologies.

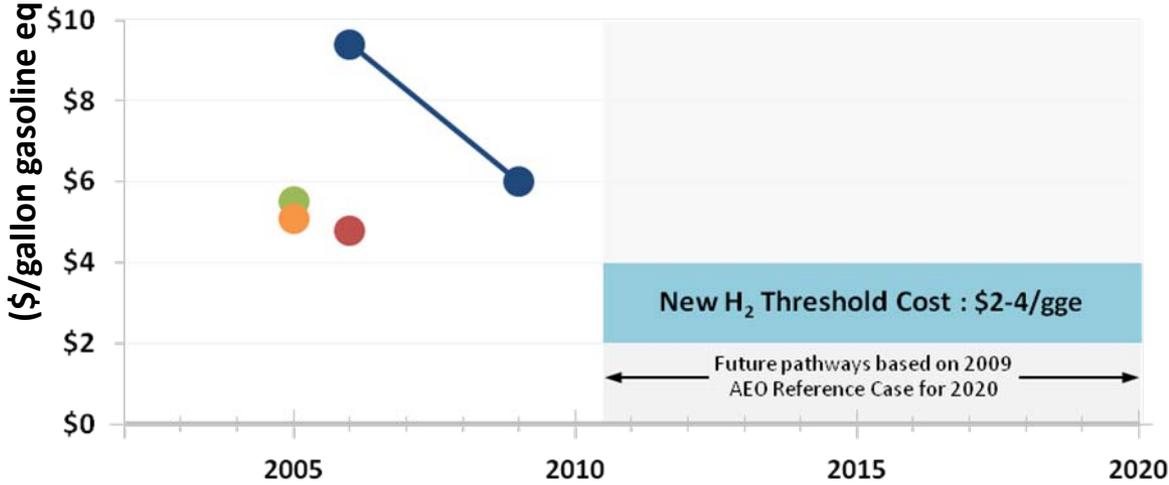
Projected High-Volume Cost of Hydrogen (Dispensed)—Status

Being updated to address gasoline cost volatility and range of vehicle assumptions

- NEAR TERM:**
Distributed Production
- ▲ Natural Gas Reforming
 - ▲ Ethanol Reforming
 - ▲ Electrolysis
- Low-volume (200 kg/day)
- ▲ Steam Methane Reforming
 - ▲ H₂ from Combined Heat, Hydrogen, and Power Fuel Cell



- LONGER TERM:**
Centralized Production
- Biomass Gasification
 - Central Wind Electrolysis
 - Coal Gasification with Sequestration
 - Nuclear

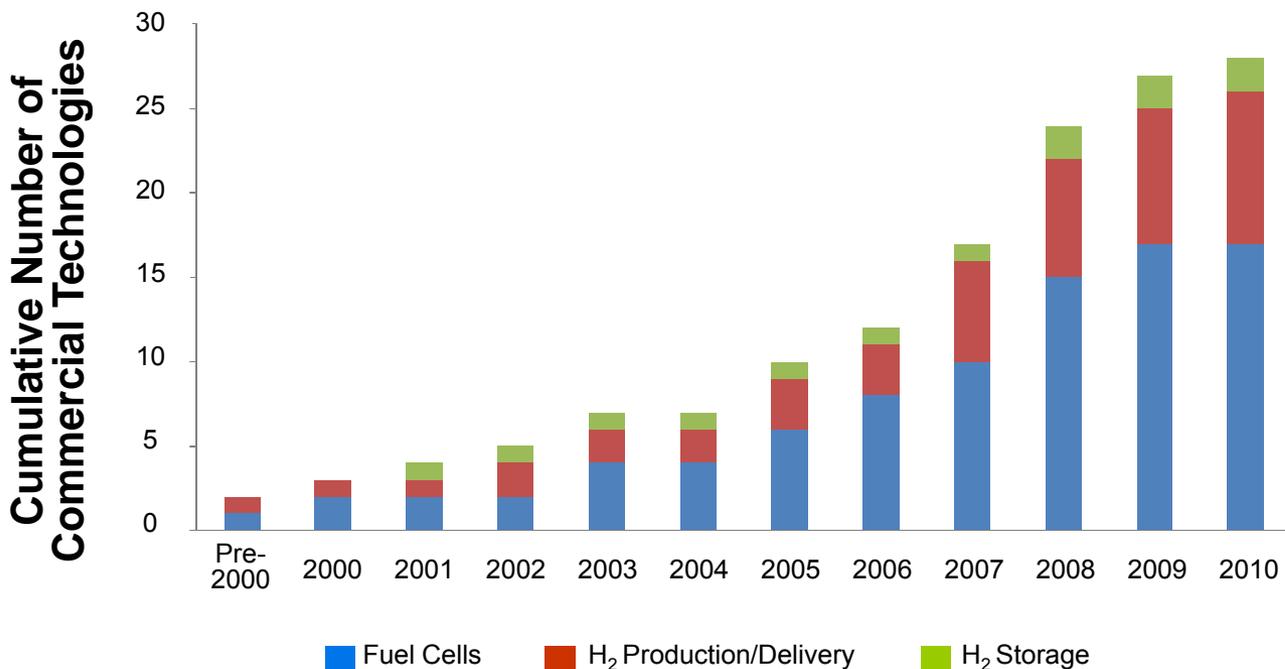


Notes:
 Data points are being updated to the 2009 AEO reference case.
 The 2010 Technology Validation results show a cost range of \$8-\$10/gge for a 1,500 kg/day distributed natural gas and \$10-\$13/gge for a 1,500 kg/day distributed electrolysis hydrogen station.

Close to 30 hydrogen and fuel cell technologies developed by the Program entered the market.

Accelerating Commercialization

EERE-funded Fuel Cell Technologies
that are Commercially Available



198 PATENTS
resulting from
EERE-funded R&D:

- 99 fuel cell
- 74 H₂ production and delivery
- 25 H₂ storage

60% are actively used in:

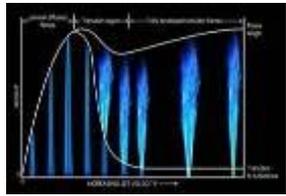
- 1) Commercial products
- 2) Emerging technologies
- 3) Research

Completed Fuel Cell Market Report provides an overview of market trends and profiles for select fuel cell companies

Safety, Codes & Standards

- *Facilitating the development and adoption of codes & standards for fuel cells*
- *Identifying and promoting safe practices industry-wide*

ACTIVITIES



Develop data needed for key codes & standards (C&S)

Harmonize domestic and international C&S

Simplify permitting process

Promote adoption of current C&S and increase access to safety information



PROGRESS (key examples)

Developed hydrogen release behavior data and incorporated quantitative risk assessment approach for separation distances into the National Fire Protection Association (NFPA) hydrogen code in 2010

Through R&D, enabled the harmonization of domestic and international Fuel Quality Specifications

Developed safety courses for researchers and held permitted workshops that reached >250 code officials

Expanded web-based resources, including: *Hydrogen Safety Best Practices Manual & Hydrogen Permitting Compendium*

Education: *We are working to increase public awareness and understanding of fuel cells.*

ACTIVITIES



Educate key audiences to facilitate demonstration, commercialization, and market acceptance



PROGRESS (key examples)

Educated over 17,000 first responders and code officials through introductory web-based courses and advanced hands-on training.

Conducted seminars and developed fact-sheets and case studies for end-users

Conducted more than 80 workshops to help state officials identify deployment opportunities

Some tax credits affecting fuel cells were expanded. Through new financing mechanisms, these credits can help facilitate federal deployments.

Hydrogen Fueling Facility Credit	Increases the hydrogen fueling credit from 30% or \$30,000 to 30% or \$200,000.
Grants for Energy Property in Lieu of Tax Credits	Allows facilities with insufficient tax liability to apply for a grant instead of claiming the Investment Tax Credit (ITC) or Production Tax Credit (PTC). Only entities that pay taxes are eligible (potential for extension)
Manufacturing Credit	Creates 30% credit for investment in property used for manufacturing fuel cells and other technologies (expires 2010)
Investment Tax Credit	Raises ITC dollar cap \$3,000/kW or 30% of total project cost (expires 2016)

Recent Federal Grants and Tax Credits

Section 1603: Payments in Lieu of Tax Credits

Business	Property Location	Fuel Cell MWe	Amount
Gills Onions, LLC	California	0.6	\$1,141, 560
M&L Commodities, Inc.	California	0.6	\$997,913
Preservation Properties, Inc.	California	0.1	\$300,000
Logan Energy Corporation	Hawaii	0.3	\$900,000
Plug Power, Inc.	Illinois	0.28	\$723,334
Logan Energy Corporation	South Carolina	0.05	\$148,988
Totals		1.9	\$4,211,795

Section 48C: Manufacturing Tax Credit

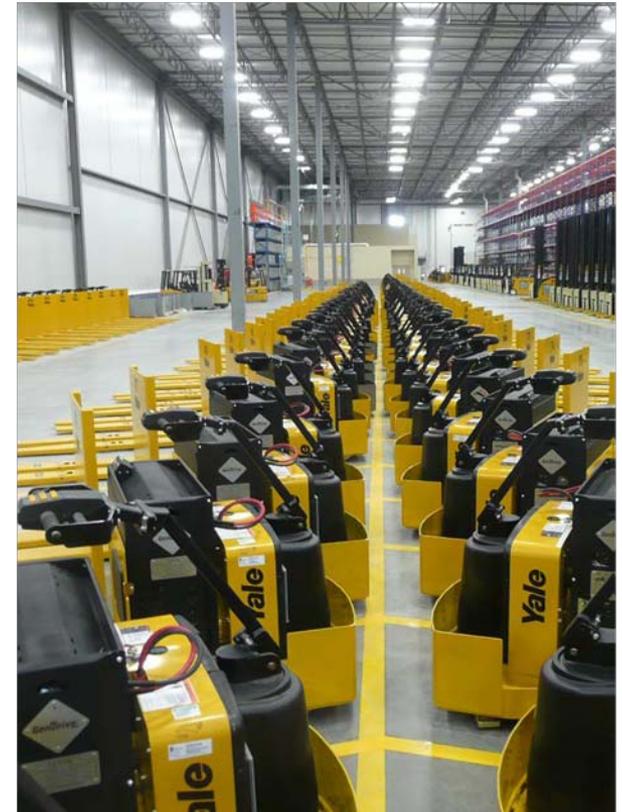
Business	Location	Product	Amount
UTC Power Corporation	Connecticut	Fuel Cells	\$5,300,100
W.L. Gore & Associates	Maryland	Fuel Cell Membranes	\$604,350
Total			\$5,904,450

Federal incentives, including §1603 grant-in-lieu of credit and §48, have helped facilitate commercial transition to fuel cell forklifts.

Examples¹:

- \$660K: Central Grocers (Joliet, IL)
- \$420K: United Natural Foods (Sarasota, FL)
- \$600K: Sysco Foods (Houston, TX)
- \$620K: Wegmans (Pottsville, PA)
- \$320K: Kimberly Clark (Graniteville, SC)
- \$400K: Coca-Cola Bottling (Charlotte, NC)
- \$390K: Whole Foods (Landover, MD)

Other examples: H-E-B, Wal-Mart, and more



**Super Store Industries - First Grocery Warehouse
and Distributor to Deploy Methanol Fuel Cells for
Material Handling Equipment**



***On October 5, 2009
President Obama signed
Executive Order 13514 –
Federal Leadership in
Environmental, Energy, and
Economic Performance***

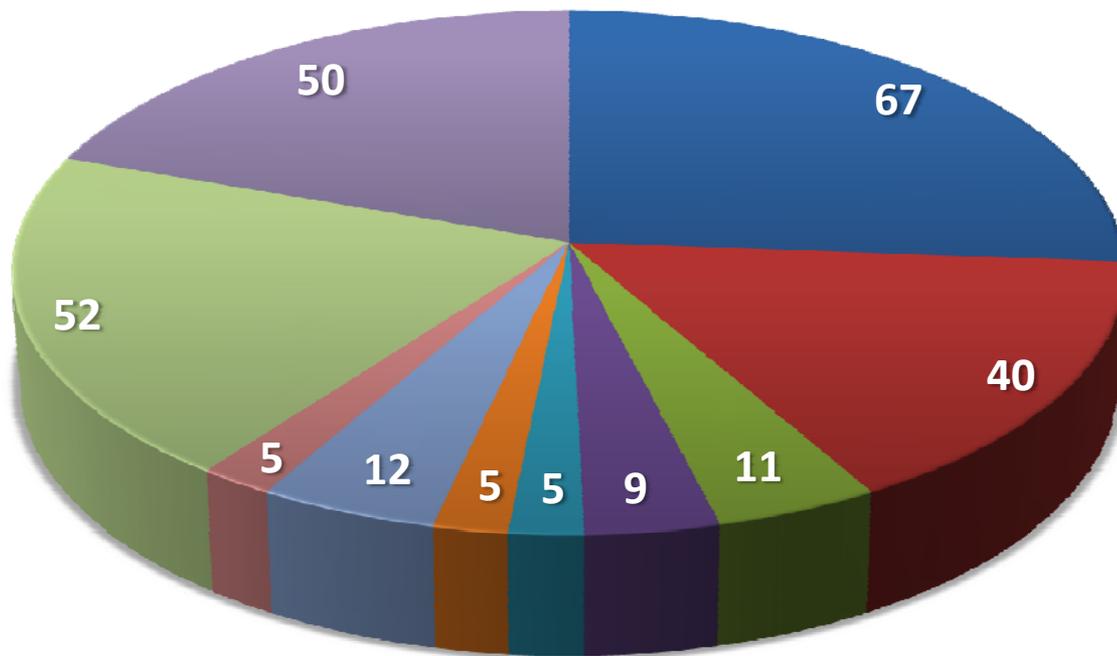
- Requires Agencies to:
 - Set GHG reduction Targets
 - Develop Strategic Sustainability Plans and provide in concert with budget submissions
 - Conduct bottom up Scope 1, 2 and 3 baselines
 - Track performance

Examples:

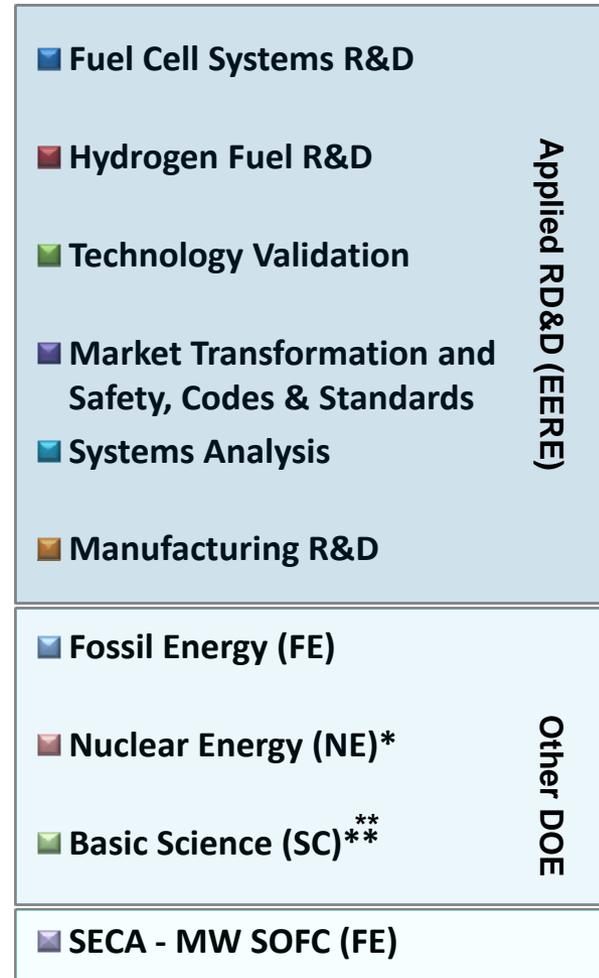
- Achieve 30% reduction in vehicle fleet petroleum use by 2020
- Requires 15% of buildings meet the *Guiding Principles for High Performance and Sustainable Buildings* by 2015
- Design all new Federal buildings which begin the planning process by 2020 to achieve zero-net energy by 2030

Potential opportunities for fuel cells and other clean energy technologies....

Total DOE Hydrogen and Fuel Cell Technologies FY11 Budget Request (in millions of US\$)



Total FY11 Budget Request \$256 Million



*NE: \$5M represents FY10 funding
**SC Includes BES and BER

EERE H₂ & Fuel Cells Budgets

Funding (\$ in thousands)						
Key Activity	FY 2008	FY 2009 ⁴	FY 2010	FY 2011 Request	FY 2011 House	2011 Senate
Fuel Cell Systems R&D¹	-	-	-	67,000	67,000	67,000
Fuel Cell Stack Component R&D	42,344	61,133	62,700	-	-	
Transportation Systems R&D	7,718	6,435	3,201	-	-	
Distributed Energy Systems R&D	7,461	9,750	11,410	-	-	
Fuel Processor R&D	2,896	2,750	171	-	-	
Hydrogen Fuel R&D²	-	-	-	40,000	40,000	47,000
Hydrogen Production & Delivery R&D	38,607	10,000	15,000	-	-	
Hydrogen Storage R&D	42,371	57,823	32,000	-	-	
Technology Validation	29,612	14,789⁵	13,097	11,000	11,000	20,000
Market Transformation³	0	4,747	15,026	0	0	20,000
Safety, Codes & Standards	15,442	12,238⁵	8,839	9,000	9,000	9,000
Education	3,865	4,200⁵	2,000	0	0	1,000
Systems Analysis	11,099	7,520	5,556	5,000	5,000	5,000
Manufacturing R&D	4,826	4,480	5,000	5,000	5,000	5,000
Total	\$206,241	\$195,865	\$174,000⁶	\$137,000	\$137,000	\$174,000

¹ Fuel Cell Systems R&D includes Fuel Cell Stack Component R&D, Transportation Systems R&D, Distributed Energy Systems R&D, and Fuel Processor R&D

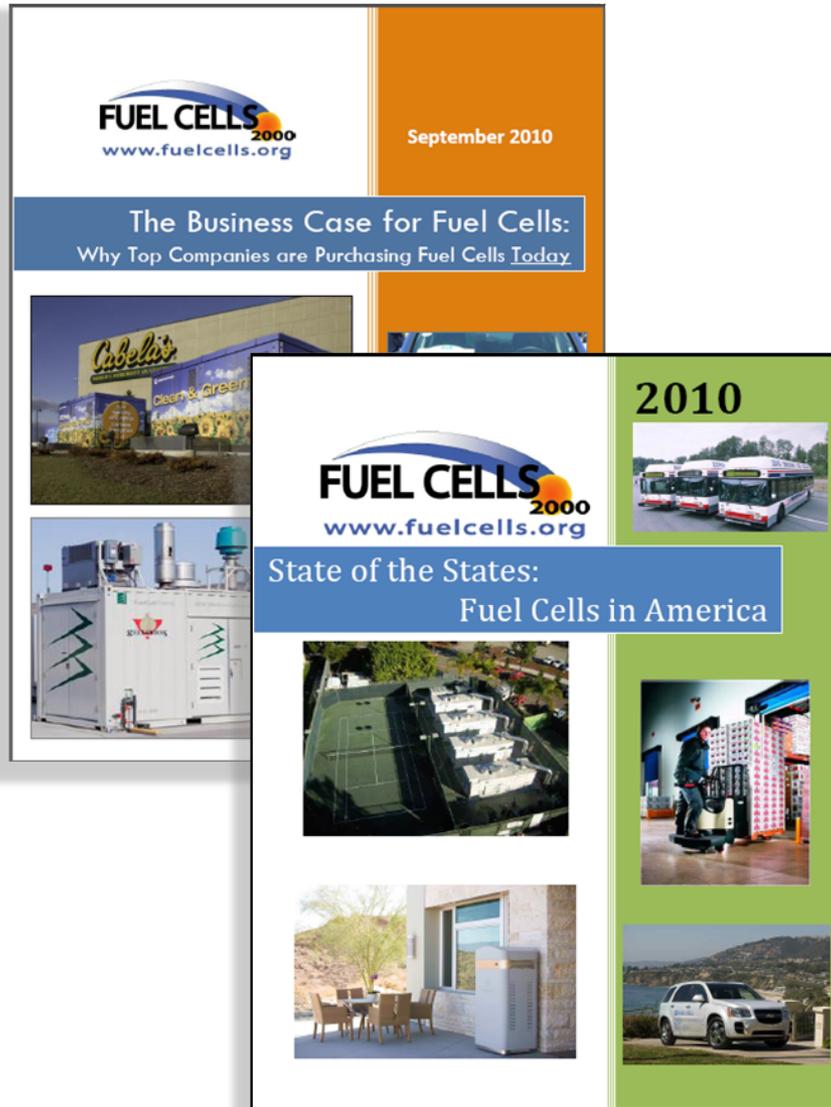
² Hydrogen Fuel R&D includes Hydrogen Production & Delivery R&D and Hydrogen Storage R&D

³ Market Transformation will fund only Safety, Codes and Standards in FY 2011

⁴ FY 2009 Recovery Act funding of \$42.967M not shown in table

⁵ Under Vehicle Technologies Budget in FY 2009

⁶ Includes SBIR/STTR funds to be transferred to the Science Appropriation; all prior years shown exclude this funding



The Business Case for Fuel Cells: Why Top Companies are Purchasing Fuel Cells Today

By FuelCells2000
<http://www.fuelcells.org>

38 companies profiled in the report, cumulatively,
have ordered, installed or deployed:

- more than 1,000 fuel cell forklifts;
- 58 stationary fuel cell systems totaling almost 15MW of power;
- more than 600 fuel cell units at telecom sites.

See report:
<http://www.fuelcells.org/BusinessCaseforFuelCells.pdf>

State of the States: Fuel Cells in America

By FuelCells2000
<http://www.fuelcells.org>

See report:
<http://www.fuelcells.org/StateoftheStates.pdf>



Sprint Nextel Corp.



Jadoo

Energy Empowers

Capturing the hearts and minds of Americans with the nation's clean energy stories



Academy Awards



MTI Micro Fuel Cell



Nuvera

Share your successes and have them highlighted at:

<http://www.energyempowers.gov/>



Gill Onions



FedEx Freight



Honda FCX Clarity

Thank you

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www.hydrogenandfuelcells.energy.gov

2011 Annual Program Merit Review
May 9-13th
Washington, DC

Additional Information

Federal Agencies

- DOC • EPA •NASA
- DOD • GSA •NSF
- DOEEd • DOI •USDA
- DOT • DHS •USPS

- Interagency coordination through staff-level Interagency Working Group (meets monthly)
- Assistant Secretary-level Interagency Task Force mandated by EPACT 2005.

Universities

~ 50 projects with 40 universities

International

- IEA Implementing agreements – 25 countries
- International Partnership for Hydrogen & Fuel Cells in the Economy – 17 countries & EC, 30 projects

DOE Fuel Cell Technologies Program*

- Applied RD&D
- Efforts to Overcome Non-Technical Barriers
- Internal Collaboration with Fossil Energy, Nuclear Energy and Basic Energy Sciences

Industry Partnerships & Stakeholder Assn's.

- FreedomCAR and Fuel Partnership
- Fuel Cell and Hydrogen Energy Association (FCHEA)
- Hydrogen Utility Group
- ~ 65 projects with 50 companies

State & Regional Partnerships

- California Fuel Cell Partnership
- California Stationary Fuel Cell Collaborative
- SC H₂ & Fuel Cell Alliance
- Upper Midwest Hydrogen Initiative
- Ohio Fuel Coalition
- Connecticut Center for Advanced Technology

National Laboratories

National Renewable Energy Laboratory

P&D, S, FC, A, SC&S, TV, MN

Argonne A, FC, P&D, SC&S

Los Alamos S, FC, SC&S

Sandia P&D, S, SC&S

Pacific Northwest P&D, S, FC, SC&S, A

Oak Ridge P&D, S, FC, A, SC&S

Lawrence Berkeley FC, A

Lawrence Livermore P&D, S, SC&S

Savannah River S, P&D

Brookhaven S, FC

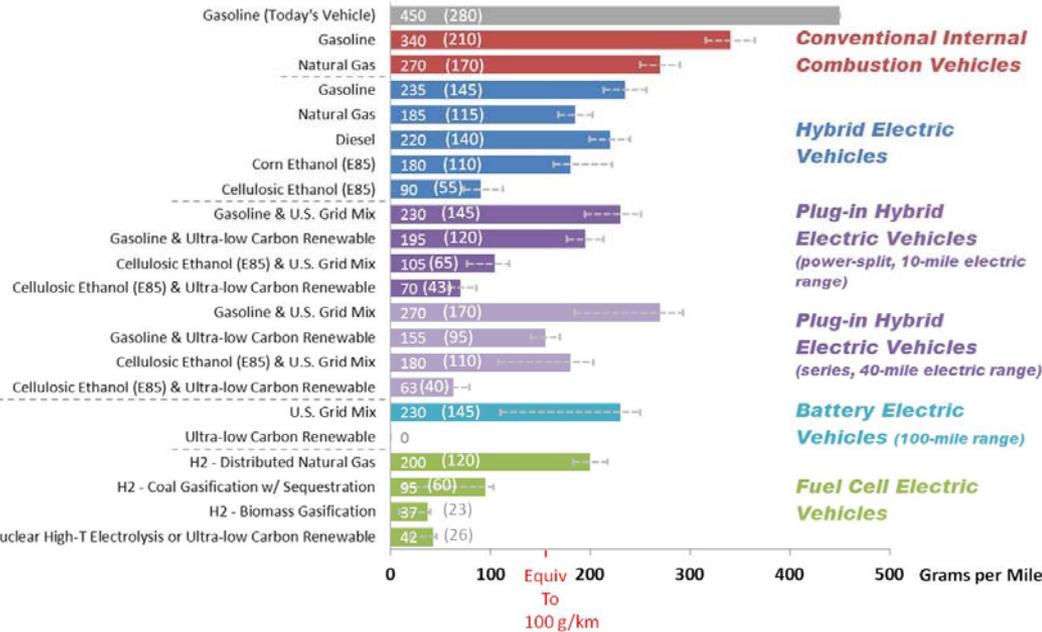
Idaho National Lab P&D

Other Federal Labs: Jet Propulsion Lab, National Institute of Standards & Technology, National Energy Technology Lab (NETL)

P&D = Production & Delivery; S = Storage; FC = Fuel Cells; A = Analysis; SC&S = Safety, Codes & Standards; TV = Technology Validation, MN = Manufacturing

Well-to-Wheels Greenhouse Gases Emissions Future Mid-Size Car

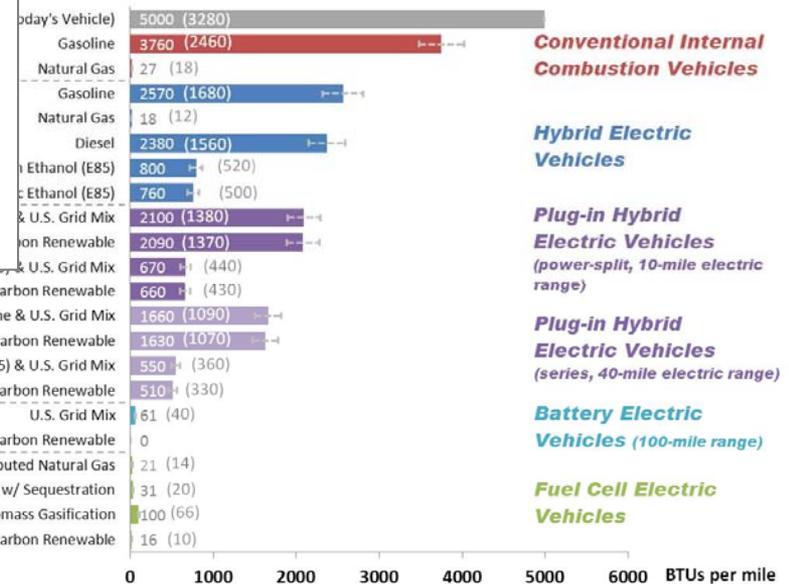
Grams of CO₂-equivalent per mile (Grams of CO₂-equivalent per km)



Analysis includes portfolio of transportation technologies and latest models and updates to well-to-wheels assumptions

Well-to-Wheels Petroleum Energy Use for Future Mid-Size Car

BTUs per mile (kJ per km)



**Fuel Cell for CHP:
75-90% less Nox
75-80% less particulates
> 50% less CO₂ emissions**

Analysis & Assumptions at:
http://hydrogen.energy.gov/pdfs/10001_well_to_wheels_gge_petroleum_use.pdf

Notes:

For a projected state of technologies in 2035-2045.
Ultra-low carbon renewable electricity includes wind, solar, etc.
Does not include the life-cycle effects of vehicle manufacturing and infrastructure construction/decommissioning.

Key Challenges

The Program has been addressing the key challenges facing the widespread commercialization of fuel cells.

Technology Barriers*

Fuel Cell Cost & Durability

Targets*:

Stationary Systems: \$750 per kW, 40,000-hr durability

Vehicles: \$30 per kW, 5,000-hr durability

Hydrogen Cost

Target*: \$2 – 3 /gge, (dispensed and untaxed)

Hydrogen Storage Capacity

Target: > 300-mile range for vehicles—without compromising interior space or performance

Technology Validation:

Technologies must be demonstrated under real-world conditions.

Market Transformation

Assisting the growth of early markets will help to overcome many barriers, including achieving significant cost reductions through economies of scale.

Economic & Institutional Barriers

Safety, Codes & Standards Development

Domestic Manufacturing & Supplier Base

Public Awareness & Acceptance

Hydrogen Supply & Delivery Infrastructure

* Targets and Metrics are being updated in 2010 .

Demonstrations are essential for validating the performance of technologies in integrated systems, under real-world conditions.

RECENT PROGRESS

Vehicles & Infrastructure

- 152 fuel cell vehicles and 24 hydrogen fueling stations
- Over 2.8 million miles traveled
- Over 114 thousand total vehicle hours driven
- 2,500 hours (nearly 75K miles) durability
- Fuel cell efficiency 53-59%
- Vehicle Range: ~196 – 254 miles

Buses

- DOE is evaluating real-world bus fleet data (DOT collaboration)
- H₂ fuel cell buses have a 39% to 141% better fuel economy when compared to diesel & CNG buses

Forklifts

- Over 18,000 refuelings at Defense Logistics Agency site

Recovery Act

- DOE (NREL) is collecting operating data from deployments for an industry-wide report



Source: US DOE 09/2010

Example: California

Hydrogen Fueling Stations

- more than 20 stations currently operating
- ~ 10 additional stations planned

Hydrogen Fuel Cell Vehicle Deployments: CA Fuel Cell Partnership is assessing the potential to deploy over

- 4,000 vehicles by 2014
- 50,000 vehicles by 2017

Potential H₂ Communities in Southern California



<http://www.fuelcellpartnership.org/>

Energy Empowers

Hydrogen fuel cells backup infrastructure cleanly and quietly



Sprint Nextel Corp. is deploying new fuel cells - such as these from ReliOn - to sites throughout the country. Photo courtesy of Sprint Nextel Corp

"We're excited to be in a leadership position but we also hope our efforts will encourage the deployment of hydrogen fuel cells across the industry."

John Holmes,
Sprint's manager of
design engineering

Through a \$7.3 million Recovery Act grant award, Sprint is reinforcing its infrastructure with clean technology, deploying 260 fuel cells in CA, CT, NJ, and NY.

Aiming to green Nascar's future: Q&A with driver Leilani Munter



In 2011, under a Recovery Act grant, fuel cells as generator units will replace gasoline-powered generators at several NASCAR racing events. The organizations and Folsom California's police and fire departments will also test SOFC generators. These projects will establish the environmental and cost benefits of using a 1 kW fuel cell power system to generate electricity, as opposed to traditional gas/diesel generators and lead acid battery power sources.

Sysco deploys hydrogen powered pallet trucks

Food service distribution company Sysco celebrated the grand opening of its highly efficient distribution center in June in Houston. As part of Sysco's efforts to reduce its carbon footprint, the company deployed almost 100 pallet trucks powered by fuel cells that create only water and heat as by-products.

The 98 new Raymond Corporation pallet lifts are powered by Plug Power Inc.'s GenDrive fuel cell units and were put to work immediately. The company calculates that it is saving about \$24,000 per quarter on labor costs



When life gives you onions, make electricity



"It was becoming really expensive and unmanageable to dispose of the waste by land application. Converting waste to energy was the best [solution]."

Nikki Rodoni, Director of Sustainability for Gills Onions.

The company commissioned a solution: a biomass and fuel cell system that turns onion trimmings into clean, renewable electricity.



The onion waste powers two 300 kW fuel cells, which produce enough electricity to meet up to 100 percent of the processing plant's baseline energy needs. If run full-time, 365 days a year, it's capable of producing up to 5,256 MW-hours of electricity.

Test drive: Honda FCX Clarity



"Fuel cell electric vehicles like Clarity are the best longer term solution to our nation's mobility needs."

Ed Cohen, American Honda VP of Government & Industry Relations

A member of the Energy Empowers team takes the Honda FCX Clarity for a drive outside the U.S. Department of Energy in Washington, D.C. Photo by Sunita Satyapal

The Department of Energy has been an important partner in the development of hydrogen fuel cell vehicles, Ed says. "Although DOE did not directly fund Honda, EERE's [The Office of Energy Efficiency and Renewable Energy] funding for R&D of fuel cell and hydrogen technologies has been critical in enabling manufacturers to meet their performance goals and supply OEMs [original equipment manufacturers] with hydrogen and fuel cell components."

Hydrogen power lit Academy Awards



This prototype mobile lighting unit, which uses energy-efficient lighting and hydrogen fuel cell power, was used during the Academy Awards. Its backers hope similar technologies can replace noisy, polluting diesel-based mobile lighting. | Photos courtesy of the Academy of Motion Picture Arts and Sciences®

The innovative mobile lighting unit used a hydrogen fuel cell and energy-efficient plasma lighting technology to generate light and electricity for the show with zero on-site emissions or technical problems. The unit's designers at Sandia National Laboratories, and its industry partners, believe the lighting could significantly improve the way events such as the Oscars are lit.

Hydrogen fuel cells providing critical backup power



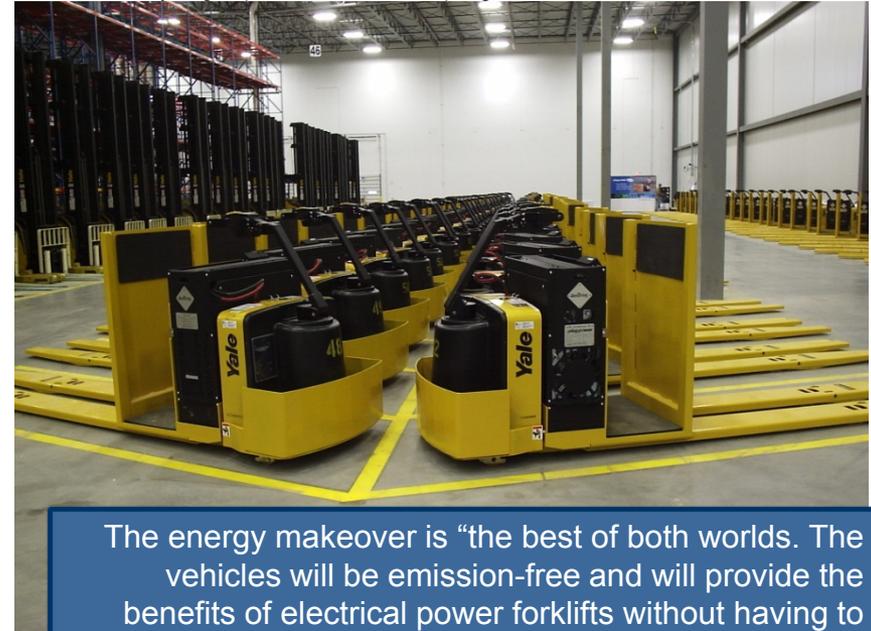
Customers of AT&T Wireless and Pacific Gas & Electric Company will enjoy service that's both cleaner and more reliable, thanks to backup power provided by about 200 hydrogen fuel cells. The two companies are becoming early adopters of hydrogen fuel cells as backups for the main power grid.

Both projects are funded by an \$8.5 million Recovery Act grant to ReliOn, Inc. which specializes in hydrogen fuel-cell backups for businesses that need to stay functional during power failures. For utilities like PG&E, which serves about 15 million people in California, backup power is critical. Telecom companies like AT&T need backup power to keep cellular towers working in an outage.

This project will help meet those goals, reinforcing America's infrastructure and creating about 14 jobs. But Sandra Saathoff, of ReliOn, says it's also an attempt to transform the market by speeding up businesses' acceptance of fuel cells.

FedEx Freight delivers on clean energy

Fed-Ex uses Hydrogen powered forklifts in Springfield Mo.



The energy makeover is "the best of both worlds. The vehicles will be emission-free and will provide the benefits of electrical power forklifts without having to plug them in to recharge the battery."
Dennis Beal, VP of physical assets at FedEx Freight.

All 35 electric forklifts at FedEx Freight's Springfield, Mo. service center will be converted to hydrogen fuel cell power. The \$2.8 million project will be completed in a few weeks and was partially funded through a grant from the Recovery Act.

Less platinum means lowers prices for autos



Mark Debe
Senior staff scientists, 3M

3M has developed technology that will reduce the amount of platinum necessary in a fuel cell system by using nano-catalyst particles that actually make surface atoms more efficient at producing energy. Platinum is needed in fuel cells because no other metals are even close to being as effective at speeding up chemical reactions to make power. 3M is among a handful of fuel cell system suppliers in the U.S., and these advancements will help the company produce a cost-effective product, enabling more purchasers to buy American-made fuel cell systems that could end up in electric-drive vehicles.

Recovery Act helps fuel cell company stay on course



“Fuel cells will lower the grocery distributor’s costs by decreasing maintenance times – the batteries in use today take longer to swap out than the time it takes to refuel the cells – cutting materials and labor costs. Just how much cost savings will be realized will be measured in this first deployment. Fuel cells will also reduce the company’s carbon footprint”

Robert Cordaro, CEO of Nuvera

An innovative company in Billerica, Mass., is taking steps to equip a major supermarket chain in the Southwest with high-performance, clean-energy fuel cells for its hundreds-strong forklift fleet. In a recently-started pilot program helped along by money from the Recovery Act, Nuvera Fuel Cells Inc. upgraded 14 forklifts at the South Texas distribution center of H-E-B to test the performance of fuel cells.

Technology to extend battery life coming soon

**\$4.8 million Recovery
Act grant award**



Many Americans across the country rely on handheld devices each day to get their jobs done or stay in touch with friends and family, and now some companies are pushing technologies that power that hardware from concept to reality faster than ever. One such firm in Albany, N.Y., has developed a clean source of energy for portable electronics designed for anybody who's tired of the nightly ritual of recharging a portable electronic device. It will allow for longer battery life for handheld devices than typical PDA batteries. MTI hopes to make life easier for millions of PDA users throughout the world. Behind its technology are **micro fuel cells** drawing power from **methanol**.

"Fuel cells have a lot of
promise."

Peng Lim, MTI Micro Fuel Cell CEO