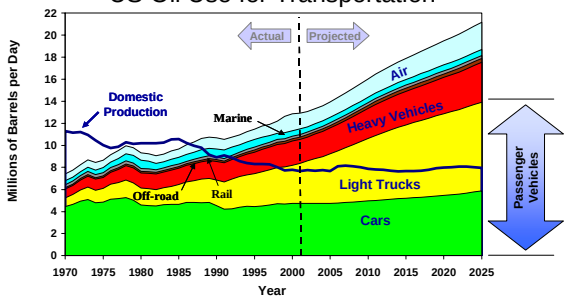
Department of Energy
Philadelphia Regional Office

Greening the Government
Conference
Hydrogen Transportation
Update
June 5, 2003

U.S. Energy Dependence is Driven By Transportation

US Oil Use for Transportation



Source: Transportation Energy Data Book: Edition 22, September 2002, and EIA Annual Energy Outlook 2003, January 2003

- **Transportation accounts for 2/3 of the 20 million barrels of oil our nation uses each day.**
- **The U.S. imports 55% of its oil, expected to grow to 68% by 2025 under the status quo.**
- **Nearly all of our cars and trucks currently run on either gasoline or diesel fuel.**

President Bush Launches the Hydrogen Fuel Initiative

"Tonight I am proposing $1.2 billion in research funding so that America can lead the world in developing clean, hydrogen-powered automobiles.

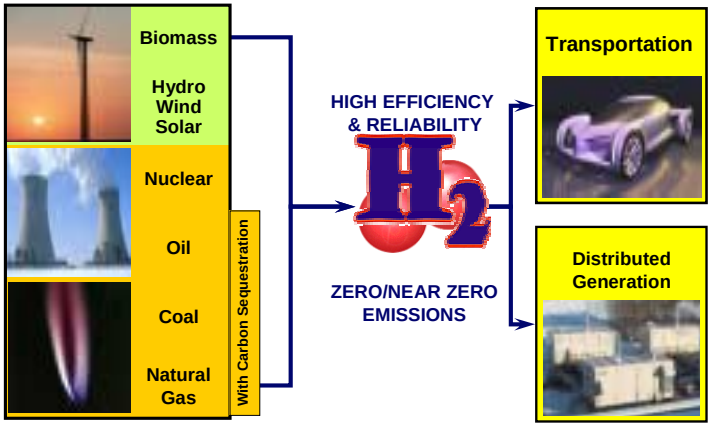
"A simple chemical reaction between hydrogen and oxygen generates energy, which can be used to power a car producing only water, not exhaust fumes.

"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.

"Join me in this important innovation to make our air significantly cleaner, and our country much less dependent on foreign sources of energy."

2003 State of the Union Address
January 28, 2003

Why Hydrogen? It's abundant, clean, efficient, and can be derived from diverse domestic resources.



The President's FY04 Budget Request for FreedomCAR and Hydrogen Fuel Initiatives

Organization	Million $
Hydrogen, Fuel Cells & Infrastructure Technologies Program (EERE)	165.5
FreedomCAR and Vehicle Technologies Program (EERE)	91.1
Office of Fossil Energy (FE)	11.5
Office of Nuclear Energy, Science and Technology (NE)	4.0
Department of Transportation (RSPA)	0.7
Total	***272.8***

President's Hydrogen Fuel Initiative Complements FreedomCAR

- Freedom from foreign petroleum dependence
- Freedom from pollutant and carbon dioxide emissions
- Freedom for Americans to drive where they want, when they want, in the vehicle of their choice
- Freedom to obtain fuel affordably and conveniently

On January 9, 2002, Energy Secretary Abraham announced the FreedomCAR Partnership

FreedomCAR and Fuel Initiative

H_2

President's FreedomCAR and Fuel Initiatives

DOE partners with USCAR and energy companies to develop hydrogen and fuel cell technologies simultaneously:

- FreedomCAR focuses on fuel cell vehicle and hybrid component technologies
- Hydrogen Fuel Initiative focuses on hydrogen storage and production and delivery infrastructure technologies

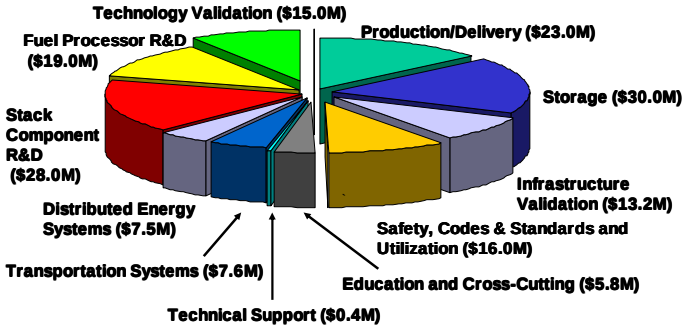
Government leadership will help advance commercialization of hydrogen fuel cell vehicles and infrastructure by 15 years, from approximately 2030 to 2015.

Hydrogen Infrastructure and Fuel Cell Technologies put on an Accelerated Schedule

- **President Bush commits $1.7 billion over first 5 years:**
  - $1.2 billion for hydrogen and fuel cells RD&D ($720 million in new money)
  - $0.5 billion for hybrid and vehicle technologies RD&D
- **Accelerated, parallel track enables industry commercialization decision by 2015.**

Fuel Cell Vehicles in the Showroom and Hydrogen at Fueling Stations by 2020

FY04 EERE Hydrogen and Fuel Cell Budget Request (Key Activities)



Total FY 04 Request $165.5M

Hydrogen, Fuel Cells and Infrastructure Technologies Program

Program Focus: Research, develop, and validate fuel cell and hydrogen production, delivery and storage technologies for transportation and stationary applications

Major Activities	FY02 Approp.	FY03 Approp.	FY04 Request
Hydrogen Production & Delivery	$11.2M	$11.8M	$23.0M
Hydrogen Storage	$6.1M	$11.3M	$30.0M
Safety, Codes & Standards, Education	$5.9M	$6.8M	$21.8M
H2 Infrastructure/FC Vehicle Demo	$5.7M	$11.9M	$28.2M
Fuel Cell Systems & Components	$46.7M	$53.7M	$62.5M
TOTAL	**$75.6M**	**$95.5M**	**$165.5M**

Highlights

- Advanced production technologies (reforming, separation, photoelectro-chemical, photobiological, electrolysis)
- Solid-state hydrogen storage materials (carbon, hydrides, etc.)
- Safety, performance & connectivity standards for hydrogen fueled devices
- Integrated fuel cell vehicle and hydrogen infrastructure technology validation
- Fuel cell stack component cost reduction (catalyst & membrane) and stationary systems development

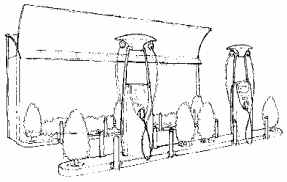
Penn State University Fueling Project

- Overview:
  - **U.S. DOE-Funded Program with cost-share**
- Goal:
  - **To achieve cost viability for a stand-alone, fully integrated,** H2 Fueling Station **based on reforming of natural gas.**
- Project Duration:
  - **9 Quarters**
- Estimated Funding:
  - **$ 7.1 MM Program**
- Contractors:
  - **APCI**
  - **Subcontractors: Development Partners, Penn State**

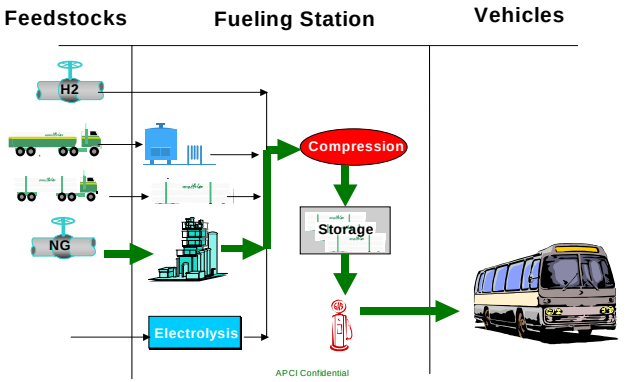
Project Plans and Milestones

- Phase 1 – Conceptual Design and Economic Evaluation
  - **Formulated & costed subsystem conceptual designs**
  - **Chose partners for development**
  - **Passed "Stage-Gate" meeting with DOE & APCI**
  - **We believe we can demonstrate the roadmap to providing H2 fuel equivalent to gasoline prices**
  - 1 Oct 2002 to 30 Jun 2002 --- Completed.
- Phase 2 – Subsystem Development
  - **Develop Subsystems and Test Components**
  - **Advancements in every aspect of station**
  - **Station aesthetics work has begun** **We Are Here**
  - **Recommend optimal integrated fueling station components**
  - 1 July 2002 to 31 Mar 2003
- Phase 3 – System Deployment
  - **Scale-up & detailed engineering**
  - **Fabricate & install at Penn State**
  - **Operate and Test – Vehicles Filled.**
  - 1 Apr 2003 to 31 Dec 2003 – Design, Fabricate, & Install
  - Jan 2004 to Jun 2004 - Operation/Testing

Progress on the Station



H2 Fueling Station at Penn State



Goals and Objectives

- **To demonstrate the economic and technical viability of a stand-alone, fully integrated H2 Fueling Station**
  - **Optimum system to compress, store, meter, and dispense H2 into vehicles**
  - **To build on the learnings from the Las Vegas H2 Fueling Energy Station program**
- **To demonstrate the operation of the fueling station at Penn State University**
- **To obtain adequate operational data to provide the basis for future commercial fueling stations**
- **To maintain safety as the top priority in the fueling station design and operation**

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