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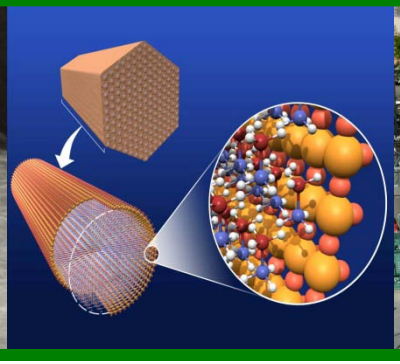

Technology Validation Sub-program
- Session Introduction -

John Garbak

2011 Annual Merit Review and Peer Evaluation Meeting

May 13, 2011

Goal & Objectives

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Goal: Validate complete systems of integrated hydrogen and fuel cell technologies for transportation, infrastructure and electricity generation applications under real-world operating conditions

Objectives:

- Validate hydrogen and fuel cell technologies
- Identify current status of the technology
  - Assess progress toward technology readiness
  - Provide feedback to H_2 Research and Development

Key Targets

Performance Measure	2009	Ultimate Target
Fuel Cell Stack Durability	2000 hours	5000 hours
Vehicle Range	250^+ miles	300^+ miles
Hydrogen Cost at Station	$3/gge	$2-4/gge

Budget

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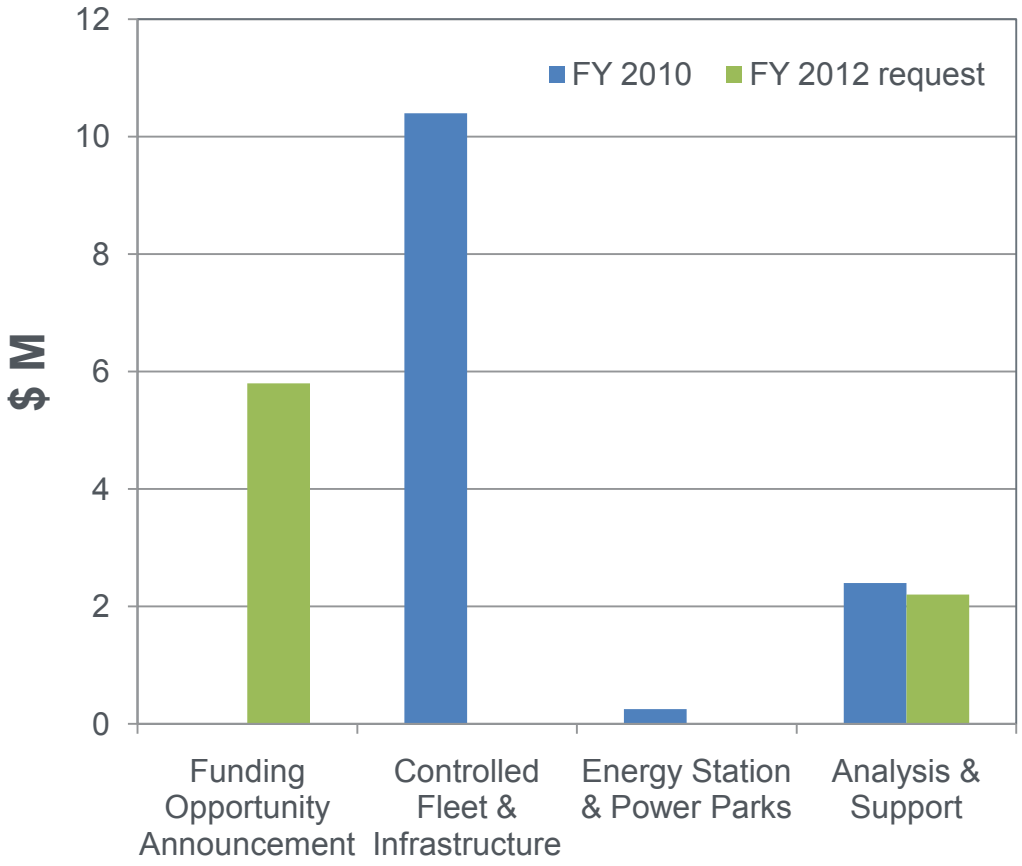
FY 2012 Request = $8.0 M

FY 2010 Appropriation = $13.1 M



* FY 2011 Appropriations to be determined

EMPHASIS

- Data Collection Activities
  - Collect real-world data from fuel cells operating in forklifts, backup power, vehicles, and buses including projects with DOD (e.g. Hawaii).
  - Collaborate with DOT on the Fuel Cell Bus Program.
  - Support CHHP (*combined heat, hydrogen, and power*) demonstration.
- Develop Funding Opportunity Announcement*
  - RFI Issued March 31 closes June 1st
    - Innovative concepts for stationary and /or CHHP systems
    - Technology Validation projects for other markets

* Subject to appropriations

Challenges

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Through data collection of vehicles and buses many challenges have been met

- Lack of fuel cell electric vehicle performance and durability data
  - Learning Demo and FC Bus evaluation have generated significant quantities of fuel cell vehicle data that have been analyzed and published.
- Lack of refueling infrastructure performance and availability data for vehicles, buses, and forklifts
  - Tech Val projects have analyzed many aspects of H_2 refueling infrastructure, including refueling rates, safety, maintenance, production efficiency, and availability.
- Fuel cell vehicle and infrastructure interface issues need to be addressed
  - Communication fills (vehicle talks to station during fill) have been evaluated, and on average communication fills are 35% faster than non-communication fills

Progress

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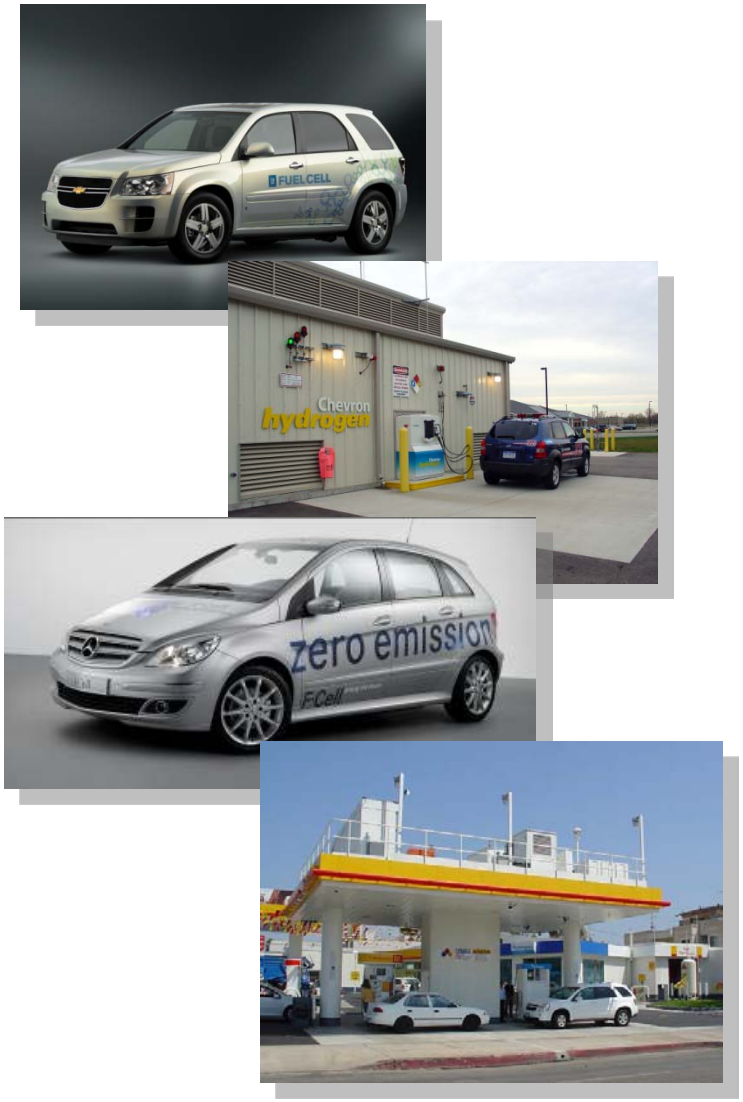
Learning Demonstration has provided valuable real-world data from fuel cell vehicles and hydrogen infrastructure



- Data has been collected on 155 fuel cell vehicles and 24 hydrogen fueling stations during the Learning Demonstration
- Fuel cell durability
  - 2,500 hours projected (nearly 75K miles)
- Range 196 -254 miles (independently validated 430 mile range)
- Over 3 million miles traveled
- Over 131K total vehicle hours driven
- Fuel cell efficiency 53-59%
- Over 140,000 kg of hydrogen produced or dispensed

Progress: Buses

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NREL has collected data for DOE and FTA on 8 FCBs in service at 4 sites:

- AC Transit
- SunLine
- CTTRANSIT
- VTA

Traveled:

- ~ 450,000 miles

Dispensed:

- >81,000 kg H_2

NREL Hydrogen Evaluations for DOE and FTA

Site/Locations	State	# Buses	Eval. Funding	2010				2011				2012				2013			
				1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
AC Transit/SF Bay Area	CA	12	DOE Technology Validation			ZEBA Demo													
SunLine/Thousand Palms	CA	1	DOE Technology Validation		Advanced FCB Project														
City of Burbank/Burbank	CA	1	DOE Technology Validation						Burbank FCB										
SunLine/Thousand Palms	CA	1	FTA National Fuel Cell Bus Program									American FCB Demo							
CTTRANSIT/Hartford	CT	4	FTA National Fuel Cell Bus Program			Nutmeg Hybrid FCB Demo													
USC, CMRTA/Columbia UT, Cap Metro/Austin	SC TX	1	FTA National Fuel Cell Bus Program	Hybrid FCB					Demo Site 2										
Logan Airport/Boston	MA	1	FTA National Fuel Cell Bus Program						MA H2 FCB Fleet										
Albany/NY	NY	1	FTA National Fuel Cell Bus Program							Light-wt FCB									
SFMTA/San Francisco	CA	1	FTA National Fuel Cell Bus Program					FC APU Hybrid											
CTA/Chicago	IL	1	FTA National Fuel Cell Bus Program											Chicago FCB					
BJCTA/Birmingham	AL	1	FTA National Fuel Cell Bus Program											Birmingham FCB					
Ohio State/Columbus	OH	1	FTA National Fuel Cell Bus Program									EcoSaver IV Hybrid FCB							
USC, CMRTA/Columbia	SC	1	FTA National Fuel Cell Bus Program									Advanced Composite FCB							

Demonstration sites color coded by geographic area:

- Northern California
- Northeast
- South
- Southern California
- Southeast
- Midwest

Fuel Cell Bus Program

Fuel economy results: 42% to 139% better than diesel and CNG buses

www.nrel.gov/hydrogen/proj_tech_validation.html

Estimate of data collection/evaluation - schedule subject to change based on progress of each project

Progress: Combined Heat, Hydrogen and Power (CHHP) Demonstration

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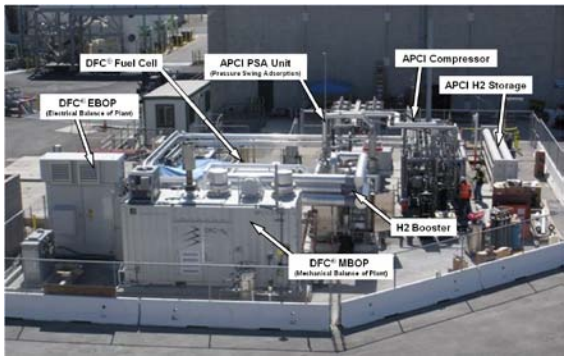
Fountain Valley Station achieved 54% efficiency (hydrogen + power) of unit when operating in hydrogen co-production mode.

BACKGROUND

- Host site: Orange County Sanitation District
- Anaerobic digestion of municipal wastewater
- 100 kg/day hydrogen capacity (350 and 700 bar)
- Funding Partners: CARB, SCAQMD and DOE

Led and coordinated by:

AIR PRODUCTS



ACCOMPLISHMENTS

- July 2010: Hydrogen Energy Station delivered to OCSD
- September 2010: First low-load power production from fuel cell unit
- September 2010: Fuel cell unit operated at full load on natural gas
- March 2011: Initial fills of fuel cell vehicles at hydrogen fueling station

NEXT STEP

- Hydrogen to be produced from biogas in FY 11

RFI: Technology Validation

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Issued March 31, 2011 and closes June 1, 2011

Areas of Interest

- Innovative concepts for:
  - Stationary fuel cell systems for residential and commercial applications, including combined-heat-and-power (CHP)
  - Combined-heat-hydrogen-and-power (CHHP) co-production fuel cell systems
- Technology Validation projects for other markets

For more information:

http://www1.eere.energy.gov/hydrogenandfuelcells/news_detail.html?news_id=16873

http://www07.grants.gov/search/search.do?&mode=VIEW&oppId=84333

Summary

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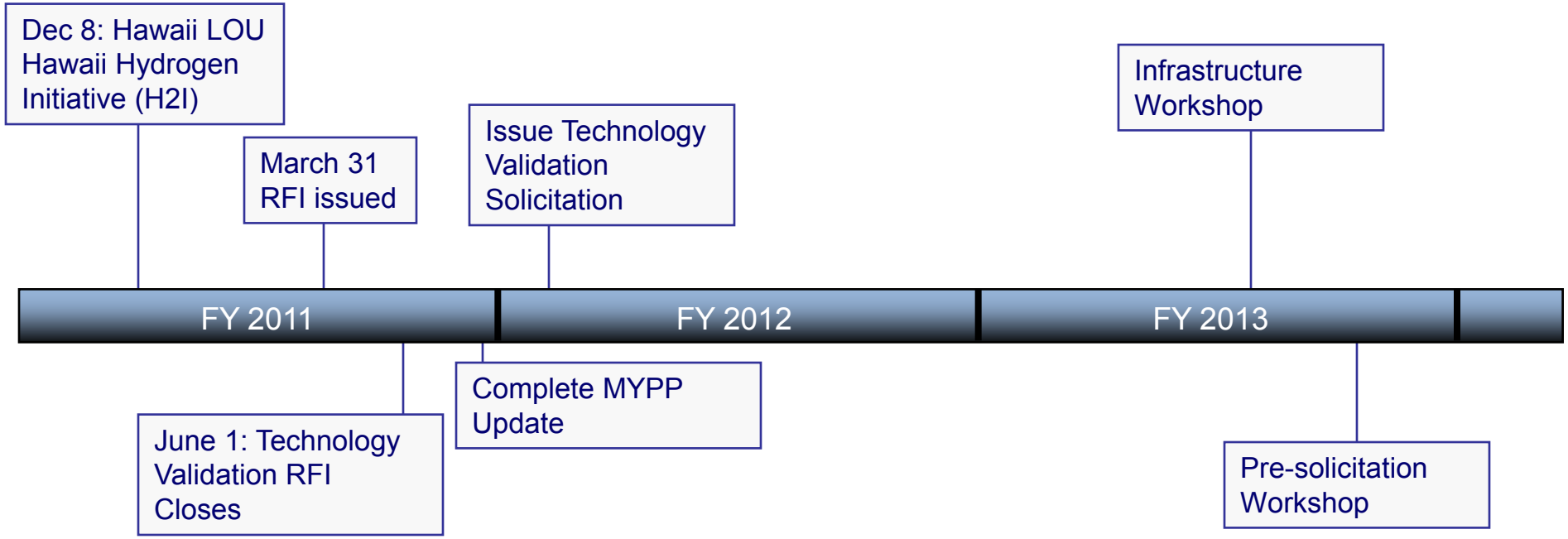
Major Milestones & Future Solicitations



Session Instructions

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- This is a review, not a conference.
- Presentations will begin precisely at the scheduled times.
- Talks will be 20 minutes and Q&A 10 minutes.
- Reviewers have priority for questions over the general audience.
- Reviewers should be seated in front of the room for convenient access by the microphone attendants during the Q&A.
- Please mute all cell phones, BlackBerries, etc.
- Photography and audio and video recording are not permitted.

Reviewer Reminders

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- Deadline for final review form submittal is May 20th at 5:00 PM EDT.i
- ORISE personnel are available on-site for assistance. A reviewer-ready room is set up in *The Rosslyn Room* (on the lobby level) and will be open Tuesday – Thursday from 7:30 AM to 6:00 PM and Friday 7:30 Am to 2:00 PM.
- Reviewers are invited to a brief feedback session – at Noon today, in this room.

For More Information

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Technology Validation

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Jim Alkire
Dave Peterson
Greg Kleen

DOE Headquarters Support:
Kathleen O'Malley

EERE Fellowship Program

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- Fuel Cell Technologies Program Opportunities Available
  - Conduct applied research at universities, national laboratories, and other research facilities
  - Up to five positions are available in the areas of hydrogen production, hydrogen delivery, hydrogen storage, and fuel cells
    - ❑ Applications are due June 30, 2011
    - ❑ Winners will be announced mid-August
    - ❑ Fellows will begin in mid-November 2011

eere.energy.gov/education/postdoctoral_fellowships/

Postdoctoral fellowships in hydrogen and fuel cell research ▸

Participating Organizations

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Technology Validation

Air Products & Chemicals, Inc.

CA Fuel Cell Partnership

General Motors Corp.

Mercedes Benz North America

NREL