The Hydrogen Fuel Initiative and the International Partnership for the Hydrogen Economy

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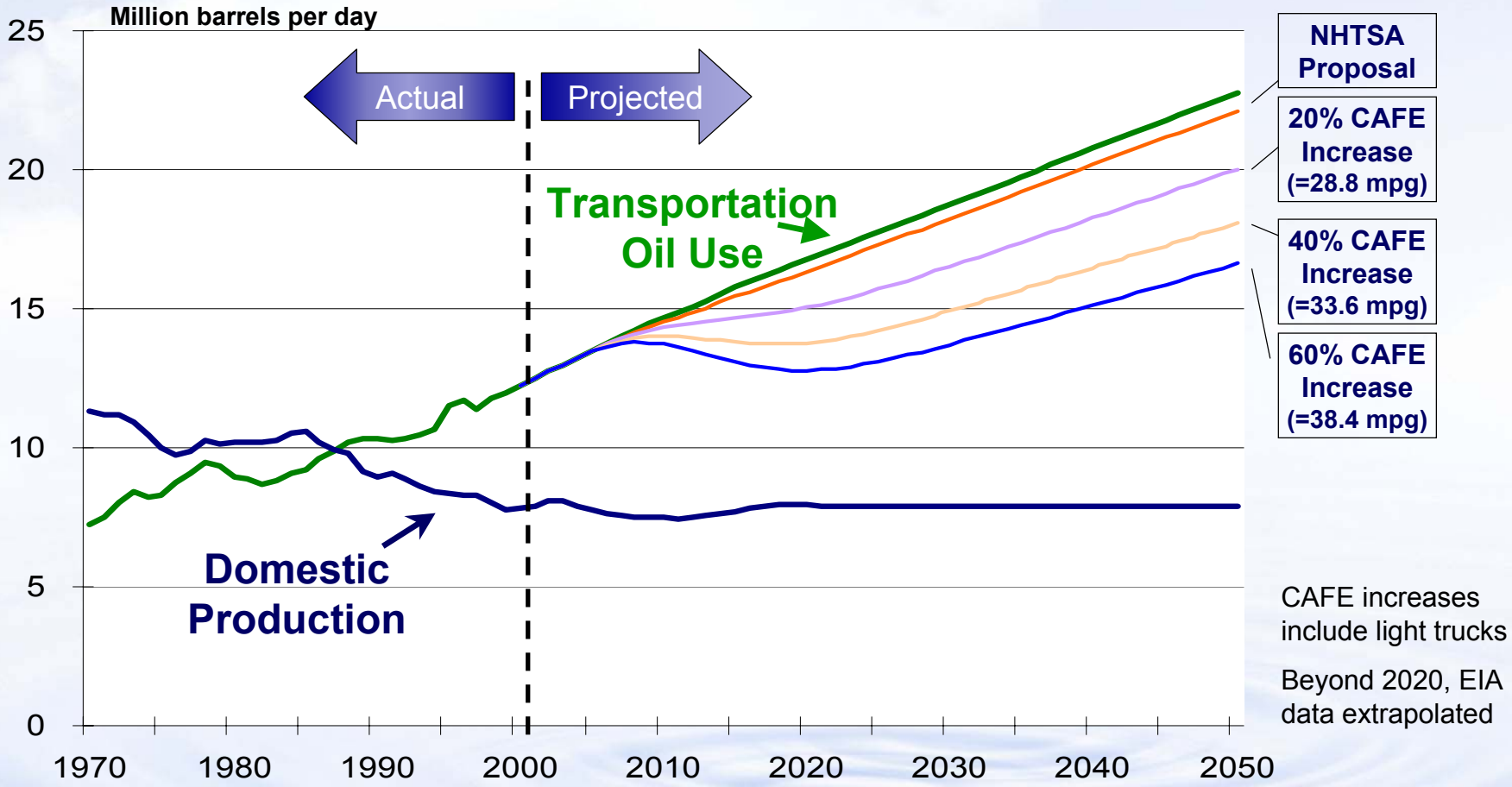
2004 Fuel Cell Seminar
San Antonio, Texas
November 2, 2004

Oil Use by U.S. Transportation is Steadily Rising



Increasing fuel economy decreases oil use for next 2 decades, but does not offset long-term growth in consumption

Why Hydrogen?

Biomass

Hydro

Solar

Wind

Geothermal

Energy Diversity/Security

Transportation

Nuclear

H_2

Stationary Power

Sequestration

Oil

Coal

Natural Gas

High Efficiency & Reliability

Low Emissions

Benefits of a Hydrogen Economy

"*If we develop hydrogen power to its full potential, (the US) can reduce our demand for oil by over **11 million barrels** per day by the year 2040.*"
President George W. Bush

Energy Security

- Hydrogen can be produced from a variety of domestic sources

Environmental

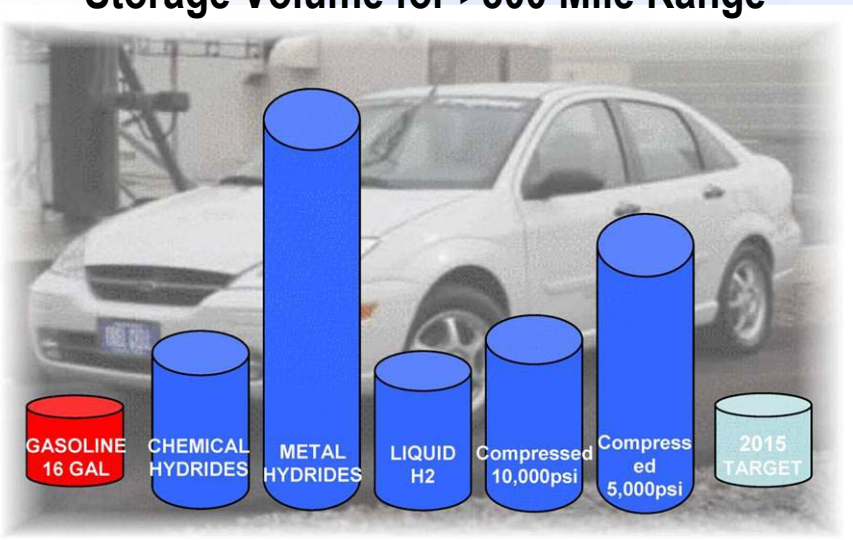
- Criteria pollutants from vehicles eliminated
- Greenhouse gas emissions significantly reduced
- LDV carbon emissions may be reduced by more than 500 million metric tons of carbon equivalent (about a 70% reduction from the base case LDV carbon emissions)

Barriers to a Hydrogen Economy

Critical Path Technology Barriers:

- Hydrogen storage (>300 mile range)
- Hydrogen production cost ($1.50 - 2.00 per gge)
- Fuel cell cost (<$50 per kW)

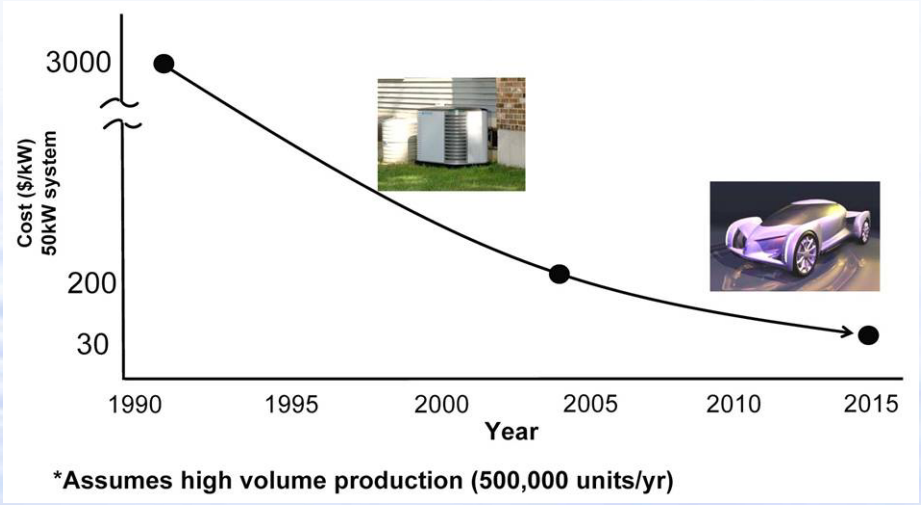
Storage Volume for >300 Mile Range



Economic/Institutional Barriers:

- Codes and standards (Safety and global competitiveness)
- Hydrogen delivery (Investment for new distribution infrastructure)
- Education

Fuel Cell Cost



President Bush Launches the Hydrogen Fuel Initiative

"Tonight I am proposing $1.2 billion in research funding...”

"With a new national commitment, our scientists and engineers will overcome obstacles to taking these cars from laboratory to showroom so that the first car driven by a child born today could be powered by hydrogen, and pollution-free.”

President George W. Bush
2003 State of the Union Address
January 28, 2003

Hydrogen Initiative Funding

- The President has requested significant funding for the Hydrogen Fuel Initiative
  - $720M in new funding, FY04-FY08
  - $1.2B total funding, FY04-FY08
  - $159M in FY04 enacted
  - $228M in FY05 request
- Links with DOE FreedomCAR partnership
  - fuel cell vehicle technology
  - other efficient vehicle technologies (e.g., hybrid-electric vehicle components, lightweight materials)
- Total request, FreedomCAR and Hydrogen Fuel Initiative
  - $1.7B for FY04-FY08

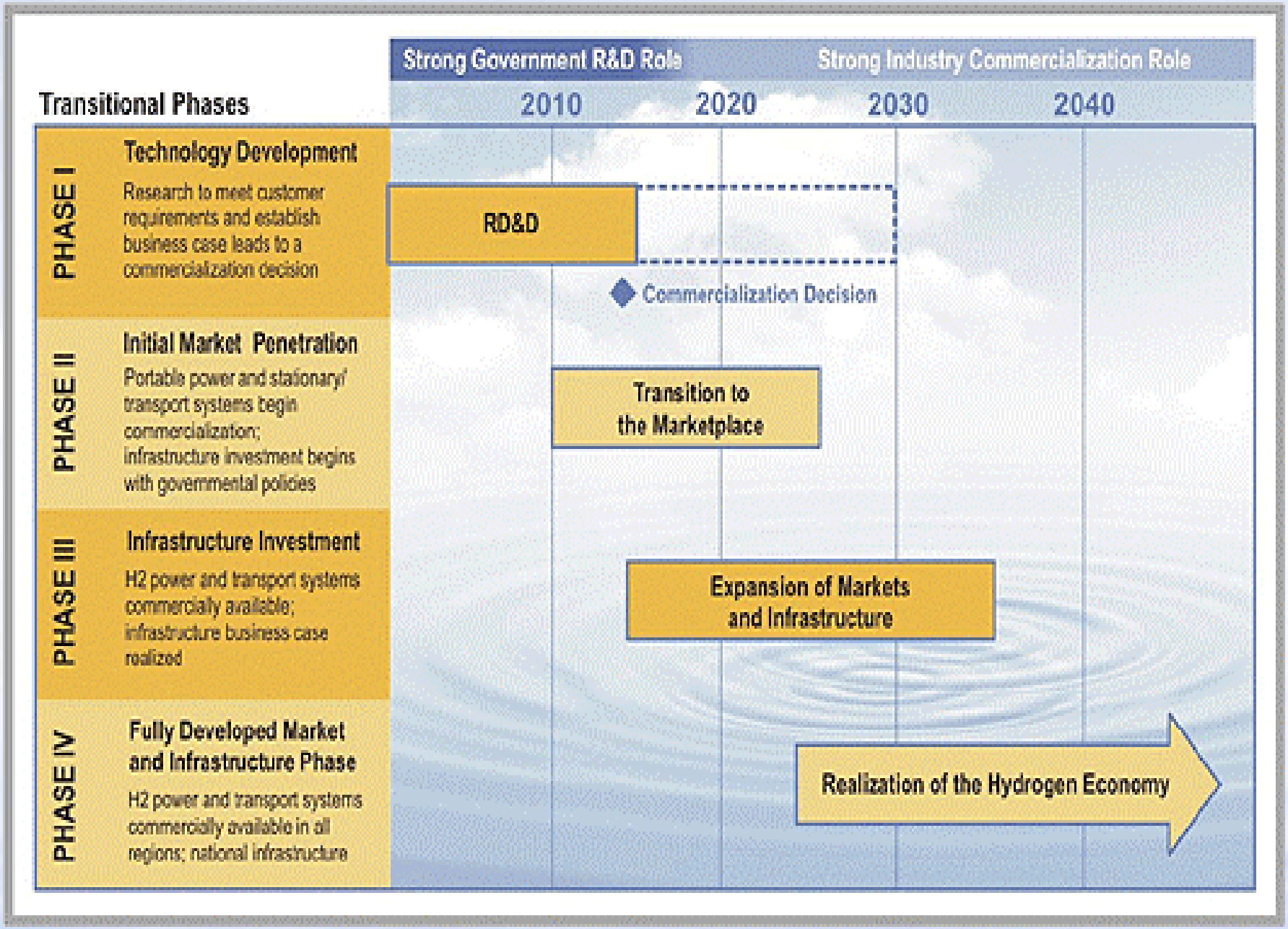
Resources to Support the President's Hydrogen Fuel Initiative ($K)

Major Line Items and Key Activities	FY 04 Appropriation	FY 05 Request
Fuel Cell Technologies : system components, stack components, fuel processors, technology validation	$65,187	$77,500
Hydrogen Technologies : distributed natural gas and renewable production, delivery, storage, safety and codes/standards, infrastructure technology validation, education/analysis	$81,991	$95,325
Coal-based Hydrogen Production : gasification, gas separation	$4,889	$16,000
Nuclear-based Hydrogen Production : high temperature reactions	$6,377	$9,000
Basic Science : production, storage and use	$0*	$29,183
Department of Transportation : safety, codes/standards	$555	$832
Total	$158,999**	$227,840

* Excludes about $8 million of baseline activities not counted as part of the Initiative.

** FY 04 Request = $181.7 M

Note: Some FY 04 numbers vary slightly due to RESCISSIONS AFTER appropriation and other reductions.


Strong Government R&D Role
Strong Industry Commercialization Role
Transitional Phases
2010
2020
2030
2040
PHASE I
Technology Development
Research to meet customer requirements and establish business case leads to a commercialization decision
RD&D
Commercialization Decision
PHASE II
Initial Market Penetration
Portable power and stationary/ transport systems begin commercialization; infrastructure investment begins with governmental policies
Transition to the Marketplace
PHASE III
Infrastructure Investment
H2 power and transport systems commercially available; infrastructure business case realized
Expansion of Markets and Infrastructure
PHASE IV
Fully Developed Market and Infrastructure Phase
H2 power and transport systems commercially available in all regions; national infrastructure
Realization of the Hydrogen Economy

Interagency Task Force

- A mechanism for collaboration among 9 federal agencies Energy, Agriculture, NASA, Transportation, Commerce, State, Defense, Environmental Protection Agency, National Science Foundation

- Co-Chaired by the: Executive Office of the President, Office of Science and Technology Policy, & Department of Energy, Energy Efficiency and Renewable Energy

- Activities include:
  - A Hydrogen R&D “Taxonomy” or topic framework of past, present, and possible future federal R&D

  - A searchable website to provide the public with news and information on the progress of the President’s Hydrogen Fuel Initiative and The Interagency Task Force efforts related to building a federal Hydrogen R&D community

Hydrogen.gov

About Hydrogen.gov | Why Hydrogen
The President's Hydrogen Initiative | Federal Programs
Funding Opportunities | Safety, Codes and Standards, and Regulations
Regional and International Partnership Initiatives | News/Events

International Partnership for the Hydrogen Economy (IPHE)


Russian Federation


USA


Canada


Iceland


Japan


South Korea


China


India

Vision:

"… consumers will have the practical option of purchasing a competitively priced hydrogen powered vehicle, and be able to refuel it near their homes and places of work, by 2020."

- Secretary Abraham, April 2003


United Kingdom


France


Germany


Italy

Partners' Economy:

- > $35 Trillion, 85% of world GDP
- ~ 3.5 billion people
- > 75% of worldwide electricity used
- > 2/3 of energy consumption and CO_2 emissions

Australia

Brazil

Norway

European Commission

IPHE First Ministerial Meeting

November 19-21, 2003 in Washington DC, USA

- Signing of the Terms of Reference
- 700+ delegates and participants representing ~30 countries
- Public-Private Dialogue Sessions
- IPHE Committee meetings

IPHE Organizational Structure

Steering Committee

- Governs framework, policies and procedures
- Reviews collaborative activities
- Provides direction to Secretariat
- Chair: U.S.
- Vice Chairs: Canada, India, Italy, and Japan



Implementation and Liaison Committee

- Review progress of collaborative projects
- Identify directions for RD&D and commercial use
- Technical assessments
- International codes, standards, and safety protocols
- Communications
- Co-Chair: Germany and Iceland
- Vice Chairs: Brazil, European Commission and Russia

IPHE Committee Meetings

Steering Committee

- May 25-28, 2004, Beijing, China
  - Consensus on action plan
- December 2004, Paris, France

Implementation – Liaison Committee

- March 1-3, 2004, Reisensburg, Germany
  - Five scoping papers to guide decision making:
    - Hydrogen Production
    - Hydrogen Storage
    - Socio-Economic of Hydrogen
    - Fuel Cells
    - Codes and Standards
- September 22-25, 2004, Reykyavik, Iceland
  - Finalization of scoping papers
  - Advances in H_2 economy
  - Outreach and education
  - Stakeholder involvement
  - H_2 demonstration experience
- March 2005, SC Brazil

National Hydrogen Commitments

United States 

Committed $1.2 billion for first five years of long-term H_2 energy technology and infrastructure development.

European Union 

Committed up to € 2 billion to long-term R&D of renewable and H_2 energy technologies.

Japan 

Fuel cell and H_2 technology RD&D program has tripled since 1995.

Canada 

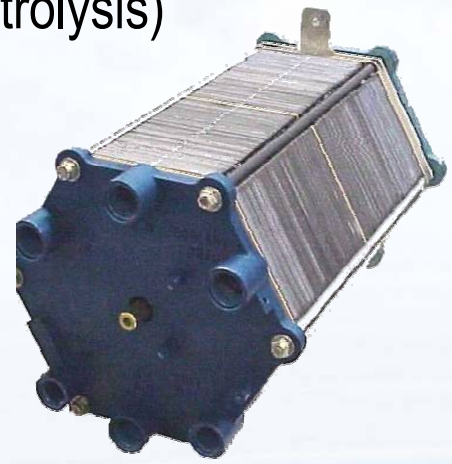
Completed fuel cell commercialization roadmap in March 2003; currently $40 million per year Federal support for hydrogen.

Initiated Roadmaps and Programs:
Australia, Brazil, China, France, Germany, Iceland, India, Italy, Republic of Korea, Norway, Russia, United Kingdom

Hydrogen RD&D

H_2 Production

- Fossil fuels
- Renewable sources (electrolysis)
- Photolytic, biological, and thermochemical



H_2 Storage

- Physical tank storage
- Hydrides
- Carbon structures

Fuel Cells

- Low and non-platinum catalysts
- High temperature membranes
- Stationary fuel processing
- Air, thermal, and water management

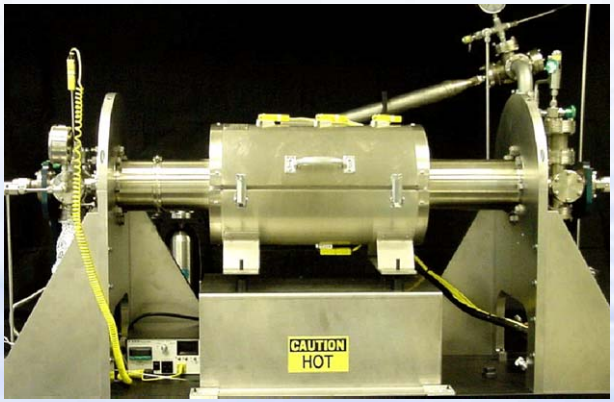
Validation

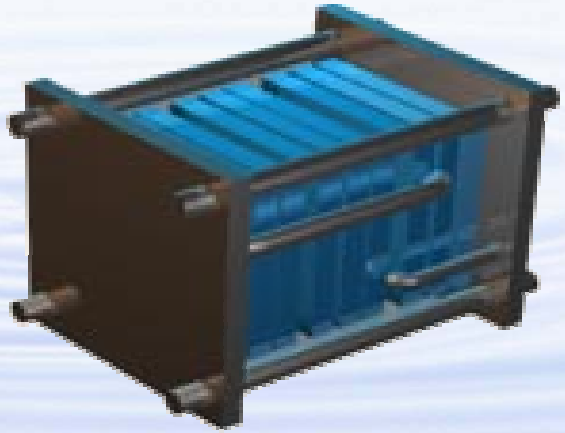
- “Learning” demonstrations
- Safety
- Codes and standards
- Education

Moving Toward a Hydrogen Economy: Next Steps

- Focus on distributed hydrogen infrastructure technologies
  - Natural gas reformers
  - Electrolyzers
  - Delivery systems

  } Capital cost, efficiency, durability improvements
- Exploratory R&D targeting critical hydrogen storage and fuel cell barriers
- Allow evolution of long-term hydrogen economy





Recent Hydrogen Awards

Hydrogen Storage - $150M over 5 years

- Three Centers of Excellence for exploratory research; individual projects to explore new materials for hydrogen storage ($25M in cost share) ***pending congressional appropriations***

Vehicle and Infrastructure "Learning" Demonstrations - $190M over 5 years

- Automobile/energy company teams will demonstrate integrated and complete system solutions in real world environments ($190M in cost share)

Fuel Cell Research

- **$75M over 3 years (FY03)** – catalyst and membrane R&D, stationary and back-up power systems, stationary fuel processing, BOP, analyses
- **$13M over 3 years** – consumer electronics, fuel cells for auxiliary power generation, and off-road fuel cell R&D ($9.5M in cost share)

Hydrogen Education - $4.5M over 5 years

- Curricula and teacher professional development, education materials, co-sponsorship of events ($800K in cost share)

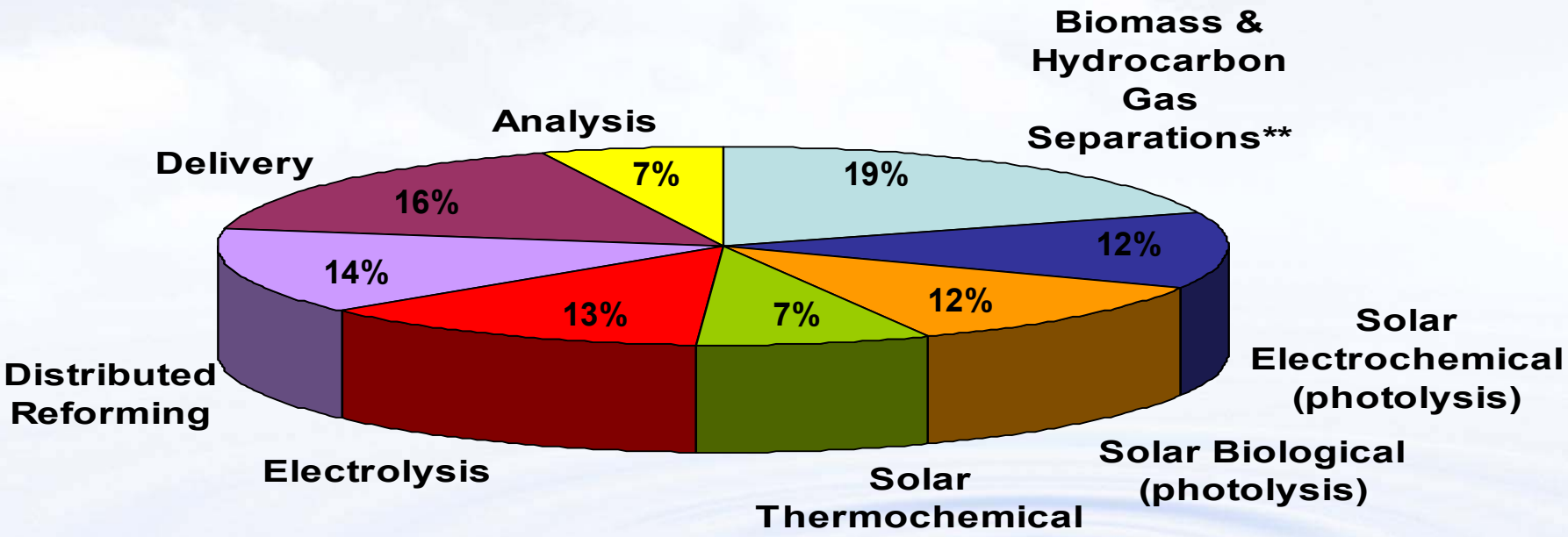
Note: Cost share amounts are in addition to government award amounts

Active Solicitations

- Production and Delivery –just announced
- Codes and Standards – Under review
- Coal-based Production – Opens this Fall
- Nuclear-based Production – 1-2 Qtr FY05
- Basic Research – 2005 Selections

Hydrogen Technology* Award Funding

Total with Cost Share = $102.54 Million
(Federal Share = $77.37 Million)



* Hydrogen Technology: Production, Delivery, and Analysis

** Hydrocarbon separation research co-funded with the Office of Fossil Energy

For More Information











www.eere.energy.gov/hydrogenandfuelcells

www.iphe.net