U.S. DEPARTMENT OF ENERGY

Hydrogen Program Cross-Cutting Activities:

Safety, Codes and Standards; Education; Manufacturing R&D; and Market Transformation

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2007 DOE Hydrogen Program

Merit Review and Peer Evaluation Meeting

May 15, 2007

Outline

- Goal and Objectives
- Challenges
- Progress
  - Accomplishments/Status
- Future Plans
- Budget

Safety, Codes and Standards

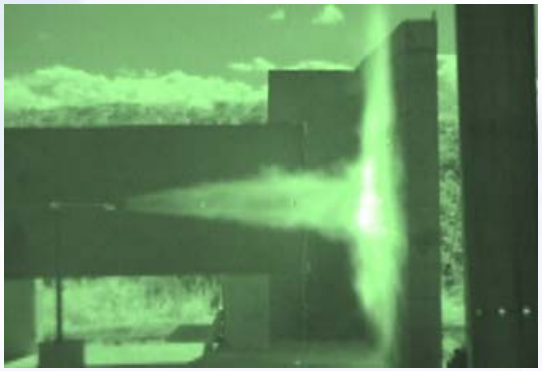
Safety, Codes and Standards

Goals and Objectives

Safety: Develop and implement the practices and procedures that will ensure safety in the operation, handling, and use of hydrogen and hydrogen systems for all DOE-funded projects and utilize these practices and lessons learned to promote the safe use of hydrogen.

Codes & Standards: Perform the underlying research to enable codes and standards to be developed for the safe use of hydrogen in all applications. Facilitate the development and harmonization of domestic and international codes and standards.

Safety, Codes and Standards
Challenges



- Limited historical data / insufficient technical data to develop and revise standards
- Large number of Authorities Having Jurisdiction
- Lack of uniform training of officials
- Lack of standard practices for safety assessments
- Lack of integrated, coordinated approach among C&S Organizations
- Lack of harmonization of domestic and international standards
- Limited government influence on C&S process
- Limited DOE role in international C&S development process

Safety, Codes and Standards
Progress

- *Technical Reference for Hydrogen Compatibility of Materials* (v.1.0) – complete
- Compendium of Permitting Tools
  - Hydrogen Fuel Station Permitting Workshop conducted
  - Case Studies workshop to be conducted July, 2007
- Hydrogen Safety Panel
  - Conducted 22 safety reviews of production, storage, fuel cells and technology validation projects
  - Reviewed 60+ safety plans
- Hydrogen Incidents Database includes over 100 documented incidents (www.h2incidents.org)

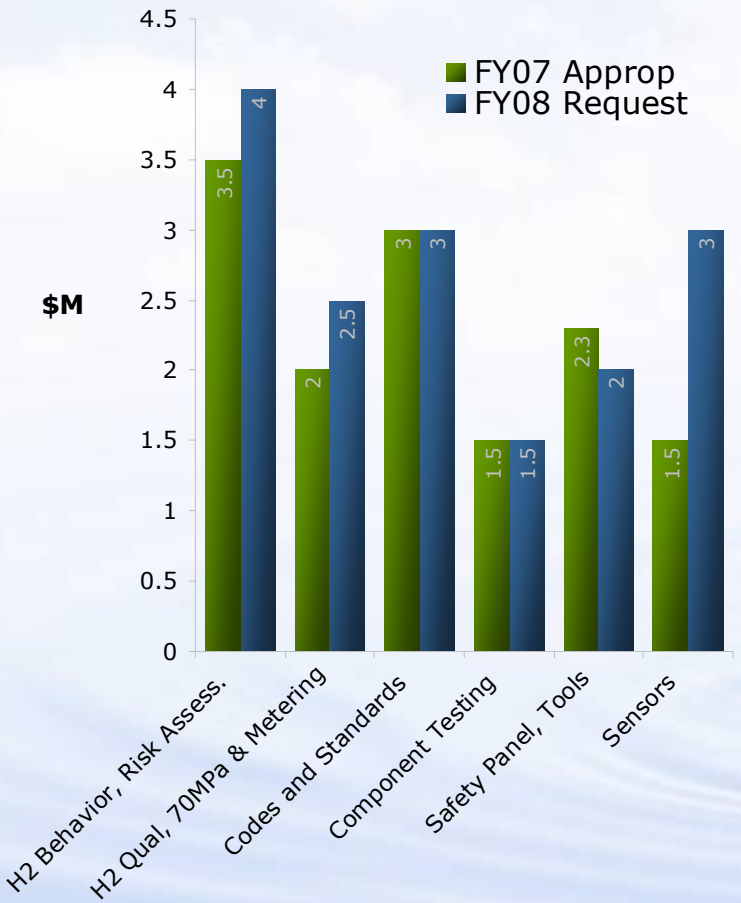
Safety, Codes and Standards
Future Plans

- Assess and improve the current state-of-the art for hydrogen safety sensors
- Publish a best practices manual for hydrogen safety
- Finalize hydrogen quality specification
- Expand efforts on hydrogen behavior, high-pressure refueling, and materials compatibility
- Grow the hydrogen safety and incidents databases
- Promote code development and permitting tools for commercial refueling stations
- Expand codes and standards activities for stationary and portable hydrogen and fuel cell systems

Safety, Codes and Standards

Budget

FY 2008 Budget Request = $16.0 M
FY 2007 Appropriation = $13.8 M



Emphasis

- Technically validated performance data needed for new codes and standards
- Permitting tools for siting of commercial refueling stations
- Hydrogen quality
- High-pressure refueling
- Conduct risk assessment and establish protocols to identify and mitigate risks
- Establish consensus R&D for global harmonization of hydrogen quality standards

FY2008 Budget Plan:

H2 Behavior/Risk Assessment	$ 4.0M
H2 Quality/70 MPa	$ 2.5M
Codes and Standards	$ 3.0M
Component Testing	$ 1.5M
Safety Panel/Tools	$ 2.0M
Sensors	$ 3.0M
Total	$16.0M

Education

Education
Goal and Objectives

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

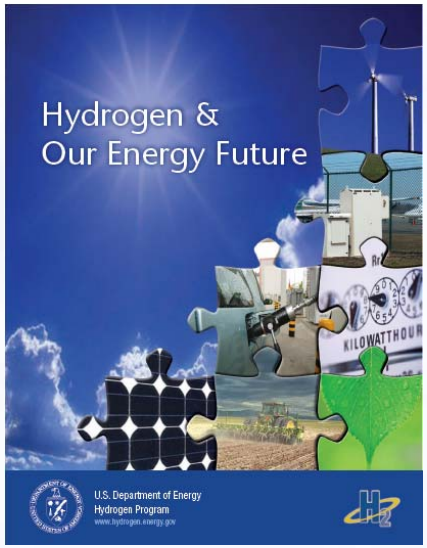
- By 2009: Increase knowledge of hydrogen and fuel cell technologies among key target populations (compared to a 2004 baseline)
  - Among state and local governments and students (ages 12-17) by 10%
  - Among the public and potential end-users by 15%

- By 2012, increase knowledge of hydrogen and fuel cell technologies among key target populations (compared to a 2004 baseline)
  - Among state and local governments and students (ages 12-17) by 20%
  - Among the public and potential end-users by 30%

Education Challenges

- Resistance to change
  - Low awareness
  - Few examples of real-world use
  - "What's in it for me?" factor
- Lack of readily-available, objective, technically-accurate – and "easily digestible" information
- Mixed messages
- Disconnect between hydrogen/fuel cell information and traditional dissemination networks
- Lack of educated trainers and training opportunities
- Regional differences
- Difficulty measuring success

Education Progress



2006 Accomplishments:

- Launched Introduction to Hydrogen Safety for First Responders education program
- Launched public education program H2IQ
  - Radio spots
  - Podcasts
  - Hydrogen book
- Restarted MS-HS projects unfunded since 2004
- State and regional initiatives: bimonthly informational conference calls and in-person networking meetings

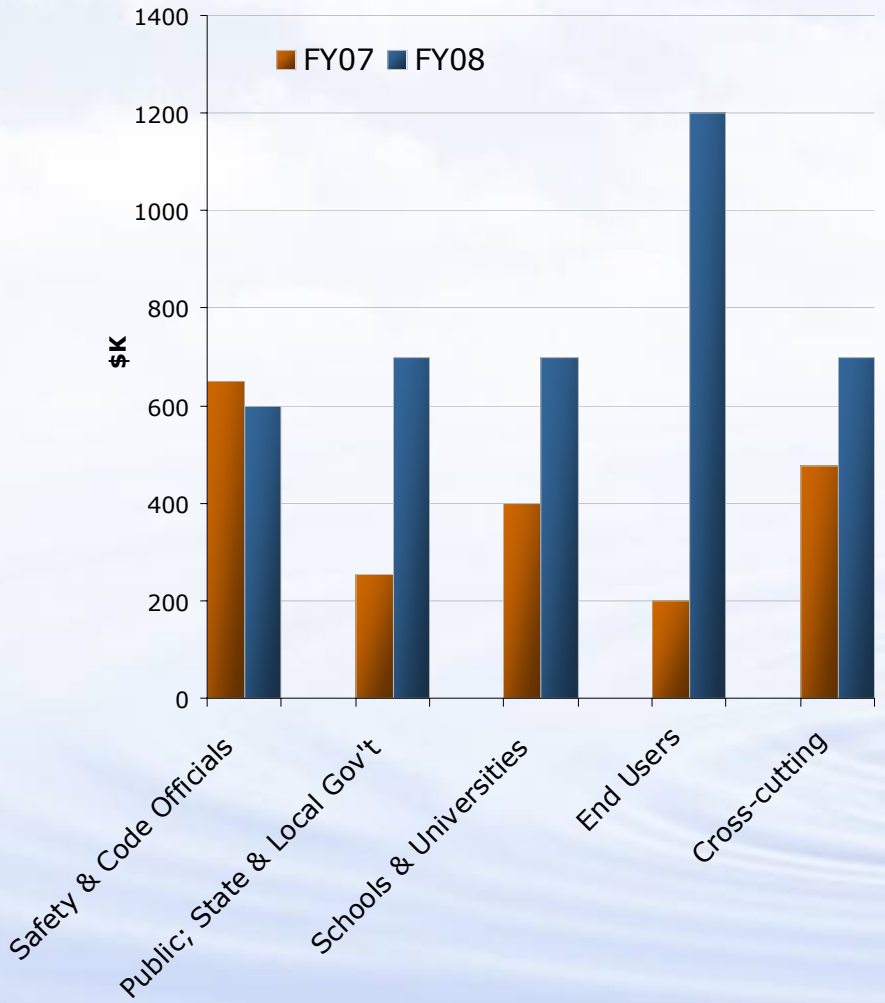
Education

Future Plans

- Ramp up outreach for Introduction to Hydrogen Safety for First Responders and develop "prop course" for hands-on training
- Develop Introduction to Hydrogen for Code Officials
- Ramp up public outreach through H2IQ program and partnership with NHA's "H2 and You" campaign
- Continue bimonthly state and regional conference calls
- Participate as partner in NHA's H2U student design contest
- Support MS-HS hands-on activity development and teacher training
- New solicitations planned for FY08:
  - Early market deployments and coordinated outreach
  - State and local government outreach
  - Universities

Education Budget

FY2008 Budget Request = $3.900K
FY2007 Budget Request = $1.978K



Emphasis

Focus on near-term high-priority target audiences:

- First responders and code officials
- Local communities where hydrogen demonstration projects are planned
- State and local government officials
- End-users/early adopters

FY08 Budget Plan

Expand safety/code education	**$600K**
Ramp up community outreach	**$300K**
Ramp up state and local government outreach	**$400K**
Initiate new end user outreach and early market deployment with state partners	**$1200K**
Initiate new university program; continue support of middle/high school projects	**$700K**
Cross-cutting and planning activities	**$700K**
TOTAL	**$3,900K**

Manufacturing R&D

Manufacturing R&D
Goal and Challenges

Goal: Research, develop, and demonstrate technologies and processes that reduce the manufacturing cost of hydrogen production, delivery, storage, and polymer electrolyte membrane (PEM) fuel cell systems.

Challenges:

- Developing innovative, low-cost manufacturing technologies for new materials and material applications
  - Adapting and scaling up laboratory fabrication methods to low-cost, high-volume production
  - Establishing and refining cost-effective manufacturing techniques while hydrogen products are still evolving
- Developing and evaluating manufacturing processes to minimize total life cycle energy requirements and environmental effects
- Developing a domestic supplier network

Manufacturing R&D Budget

FY2007: $1,978K

FY2008: $5,000K

Progress

- Workshop on Manufacturing R&D for the Hydrogen Economy, July 13-14, 2005
  - R&D priorities identified
- Roadmap on Manufacturing R&D for the Hydrogen Economy
  - Based on workshop results, feedback from industry

Future Plans

- Pre-solicitation meeting Friday, May 18, 2007, 1-3:30 PM
- Solicitation planned - Summer 2007

Market Transformation

Market Transformation

Goal: To facilitate commercialization of hydrogen and fuel cell technologies by supporting early adoption, and by building partnerships with Federal, State, and local governments and industry.

Challenges:

- Resistance to new technologies
- Lack of information on life-cycle costs
- Lack of user confidence related to reliability
- High capital cost

Market Transformation

Progress

- Meeting: Matching Federal Government Energy Needs with Energy Efficient Fuel Cells, April 26, 2007
  - Brought Federal agency representatives and fuel cell companies together
- Request for Information (RFI) on Hydrogen and Fuel Cell Early Markets, April 26, 2007
  - Seeks public input in three areas by June 30, 2007:
    - Early market financial assistance
    - Fuel cell performance testing
    - Community partnerships, including utility applications

Future Plans

- GovEnergy 2007 Conference, August 5-8, 2007, New Orleans
  - "New Technology" track focusing on fuel cells and early market opportunities for Federal facility and energy managers
  - Exhibit in conjunction with the USFCC, bringing together Federal managers with fuel cell industry representatives
- Funding Opportunity Announcement (FOA) in first quarter of FY2008
  - Will provide financial assistance for activities that:
    - Cultivate demand for new hydrogen and fuel fell technologies
    - Accelerate market development
    - Reduce non R&D barriers that hinder market penetration

For More Information

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