

PRESENTATION ON U.S. HYDROGEN PROGRAM

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Partnership for Advancing

the Transition to Hydrogen

Topics



- PATH
- Hydrogen Program History
- Current Program

pURPOSE



- Create a global community of interest in hydrogen
- Initial focus in the Pacific Rim

Objectives



- To identify and develop a community of interest among Members and address common issues
- To encourage a certain level of knowledge, activity and safety in hydrogen among PATH Members
- To assist interested hydrogen parties in countries which are not members to organize a hydrogen activity within their country and become a contributing member of the hydrogen community

Activities

(Beginning May 2002 – March 2003)



- Codes and Standards Rpt
- Mexican Workshop
- Formation of a Board Committee to develop a collective hydrogen vision

2003 Activities



- Country Workshop in China
- Potential demonstration projects
- Educational Activities

Technical Activities



- Update the codes and standards report
- Prepare a report that categorizes the CO₂ regulations and approaches to “greenhouse gas” reductions of member countries
- Develop a comprehensive vision for hydrogen energy based on the collective vision of members and PATH country workshops
- Catalyze the expansion of the *Hydrogen Sourcebook* to capture the Japanese experience

Early U.S. Hydrogen Program



- Started by four Universities with Political Clout
- Focus on Research
- Initial Funding 200k through NREL
- NHA initiated in 1988 by NASA and EPRI
- NHA funded by those organizations in the early years

Program Foundation (1990-2)



- Matsunaga Act (1990)
 - Required DOE to develop a hydrogen program & publish a plan
 - Required small scale hydrogen demonstration within 5 years
 - Required the formation of a Hydrogen Technical Advisory Committee to advise the Secretary of Energy on hydrogen policies & technology

Program Foundation (1990-2) Cont'd



- South Coast Air Quality Management District (1992)
 - Mandated that a certain percentage of cars be zero pollution vehicles by 1998
 - Action was opposed by auto industry
 - Date was delayed to 2002 and then further delay
 - Out of this conflict came the California Fuel Cell Partnership

Program Builds



- 1993 DOE develops hydrogen program plan- criticized for large scale demos in 2025; principle DOE focus is on hydrogen production research
- 1995 HTAP produced a hydrogen vision that presents a renewable hydrogen future
- 1996 Hydrogen Future Act is passed
 - Congressionally mandates HTAP and requires a report to Congress on Hydrogen and a complementary report by the Secretary of Energy on Hydrogen.
 - It sets authorization levels for the hydrogen program for the next five years at increasing funding levels.

Program Builds Cont'd



- 1996 NHA presented its Commercialization Plan
 - Provided a rationale for hydrogen
 - Set long and short term targets for hydrogen applications
 - In 1997, DOE realigns its program to conform to the Hydrogen Commercialization Plan
 - Not one of the near term Commercialization Plan goals has been achieved

DOE Program



- Funding builds from under \$5 million in 1996 to over \$20 millions over the 5 years
- The program continues a focus on research, but the emphasis is on projects that will have a nearer term impact
 - Program goals are set for passenger vehicles and become the prime focus of the program
 - On-board storage of hydrogen 6% by weight
 - Cost of hydrogen delivered to the vehicle approximately \$1.50/gallon equivalent
 - Price of the fuel cell \$35/kW with greater than a 5,000 hour life

Other DOE Programs



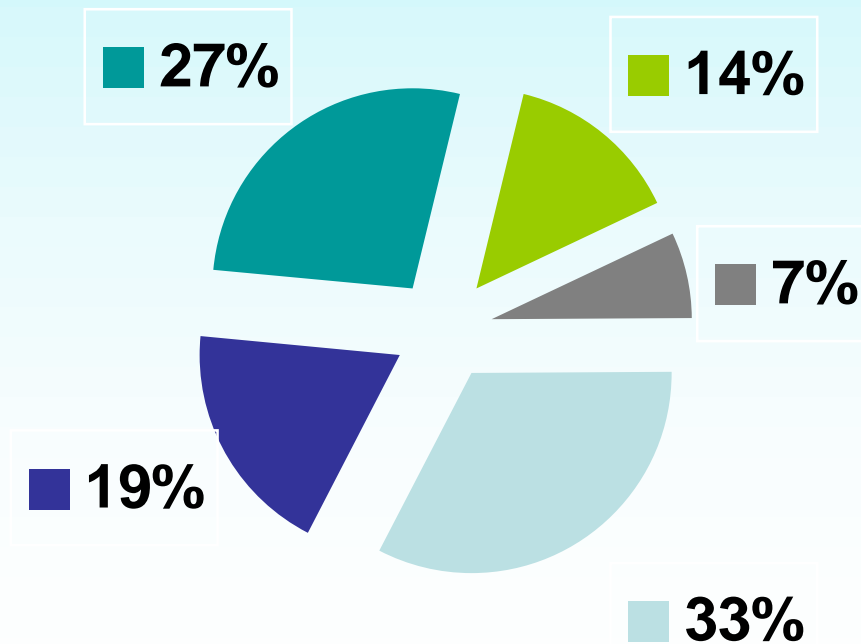
- Low Temperature Fuel Cell (PEM) in the transportation program funded at more than the hydrogen program (\$30 to \$80 million/yr from 1996 to 2000). Focus was on on-board reforming till 2002
- High Temperature Fuel Cell Program (MCFC and SOFC) in DOE's Fossil Energy Office (\$40 million/yr)
- PNGV which was to design a low pollution car which achieved 80/mpg (>\$100 million/yr)

Significant Recent Events



- ? PNGV becomes U.S. CAR with a mission to develop the components for a fuel cell hybrid vehicle operating on hydrogen (\$150 million/yr. FY 2003)
- ? Transportation and hydrogen program get combined to form the Hydrogen, Fuel Cells & Infrastructure Technology Program (\$90 million FY 2003) with a focus on Storage, Fuel Cells and Hydrogen Production
- ? High temperature fuel cells will be included in the Hydrogen, Infrastructure and Fuel Cell Program
- ? A workshop was held in 2002 to develop a National Hydrogen Energy Roadmap

Freedom car budget



- Fuel Cells
- Hydrogen and Infrastructure
- E/HEV Componentry
- Adv. Engines/Fuels
- Light Weight Materials

Las Vegas Hydrogen Refueling Station

Completed 5-year project resulting in design, construction, and demonstration of a multi-purpose refueling station with capability of:

- on-site H₂ production (natural gas reforming)
- hydrogen/electricity co-production system operating a 50kW PEM FC
- H₂/CNG blends and pure H₂ vehicle dispensers.

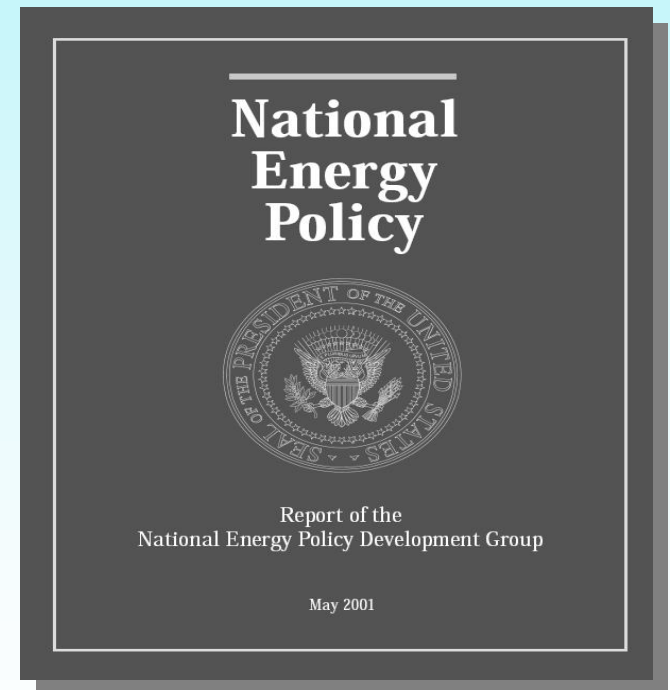


Dedicated November 2002

Future plans are to evaluate operability, reliability, economic feasibility, and to certify integrated power generation and vehicle refueling designs.

National Energy Policy

- Aggressively reduce demand through energy efficiency
- Increase energy supply
- Enhance diversity of energy sources
- Dramatically upgrade national energy infrastructure
- Build on record of environmental protection
- Create a new vision for our energy future



National Energy Policy



Directs the Secretary of Energy to:

“explore the possibility of a hydrogen economy...

“develop next generation technology including hydrogen...

“Focus research and development efforts on integrating current programs regarding hydrogen, fuel cells, and distribution...

Develop legislation to provide for a temporary income tax credit available for the purchase of new hybrid or fuel cell vehicles.”



Vehicle Program Strategy



- Develop technologies to enable mass production of affordable hydrogen-powered fuel cell vehicles and assure the hydrogen infrastructure to support them.
- Continue support for hybrid propulsion, advanced materials, and other technologies that can dramatically reduce oil consumption and environmental impacts in the nearer term.
- Instead of single vehicle goals, develop technologies applicable across a wide range of passenger vehicles.

Vehicle Program Strategy



- **Conduct R&D to solve critical path technologies**
 - Hydrogen Storage (7.5 wt%; 1100 W-h/l, \$5/kW-h)[Under discussion with FreedomCAR partners]
 - Hydrogen Production Cost (NG-based \$1.50/gge untaxed)
 - Fuel Cell Cost (2010:\$45/kW; 2015:\$30/kW)
- **Validate technology development through “learning” demonstrations**
 - Centrally fueled vehicles and production/refueling infrastructure
 - Power park concept
- **Lead codes and standards development**

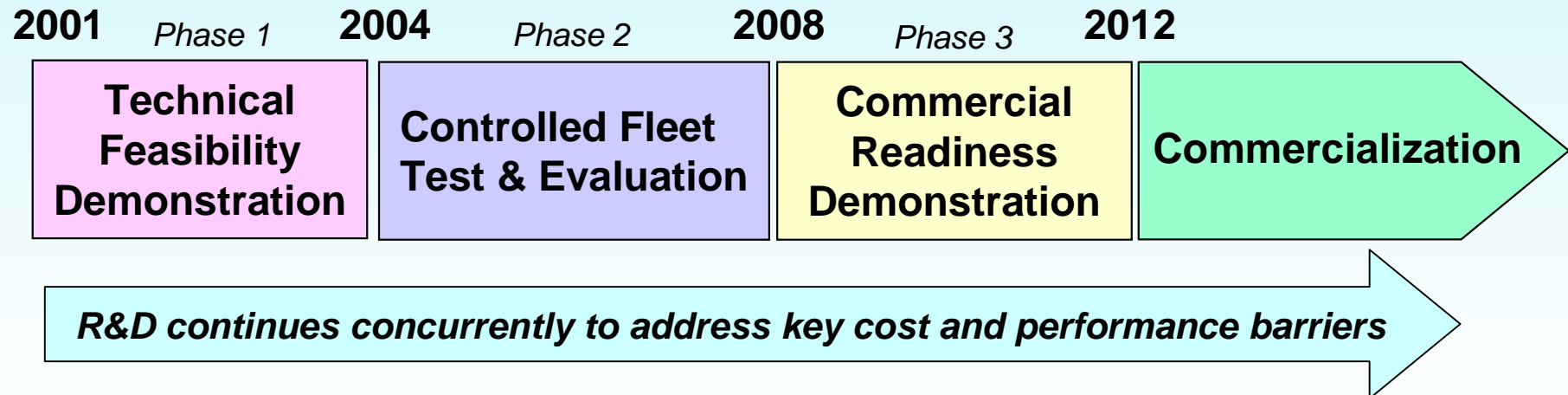
Field Demonstrations



Goal: To determine if investment is warranted in fuel cell vehicles and H₂ infrastructure technologies at commercial production volumes

Potential Demonstration Program

Potential Demonstration Program



- Subsequent phases only proceed if success criteria
- for the previous phase have been met.

U.S. International Activities on Hydrogen



- Japan- U.S. Science and Technology Cooperation on Climate Change
- DOE/EU Agreement for S&T Cooperation
- IEA Agreements
- International Code Activities including U.N. GRPE Working Party 29 GTRs for hydrogen and fuel cell technologies
- PATH