



U.S. DEPARTMENT OF  
**ENERGY**

# **Program Overview**

Patrick Davis

Acting Program Manager

**2007 DOE Hydrogen Program  
Merit Review and Peer Evaluation Meeting**

**May 15, 2007**



# Mission Statement

The Hydrogen Program mission is to research, develop, and validate hydrogen production, storage, and fuel cell technologies to reduce dependence on oil in the transportation sector, and to enable clean, reliable energy for stationary and portable power generation.



# Hydrogen Fuel Initiative

## *Total Budget*

- President Bush committed \$1.2 billion over 5 years (FY04 – FY08) to accelerate R&D to enable technology readiness in 2015.

Hydrogen Fuel Initiative Funding <sup>1</sup> (\$ in millions)				
FY2004 Approp.	FY2005 Approp.	FY2006 Approp.	FY2007 Approp.	FY 2008 Request
157	222	232	274	309

- President's cumulative request has been consistent with the commitment: \$1.2 B (FY04 – FY08).

<sup>1</sup> Includes EERE, FE, NE, SC and Department of Transportation



# Hydrogen Fuel Initiative

## *Budget by Participant Organization*

Activity	Funding (\$ in thousands)			
	FY2005 Approp	FY2006 Approp	FY2007 Actual	FY2008 Request
<b>Hydrogen Fuel Initiative</b>				
EERE Hydrogen (HFCIT)	166,772	153,451	193,551	213,000
Fossil Energy (FE)	16,518	21,036	23,611	12,450
Nuclear Energy (NE)	8,682	24,057	18,665	22,600
Science (SC)	29,183	32,500	36,500	59,500
<b>DOE Hydrogen TOTAL</b>	<b>221,155</b>	<b>231,044</b>	<b>272,327</b>	<b>307,550</b>
Department of Transportation	549	1,411	1,420	1,425
<b>Hydrogen Fuel Initiative TOTAL</b>	<b>221,704</b>	<b>232,455</b>	<b>273,747</b>	<b>308,975</b>

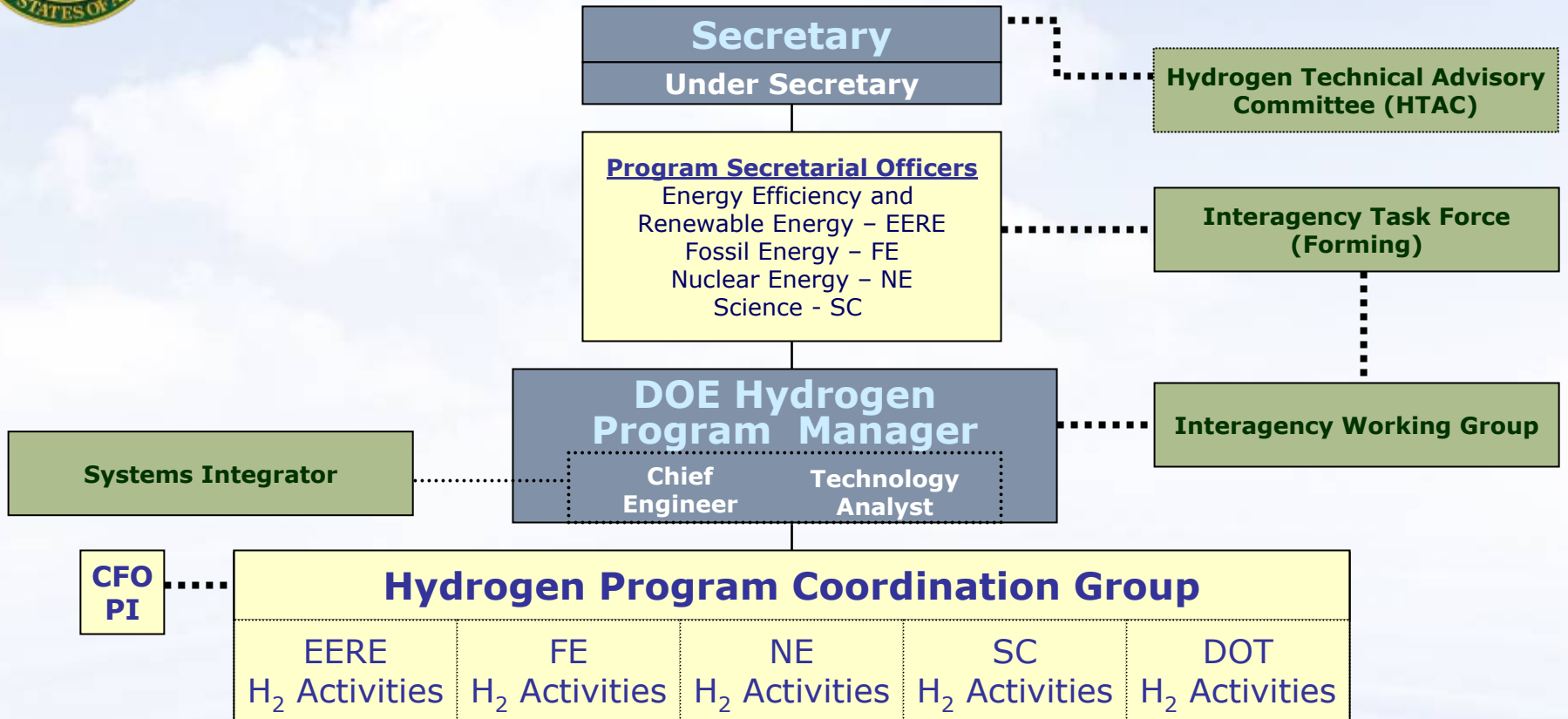


# EERE Hydrogen Budget

Activity	Funding (\$ in thousands)			
	FY 2005 Approp	FY 2006 Approp	FY 2007 Actual	FY 2008 Request
Hydrogen Production & Delivery	13,303	8,391	34,594	40,000
Hydrogen Storage R&D	22,418	26,040	34,620	43,900
Fuel Cell Stack Component R&D	31,702	30,710	38,082	44,000
Technology Validation	26,098	33,301	39,566	30,000
Transportation Fuel Cell Systems	7,300	1,050	7,518	8,000
Distributed Energy Fuel Cell Sys.	6,753	939	7,419	7,700
Fuel Processor R&D	9,469	637	4,056	3,000
Safety, Codes & Standards	5,801	4,595	13,848	16,000
Education	0	481	1,978	3,900
Systems Analysis	3,157	4,787	9,892	11,500
Manufacturing R&D	0	0	1,978	5,000
Technical/Program Mgt. Support	535	0	0	0
Congressionally Directed Activities	40,236	42,520	0	0
<b>TOTAL</b>	<b>166,772</b>	<b>153,451</b>	<b>193,551</b>	<b>213,000</b>



# DOE Hydrogen Program

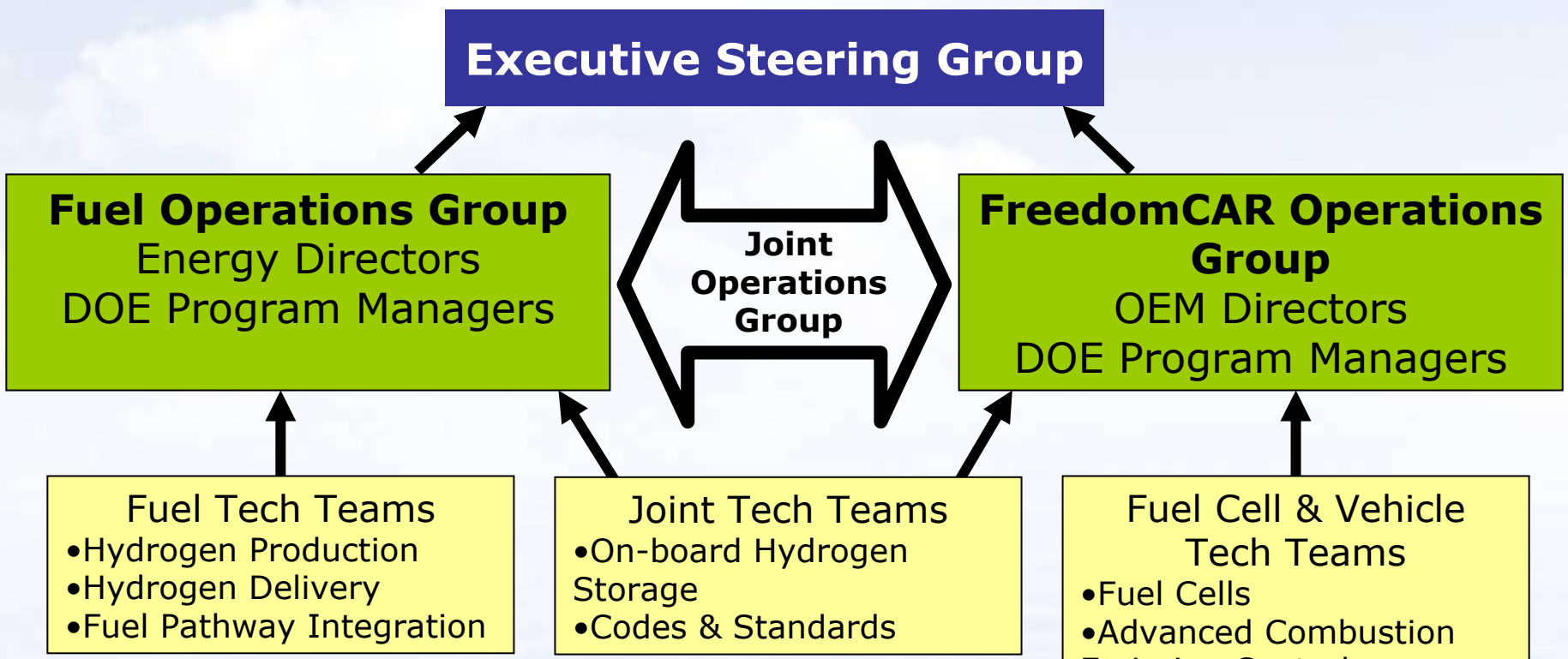


## Program Management (Headquarters)





# FreedomCAR and Fuel Partnership







# Other Partnerships

- Hydrogen Utility Group (e.g. Xcel Energy, Sempra)
- Interagency Hydrogen and Fuel Task Force (with OSTP)
- Interagency Working Group on Manufacturing R&D
- State/Local Governments, e.g. California Fuel Cell Partnership, Upper Midwest Hydrogen Initiative
- International Partnership for the Hydrogen Economy
- International Energy Agency



*The Program maintains strong partnerships with industry and government, and coordinates extensively with other stakeholder groups.*







# Program Evaluations

- National Academy of Sciences (NAS) Reviews
  - 2 completed, 2 ongoing
  - Biannual review of the Hydrogen Program and the FreedomCar and Fuel Partnership currently underway
- Government Accountability Office (GAO)
- Hydrogen Technical Advisory Committee (HTAC)
  - Advisory committee comprised of stakeholders from federal government, industry, and the research community
- Annual Merit Review (AMR)
  - Annual review of research projects funded in the past year (proceedings and progress report published)
- FreedomCAR Tech Team project reviews

*The Program undergoes regular reviews to evaluate progress and inform planning activities.*



# New Activities

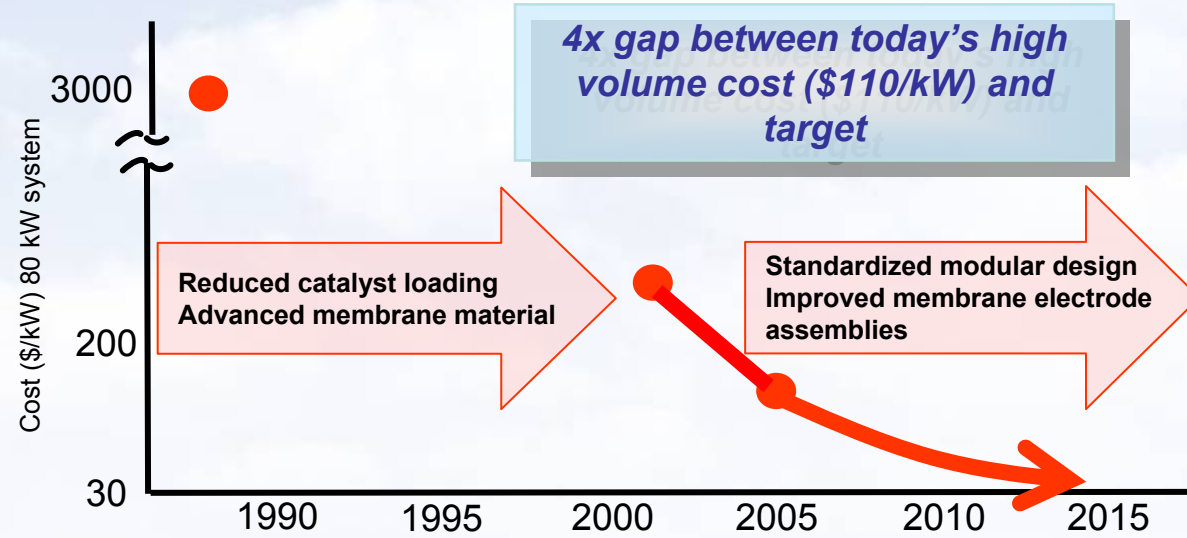
- Early Markets
- Manufacturing
- Integrated Renewable Hydrogen
  - HUG
  - NREL/Xcel
  - DTE
  - Hawaii



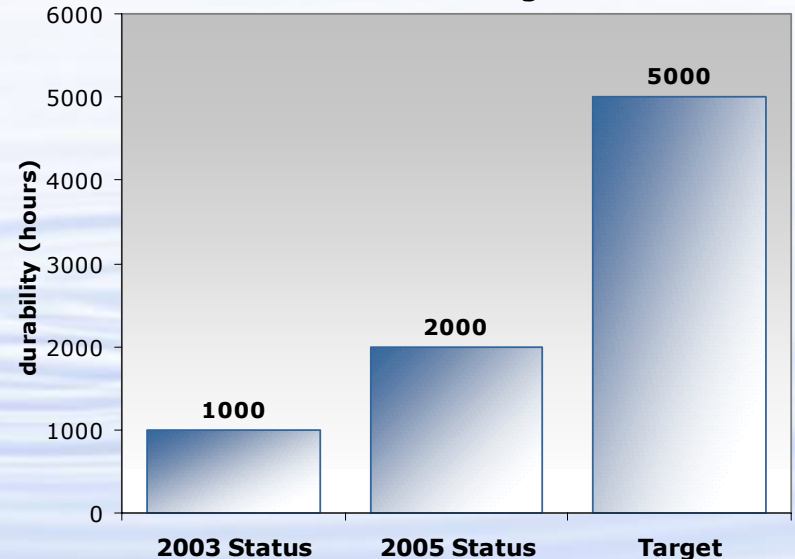
*Supplementing focus on R&D to foster movement of hydrogen and fuel cells into early markets.*



# Progress Fuel Cells



Fuel Cell System Stack (only) Durability Status vs Targets

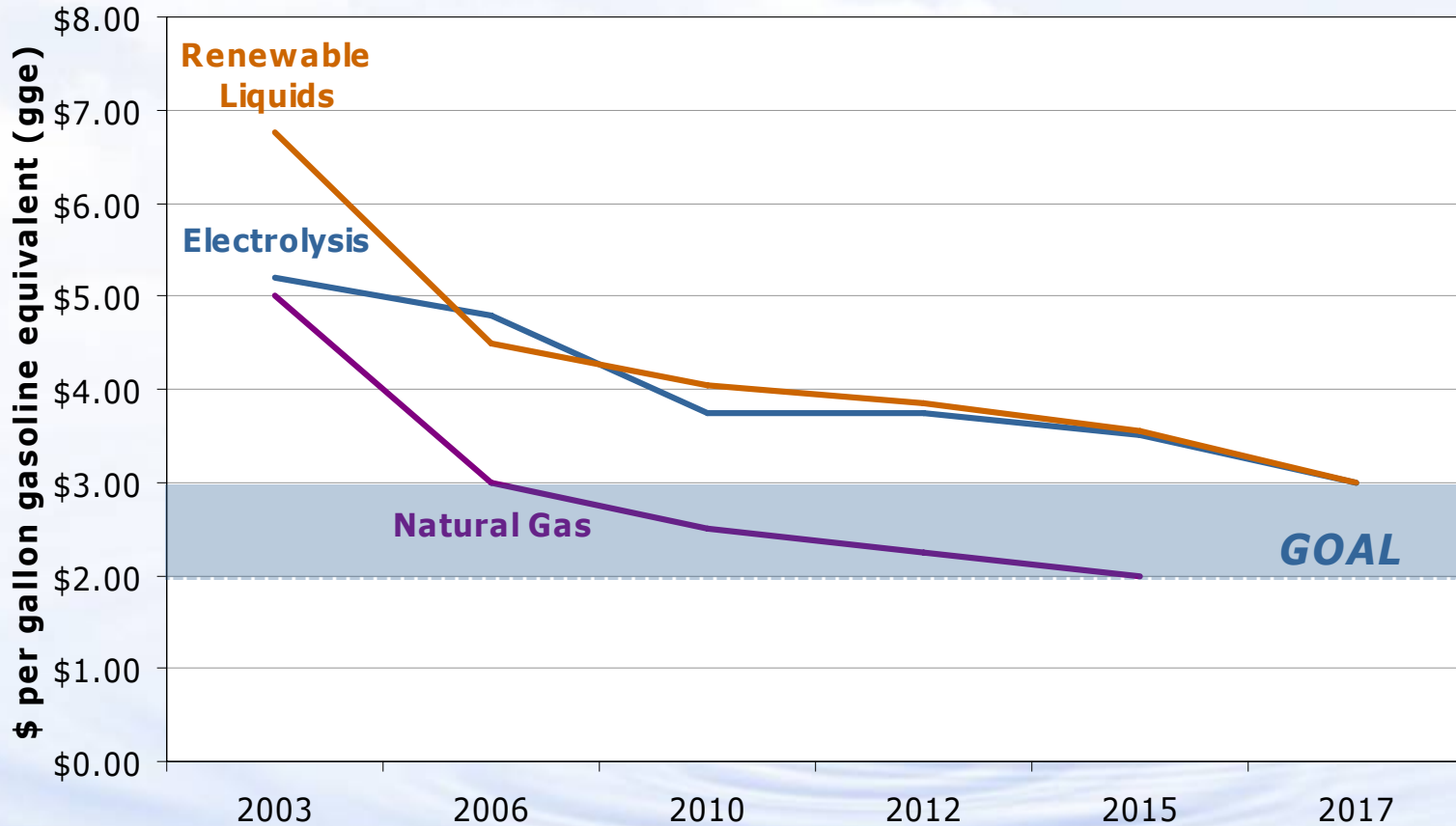


*The Program has reduced the cost of fuel cells and improved durability.*



# Progress *Hydrogen Production*

**Distributed Hydrogen Production Cost  
Status and Targets (Goal: \$2.00-\$3.00/gge)**



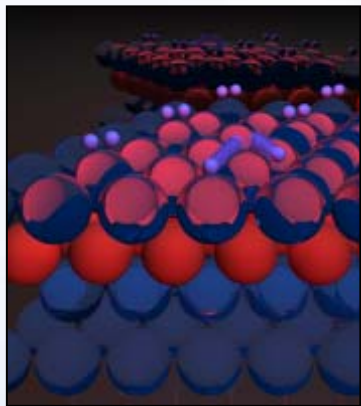
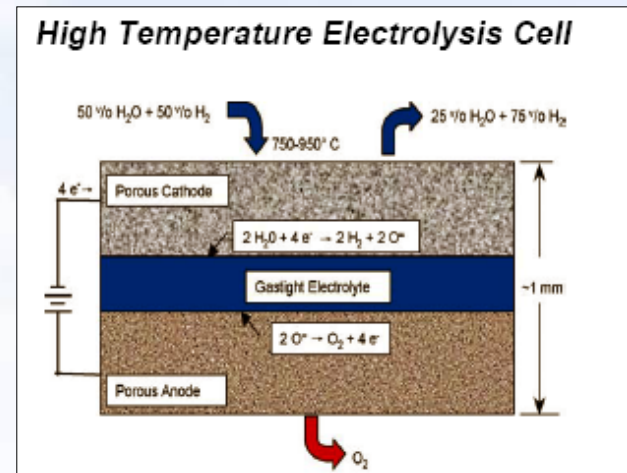
*The Program has reduced the cost of hydrogen production*





# Progress

- The Office of Nuclear Energy completed bench-scale testing of its baseline hydrogen production technologies, and will begin operation of integrated laboratory-scale experiments of both thermochemical and high temperature electrolysis production methods in September 2007.



- Basic Energy Sciences: New alloys with novel architectures and compositions have been identified and await experimental validation. This is a rare instance in which theoretical catalysis precedes experiments.

- The Office of Fossil Energy has completed Initial bench-scale success in H<sub>2</sub> separation membranes achieving their 2008 flux goal early





# Progress Technology Validation

## DOE Vehicle/Infrastructure Demonstration

Four teams in 50/50 cost-shared projects:

- General Motors/Shell, Ford/BP, Hyundai/Chevron, DaimlerChrysler/BP
- Current Status/Data:

Fuel Cell Vehicles	77
Hydrogen Stations	10
Fuel Cell Efficiency	53 - 58%
Range	103 -190 miles
Durability	1200 hrs ( ~36,000 miles)

DOT is demonstrating fuel cell buses and providing data to DOE for analysis.

- Eight buses in California, Massachusetts, New York, South Carolina, and Washington, DC

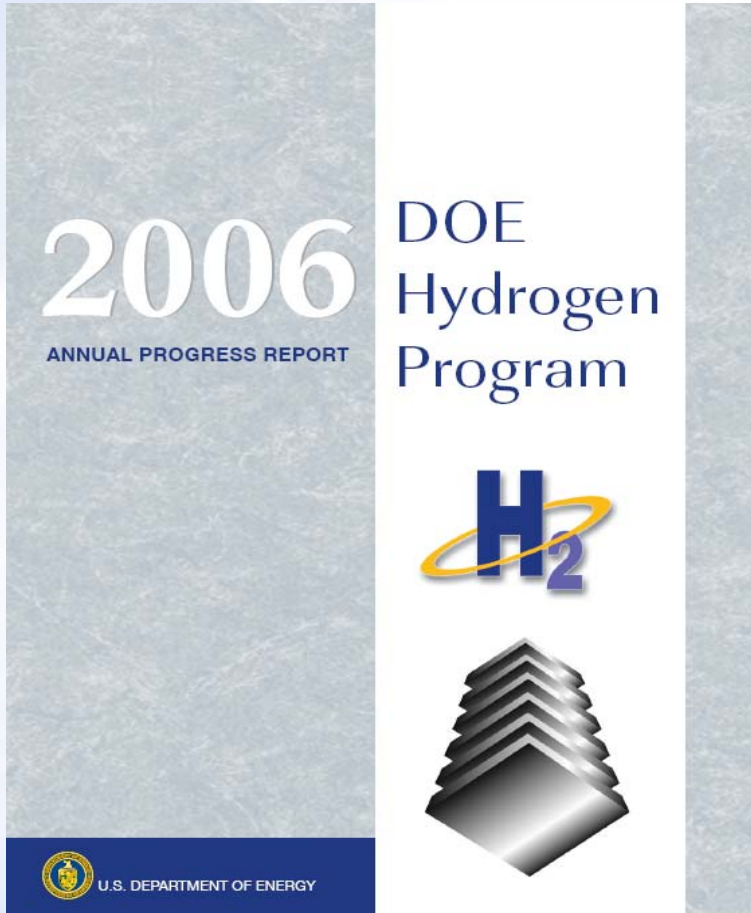
*Technologies are validated and progress evaluated through learning demonstrations.*







# For more information...



## DOE Hydrogen Program Annual Progress Report

U.S. DEPARTMENT OF ENERGY  
**Hydrogen Program**  
hydrogen.  
energy.gov

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**INCREASE YOUR H<sub>2</sub> IQ**

**Announcement**  
Register Now for 2007 Annual Merit Review and Hotel Accommodations

**DOE Hydrogen Program**

**Features**

**President's Hydrogen Fuel Initiative**

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**Hydrogen.gov**

**FreedomCAR & Fuel Partnership**

**News**  
**DOE Requests Information on Early Markets for Hydrogen and Fuel Cells**  
DOE "request for information" focuses on opportunities for the early adoption of hydrogen and fuel cell technologies.  
April 26, 2007 [More >](#)

**DOE Announces R&D Solicitation Selections for Hydrogen Storage**  
DOE plans to provide up to \$8.2 million for six hydrogen storage research projects that support the Advanced Energy Initiative.  
April 12, 2007 [More >](#)

**New DOE Employment Opportunity Available in Hydrogen Production**  
DOE seeks a chemical engineer to serve as the hydrogen production team leader within the Hydrogen, Fuel Cells, and Infrastructure Technologies Program.

[www.hydrogen.energy.gov](http://www.hydrogen.energy.gov)