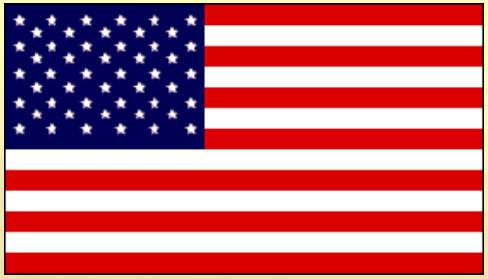
# U.S. HYDROGEN PROGRAM

## Update to IPHE - ILC




*JoAnn Milliken*

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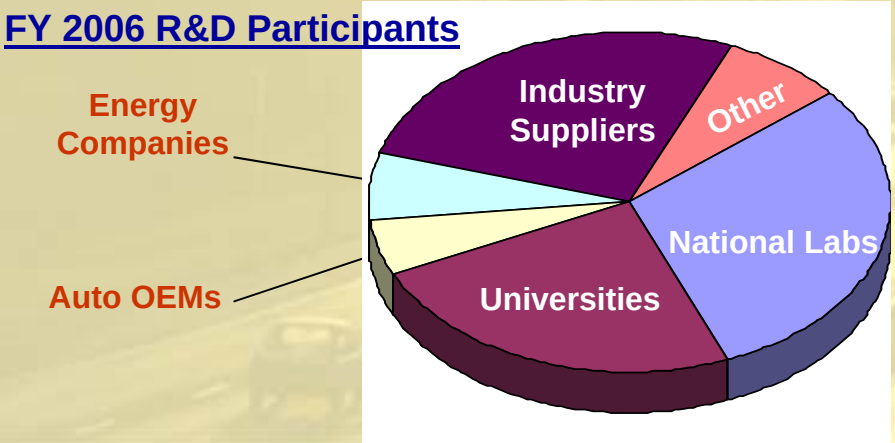
**Hydrogen Program**
**U.S. Department of Energy**
**Washington, D.C.**


**Oxford, UK**
**January, 2007**

# Hydrogen Fuel Initiative Budget

| Funding (dollars in thousands) | | | |
|---|---|---|---|
| **Office** | **FY05 Comparable Approp.** | **FY06 Comparable Approp.** | **FY07 Request** |
| **Hydrogen Fuel Initiative** | | | |
| EERE | 166,772 | 153,451 | 195,801 |
| Fuel Cells | 73,419 | 74,266 | 81,804 |
| Hydrogen | 93,353 | 79,185 | 113,997 |
| FE | 16,518 | 21,036 | 23,611 |
| NE | 8,682 | 24,057 | 18,665 |
| SC | 29,183 | 32,500 | 50,000 |
| DOE Total | 221,155 | 231,044 | 288,077 |
| DOT | 549 | 1,411 | 1,420 |
| **HFI Total** | **221,704** | **232,455** | **289,497** |

**FY 2006 R&D Participants**



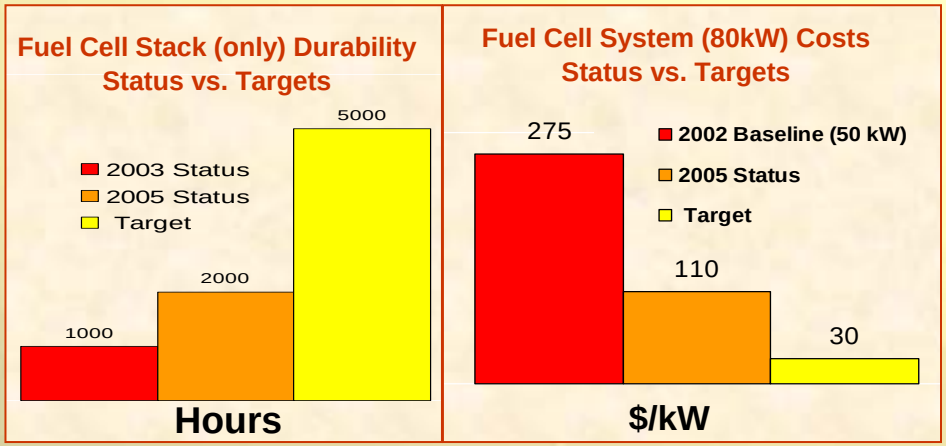

## Key Activities focus on:

- Technology Challenges
  - ⇨ Hydrogen Cost (target: $2.00 - 3.00/kg) independent of production pathway
  - ⇨ Hydrogen Storage (target: >300-mile range)
  - ⇨ Fuel Cell Cost and Durability (targets: $30 per kW, 5000 hours)
- Economic/Institutional Challenges
  - ⇨ Safety, Codes and Standards
  - ⇨ Hydrogen Infrastructure
  - ⇨ Market Transformation
  - ⇨ Education (safety and code officials, local communities, state and local governments, students)

# Hydrogen Program R&D Progress

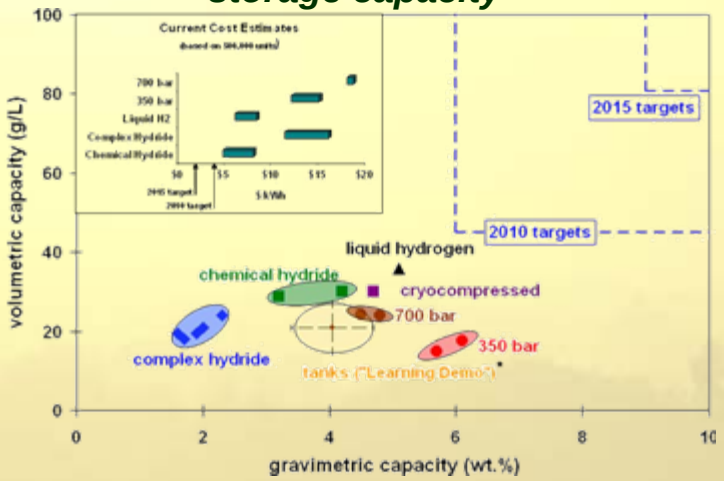
## Fuel Cells

***Lowered high-volume cost to 4X that of ICEs***



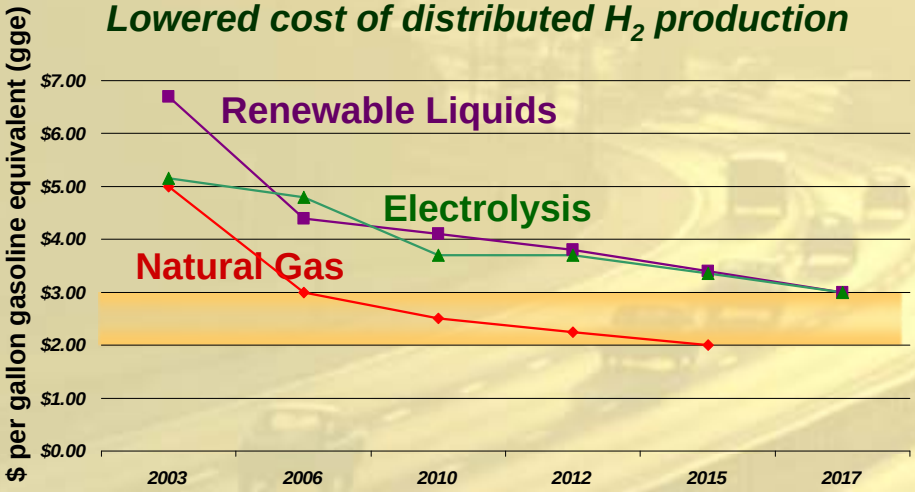

## Hydrogen Storage Technology

***Identified new materials with potential for high storage capacity***




## Hydrogen Production

***Lowered cost of distributed $H_2$ production***




## Technology Validation

***Obtained valuable data on FCVs and $H_2$ stations***

**69 vehicles, 10 stations in operation**

**Fuel cell durability:**
Maximum: 950 hours

**Range:** 103 to 190 mi (equivalent to EPA vehicle sticker rating)

**Cost of hydrogen production:** $3.00/gge

# Safety Codes and Standards Status

- **DOE National Template** process developed industry consensus on which organizations would develop specific standards, eliminating duplication and promoting harmonization.
  - Established templates for stationary fuel cells, vehicle, refueling and transport
- DOE facilitated formation of the **Hydrogen Industry Panel on Codes** (HIPOC).
  - For the first time established mechanism for the International Code Council (ICC) and the National Fire Protection Association (NFPA) to harmonize codes.

**Hydrogen Incidents Database** online: ***www.h2incidencts.org***

Reports contain summaries & links to related information

***Over 100 Hydrogen Codes and Standards are drafted, approved, or currently under development. See: www.fuelcellstandards.com***

**Hydrogen Bibliographic Database** online: ***www.hydrogen.energy.gov***

This searchable database provides references for information on hydrogen safety

**"Best Management Practices for Safety"** under development

# Education Status



## Safety & Code Officials

- DOE Introduction to Hydrogen Safety for First Responders web-based course; print and CD available (Jan 2007)
- Introduction to Hydrogen for Code Officials, modeled after first responder course (planned for 2007-08)

## Local Communities

- Basic information on hydrogen technologies, fuel cells, and safety available online
- “Increase Your H2IQ” community/media outreach – Podcasts, radio spots (Spring 2007)

## State and Local Government Representatives

- Bi-monthly informational calls for states/state and regional initiative leaders (ongoing)
- Database of state activities – demonstration projects, policies, initiatives (ongoing)
- Workshops – “Hydrogen 101” and “Hydrogen Energy Institute” (ongoing)

## Potential End Users (includes Federal government as well as private sector businesses needing uninterruptible power, transportation, and large power users)

- Information resources – basic technology explanations, available products, case studies – marketed to potential early adopters (planned for 2007)
- Working in partnership with other DOE programs to reach out to key early adopters – FEMP, EnergySmart Schools, WIP, Clean Cities (planned for 2007)

# Validation Planning & Scenario Analyses Underway

2005 2010 2015 2020 2025

## Current DOE/HFI Plan

**R&D to Meet Targets**

Technology Readiness based on lab results and high-pressure storage

Hydrogen Fuel Initiative

Production vehicles

| Learning Demo 1 | | Learning Demo 2 | |
|---|---|---|---|
| Gen 1 | Gen 2 | Gen 3 | Gen 4 |

2,000 hours FC durability
250 mile range
$3/gge $H_2$ at pump

5,000 hours FC durability
300+ mile range
$2.50/gge at pump

## Proposed Alternatives

| Learning Demo 2 | |
|---|---|
| Gen 3 | Gen 4 |

Cold Start

3,500 hours durability

5,000 hours FC durability
300+ mile range
$2.50/gge at pump

**Lighthouse Validation**

Production vehicles based on road tests and integrated, clustered fuel network

**Policy Actions**

Infrastructure, Vehicle

# Status of FutureGen

## Seven states proposed 12 host sites

- **FutureGen Alliance** selected four sites in two states for further evaluation (Illinois and Texas)
  - DOE is leading the environmental impact assessment (NEPA)
  - Final site to be selected by the Alliance in Fall 2007
- **Conceptual Plant Design Underway**
  - Alternative conceptual facility configurations are being evaluated
  - Discussions with major gasification & turbine technology suppliers are being held
- **Industrial Alliance:** Now up to 12 companies in 4 countries (Australia, China, UK and USA)
- **Government Alliance:** USA, India and Korea


# U.S. Department of Transportation Update

- **Regulatory Coordination & Assessment**
  - ***http://hydrogen.gov/regulations***
  - Shares current U.S. statutes and regulations that may be applicable to the hydrogen economy

- **National Fuel Cell Bus Program – announced**
  - ***http://www.fta.dot.gov/news/news_events_5830.html***
  - 14 projects from 3 organizations selected
  - ~ $49 million over 4 years
- **FAA 5kw Backup power demo**
  - Providing back-up power for national airspace applications

- **NHTSA:**
  - Performing comparative assessment of codes, standards and regulations
  - Conducting:
    - FMEA of hydrogen fueled vehicles
    - Electrical isolation test procedure
    - Integrity tests of high pressure storage cylinders and packaged fuel systems (burst, bonfire, pressure cycling, drop, flame impingement)

# U.S. Implementation - Liaison Committee Program Technology Contacts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***Reminder: 2007 Annual DOE Hydrogen Program Merit Review and Peer Evaluation Meeting***
***May 14-18, 2007 - Arlington, VA***
***See www.hydrogen.gov***