



U.S. DEPARTMENT OF
ENERGY

Education

Connie Bezanson

Christy Cooper

Antonio Ruiz

**2009 DOE Hydrogen Program & Vehicle
Technologies Program Annual
Merit Review and Peer Evaluation Meeting**

May 21, 2009



Hydrogen and Fuel Cell Knowledge and Opinion Survey

- Finalized follow-up survey with the addition of safety and code officials survey, analysis and report to be published at the end of FY09

Safety and Code Officials

- Launched advanced-level first responder training that includes hands-on prop
- Launched Introduction to Hydrogen for Code Officials web course

Schools and Universities

- Trained 7,000 middle school teachers through full-day workshops and conference sessions (cumulative, since 2004)
- More than 600 high school students and 100 high school teachers introduced to hydrogen and fuel cell course materials
- 22 university courses and curriculum modules under development at 5 universities for general science and engineering programs and specialized hydrogen and fuel cell concentrations

End Users

- Conducted monthly educational seminars targeted to lift truck users, including demonstration of fuel cell lift trucks with potential early adopters

State and Local Governments

- Conducted more than 19 workshops and seminars across the country to help decision-makers identify and assess opportunities for fuel cell deployment

Automotive X-Prize/Fuel Our Future Now

- In partnership with Discovery Education, launched “Fuel Our Future Now” site, a portal to curricula materials for grades K-12 – focus is alternative fuel and advanced vehicle technologies



GOAL: Educate key audiences about hydrogen and fuel cell technologies to facilitate near-term demonstration, commercialization, and long-term market acceptance

Objectives

- By 2009, increase knowledge of hydrogen and fuel cell technologies among key target populations (compared to a 2004 baseline)
 - State and local government officials, students – by 10%
 - Public, potential end-users – by 15%
- By 2012, increase knowledge of hydrogen and fuel cell technologies among key target populations (compared to a 2004 baseline)
 - State and local government officials, students – by 20%
 - Public, potential end-users – by 30%

Target audience definitions:

State and local government officials: State agency representatives (energy office, DOT, DEP), mayors and county supervisors or their designees

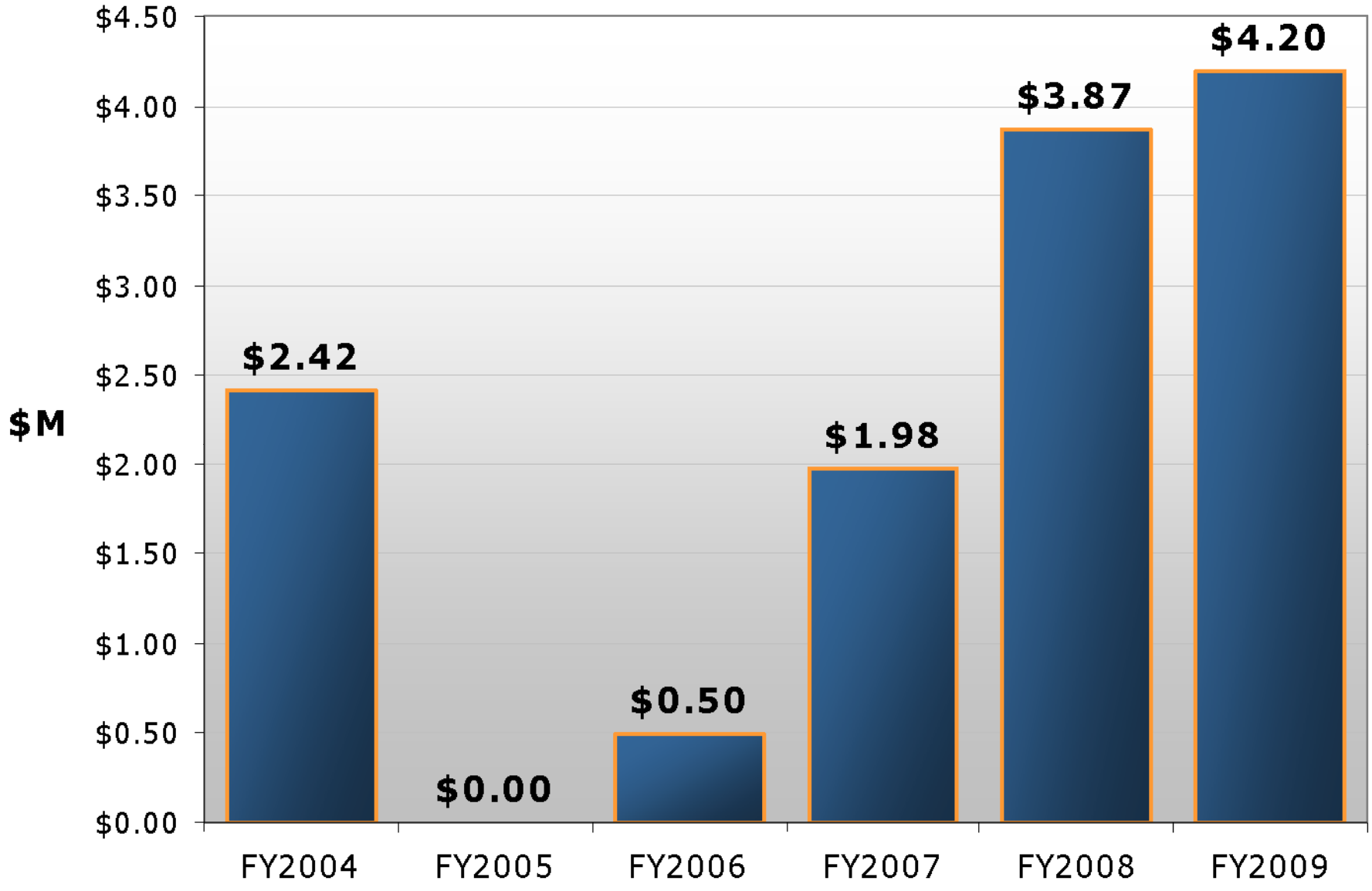
Students: Middle and high school students

Public: Adults ages 18+

Potential end users: Three categories – transportation, businesses needing uninterruptible power, and large power users



Audience	Rationale
First Responders	Must know how to handle potential incidents; their understanding can also facilitate local project approval
Code Officials	Must be familiar with hydrogen to facilitate permit process and local project approval
Local Communities/ General Public	Will be more likely to welcome local demonstration projects when they are familiar with hydrogen
State and Local Government Representatives	A broad understanding of hydrogen supports decision-making on current opportunities and laying the foundation for long-term change
Potential End Users	Potential early adopters need information about near-term opportunities
University Faculty and Students	Current interest is high; graduates needed for research in government, industry, and academia
Other Teachers and Students	Current interest is high; teachers looking for technically accurate information and usable classroom activities



Challenges

- **Resistance to change**
- **Lack of readily-available, objective, technically-accurate and “easily digestible” information**
- **Conflicting messages**
- **Lack of hydrogen/fuel cell information available through existing training and education networks**
- **Lack of educated trainers and training opportunities**

Opportunities

- **Energy is part of today’s daily public conversation**
- **Demonstration and deployment is ramping up, particularly in early markets, providing opportunities for education and outreach**



- Four populations (general public, students, state and local officials, and potential end users) surveyed in late 2008
- Safety and code officials survey to be administered spring/summer 2009
- Findings will be analyzed and compared with 2004 baseline survey results
- Final report planned for release by September 30, 2009
- Lead: ORNL, with Opinion Research Corporation

Sample knowledge question:

To which of the following can fuel cells provide power?

- a. Your home
- b. Your car
- c. Your laptop computer
- d. All of these
- e. Or, none of these
- f. Don't know/No opinion

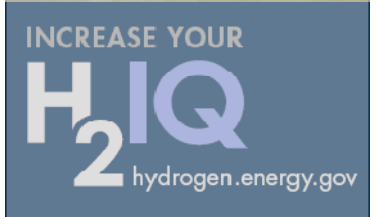
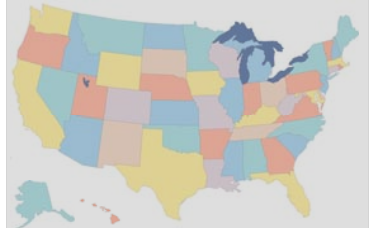
Sample opinion question:

How would you feel if a school, hospital, or other building in your neighborhood was powered by a fuel cell located on its property? Would you say ...

- a. Frightened
- b. Uneasy
- c. At ease
- d. Or, pleased
- e. Don't know/No opinion

First Responder Education

- Completed upgrade of web-based *Introduction to Hydrogen Safety for First Responders* – averaging 300-500 unique visits/month
- Completed development and conducted inaugural advanced-level training course that includes hands-on prop
- Lead: PNNL, with HAMMER Training and Education Center



Introduction to Hydrogen for Code Officials

COURSE MATERIALS LIBRARY EXIT

Hydrogen & Fuel Cell Basics Hydrogen & Fuel Cell Applications Permitting Hydrogen Fueling Stations Permitting Stationary Facilities

Hydrogen Fueling Station Layout

CONSTRUCTION APPROVAL

ASME B31.3 Process Piping (American Society of Mechanical Engineers, 2001)

- NFPA 400 (Hazardous Material Codebook)
- 10 4000 Piping, Bends, and Branch Connections
- 10 4000 Valves and Specialty Components

CGA G-5.4 Standard for Hydrogen Piping Systems at Consumer Locations (Compressed Gas Association, 2009)

- 3.0 Piping System Criteria
- 3.1 General
- 3.2 Piping Materials
- 3.3 Isolation Valves
- 3.3.3 Emergency Isolation Valves
- 3.3.4 Isolation Flow Valves
- 3.3.5 Check Valves
- 3.3.7 Gaskets and Sealing Materials
- 3.3.8 Additional Requirements
- 5.0 Installation
- 5.1 Installation General

Back Slide 15 of 21 Next

Code Official Education

- Completed Introduction to Hydrogen for Code Officials course website
- Launch planned for May 2009
- Lead: NREL



INCREASE YOUR
H₂IQ
hydrogen.energy.gov

Middle School & High School Education

- Trained 7,000 middle school teachers through full day workshops and conference sessions (cumulative since 2004)
- More than 600 high school students and 100 high school teachers introduced to hydrogen and fuel cell course materials
- Leads: The NEED Project (middle school), Lawrence Hall of Science at UC-Berkeley (high school)

University Education Projects (5 projects)

- 22 courses and curriculum modules under development at 5 universities for general science and engineering programs and specialized hydrogen and fuel cell concentrations
- Targeting broad student audience in general courses and specialized science and engineering programs
- Includes lab kits and textbook modules for general use, teaching assistantships and internships
- Leads: Cal State-LA, Humboldt State, Michigan Tech, University of Central Florida, University of North Dakota

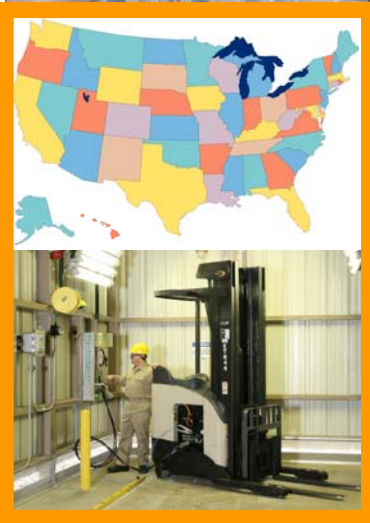
Student Competitions/Events

- Hydrogen Student Design Contest



End Users/Early Market Outreach & Demonstration Project (1 project)

- Conducted monthly educational seminars targeted to lift truck users
- Deployed first 2 lift trucks supporting early market commercialization
- Lead: Carolina Tractor & Equipment Company



State and Local Government Outreach (7 projects)

- Conducted more than 19 workshops and seminars across the country for state and local government officials
- Developing technology basics, case studies, best practices, and technical assistance resources to help decision-makers identify and assess opportunities for fuel cell deployment
- Disseminating information through workshops, webinars, websites, video, and publications
- Leads: CT Center for Advanced Technology; Houston Advanced Research Center; Ohio Fuel Cell Corridor; SC Hydrogen and Fuel Cell Alliance; VA Department of Mines, Minerals, and Energy; Clean Energy States Alliance; Technology Transition Corporation

INCREASE YOUR

H₂IQ

hydrogen.energy.gov



- ❑ **Partnered with Clean Cities Activity, the Automotive X Prize and Discovery Education**
- ❑ **Launched at the Washington DC Auto Show in February**
- ❑ **Curriculum available for K-12**
 - Grades K-2: Vroom! Vroom! What Makes Cars Go?
 - Grades 3-5: Designed for Efficiency
 - Grades 6-8: Designing a Vehicle for the Year 2020
 - Grades 9-12: Transport to the Future: Making a Plan for Positive Change

FUEL OUR FUTURE NOW
Igniting Imaginations to Empower the Next Generation

PROGRESSIVE AUTOMOTIVE X PRIZE
Discovery EDUCATION

Home Elementary Middle School High School Teachers Parents News & Events

HIGH SCHOOL
Teachers: Put your students behind the wheel! Discover factors that impact fuel efficiency and engineer vehicles that will transform where we're going and how we'll get there.
GO!

Fuel up on videos – watch now!

MIDDLE SCHOOL
Go the extra mile with your students! Investigate alternative fuels and determine which vehicles exhibit ultimate energy efficiency.
GO!

What's your Speed IQ?
Test your need for speed in a Virtual Lab!

ELEMENTARY
Teachers: Get your classroom moving! Explore motion, forces, and sources of energy.
GO!

Students: Conduct your own race car experiment!

About the Progressive Automotive X PRIZE Revolution Through Competition
Teams from around the globe are competing to design the first super-efficient vehicle that we could be driving one day. Get up to speed on the world's foremost engineering competition, the future of our planet and \$10 million are riding on it.
LEARN MORE!

News & Events
Sign up to receive updates and be the first to hear what's new! Keep checking back regularly for webinars, local race info and more coming soon!
LEARN MORE!

Parent Corner
Drive home the fun and energize students with activities, energy conservation tips and more!
LEARN MORE!

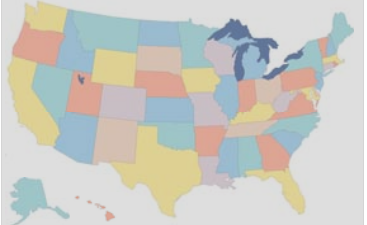
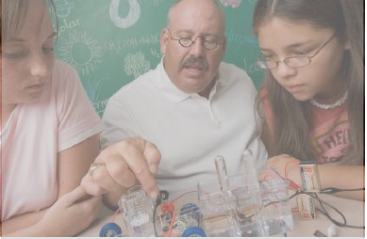
U.S. DEPARTMENT OF ENERGY
Acknowledgment: This material is based upon work supported by the Department of Energy, National Energy Technology Laboratory under Award Number DE-FG25-08NT03077.
Disclaimer: This Website was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor any of their employees, makes any warranty, express, or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe on any privately owned rights. References herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.

General Educational Resources

Fact sheets

Radio spots and podcasts

MySpace page



INCREASE YOUR H₂IQ
hydrogen.energy.gov

INCREASE YOUR H₂IQ
www.hydrogen.energy.gov

Hydrogen Program hydrogen.energy.gov

- Home
- About
- DOE Participants
- International
- Library
- News/Events

INCREASE YOUR H₂IQ

The Hydrogen Program Web site offers a portal to information about the Department of Energy's research and development in hydrogen production, delivery, storage, and fuel cells, as well as activities in technology validation, systems analysis and integration, safety codes and standards, and education.

Secretary Chu Announces \$41.9 Million to Spur Growth of Fuel Cell Markets
This American Recovery and Reinvestment Act funding for fuel cell technology will be used to expand the use of clean and renewable energy sources and reduce America's dependence on foreign oil. April 15, 2009 [More >](#)

President Obama Announces \$2.4 Billion to Support Next-Generation Electric Vehicles
President Barack Obama announced on March 19 that the DOE is offering up to \$2.4 billion in American Recovery and Reinvestment Act funds to support next-generation plug-in hybrid electric vehicles and their advanced battery components. March 19, 2009 [More >](#)

DOE Releases a Hydrogen Sensor Funding Opportunity Announcement
The goal of this FOA is to develop low cost sensor technologies that can be directly integrated with hydrogen systems and are resistant to contaminants. March 10, 2009 [More >](#)

DOE Hydrogen Program

Features

- Hydrogen.gov
- FreedomCAR Fuel Partnership
- Permitting Hydrogen Facilities - Fueling stations and fuel cell use for telecommunications
- Hydrogen Fueling Station Information

Information on

- Hydrogen Analyses & Models
- Financial Opportunities
- Key Documents

hydrogen.energy.gov

INCREASE YOUR H₂IQ
A Guide to Hydrogen and Fuel Cells
Brought to you by the U.S. Department of Energy's Hydrogen Program

ADD TO FRIENDS ADD TO FAVORITES FORWARD TO FRIENDS VIEW FRIENDS

Welcome!

Play some videos to learn more!

For more information, visit: hydrogen.energy.gov

www.myspace.com/h2iq

U.S. Department of Energy
Energy Efficiency and Renewable Energy *Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable.*

Vehicle Technologies Program

About the Program Program Areas Information Resources Financial Opportunities Technologies Deployment

Petroleum Reduction Tools & Information
Alternative Fuels and Advanced Vehicles Data Center: This Web site educates consumers and fleets on alternative fuels and advanced vehicles.

Fuel Economy.gov: This Web site compares gas mileage, emissions, air pollution ratings, and safety data for new and used vehicles.

Hybrid & Vehicle Systems >

Energy Storage >

Power Electronics >

Advanced Mechanical Machines >

Advanced Combustion Engines >

Fuels & Lubricants >

Materials Technologies >

Analysis & Tools >

EPAct >

Clean Cities >

Research Partnerships >

Research Spotlight
President Barack Obama announced on March 19 that the DOE is offering up to \$2.4 billion in American Recovery and Reinvestment Act funds to support next-generation plug-in hybrid electric vehicles (PHEV) and their advanced battery components. [\(more...\)](#)

Video of the Month
Learn how Argonne National Laboratory is making clean automotive power sources a viable reality. (Courtesy of Motorweek.)

2009 Annual Merit Review

ARRA FUNDING Opportunities

FACT OF THE WEEK
Cars are Growing Older > April 20, 2009

NEWS
U.S. Government Accelerates its Purchase of Fuel-Efficient Vehicles > April 15, 2009
Mercedes-Benz Offers Hybrid with Lithium-Ion Battery at a \$120k Premium > April 15, 2009
EIA Expects Gasoline Prices to Rise Moderately by Summer > April 15, 2009

EVENTS
AICHE National Spring Conference >

eere.energy.gov/vehiclesandfuels/



Education Team

Connie Bezanson

connie.bezanson@ee.doe.gov

Christy Cooper

christy.cooper@ee.doe.gov

Antonio Ruiz

antonio.ruiz@ee.doe.gov

Reg Tyler (Golden Field Office)

reginald.tyler@go.doe.gov