



**U.S. DEPARTMENT OF  
ENERGY**

# **Hydrogen from Coal Program Overview and Accomplishments**

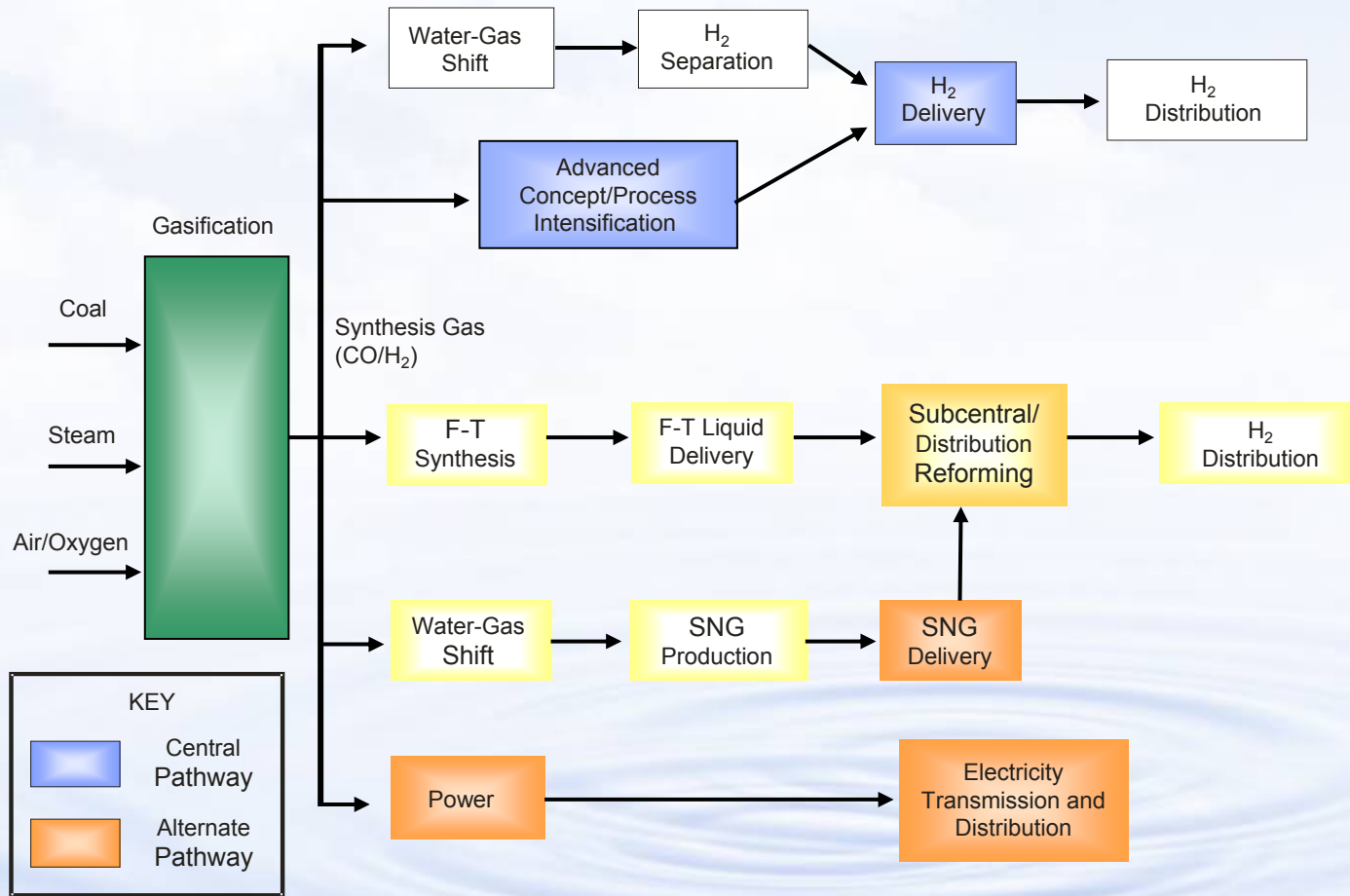
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U.S. Department of Energy**

**2006 DOE Hydrogen Program  
Merit Review and Peer Evaluation Meeting**

**May 16, 2006**

# Hydrogen from Coal Pathways



# Hydrogen from Coal: Technology Challenges

## ● Reduce the cost/improve efficiency

### → Clean synthesis gas production

- Advanced gasification
- Oxygen production
- Advanced gas cleaning

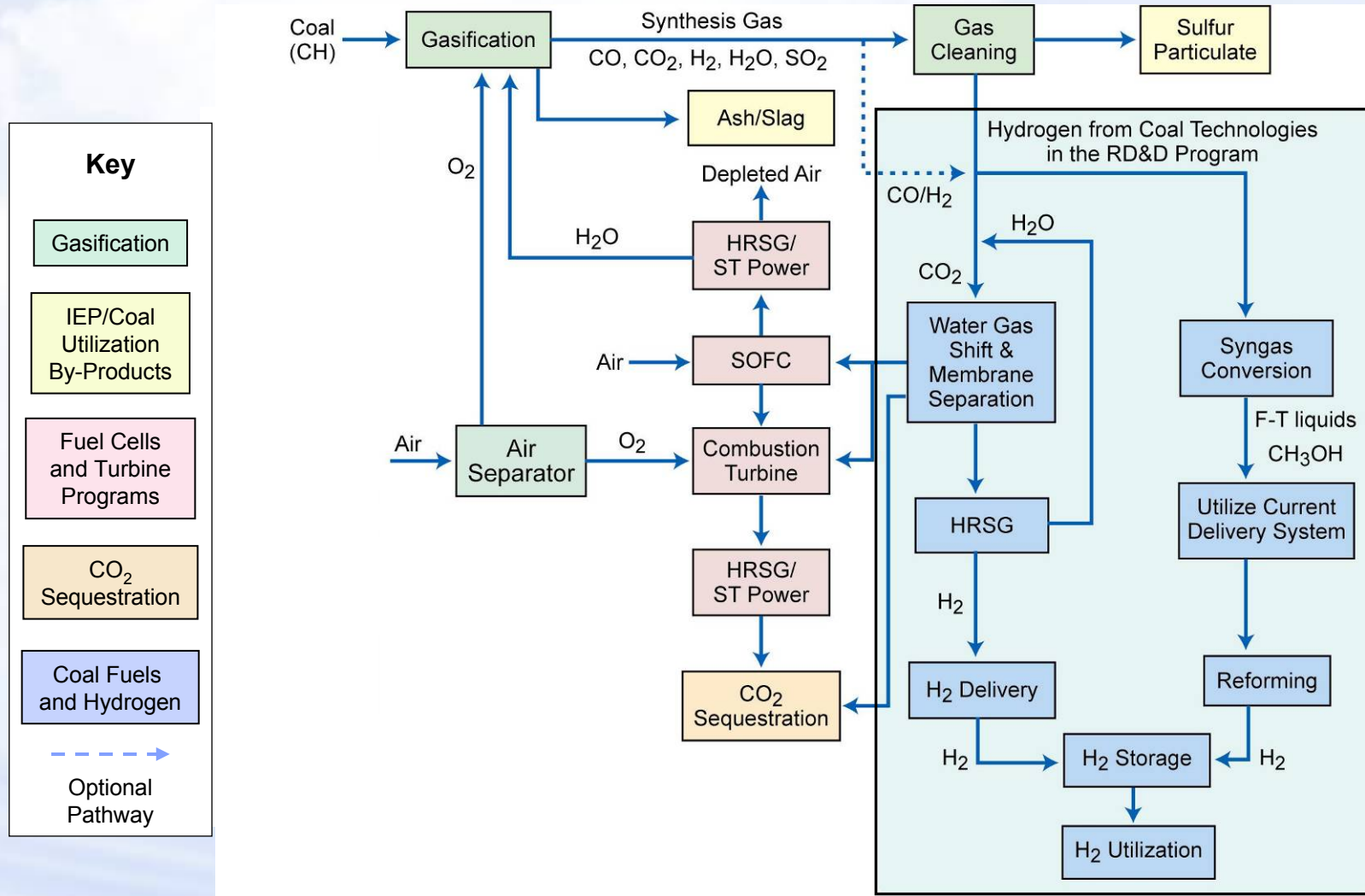
### → Hydrogen separation & purification

### → Process intensification

## ● Capture and store carbon

## ● Integrate technologies into FutureGen

# Hydrogen from Coal: Technology



# Hydrogen from Coal: Research Areas

Research Area*	Number of Projects
Membrane research	6
Module scale-up	1
Membrane reactors & process intensification	7
CO <sub>2</sub> removal	1
Novel sorbent	1
Co-production	4
Liquid H <sub>2</sub> carriers	4
Storage	3
Utilization	5
<b>TOTAL</b>	<b>32</b>

\* Complementary projects are supported by the Gasification and Sequestration Programs

**FY 2007 Budget Request \$22.1 M**  
**FY 2006 Appropriation \$ 28.7 M**  
**FY 2005 Appropriation \$ 17.0 M**

# Hydrogen From Coal: Goal

*Facilitate the transition to a sustainable hydrogen economy through the use of coal, our largest domestic fossil resource*

## Objectives

### ● *Production: Central Pathway*

→ By 2015, demonstrate a 60% efficient, zero-emission, coal-fueled hydrogen and power co-production facility that reduces the cost of hydrogen by 25% compared to current coal-based technology.

### ● *Production: Alternative Hydrocarbon Pathway*

→ By 2011, an alternative hydrocarbon pathway and reforming system for sub-central/decentralized hydrogen from coal is available.

# FY2005 Accomplishments

- **Completed update of the Hydrogen from Coal RD&D Plan – September 2005**
- **Sampling of Project Accomplishments**
  - ➔ **Media and Process Technology, Inc.: H<sub>2</sub> Production via a Commercially-Ready Inorganic Membrane Reactor**
    - 100-hour field test of a carbon sieve-based membrane
    - Showed excellent H<sub>2</sub> selectivity and permeance in presence of H<sub>2</sub>S, NH<sub>3</sub>, and hydrocarbons
    - Can potentially combine WGS, separation, CO<sub>2</sub> capture, and contaminant removal in single step
    - Mathematical model developed is consistent w/experimental data

# FY2005 Accomplishments (cont.)

## ● Sampling of Project Accomplishments (cont.)

### → Siemens Power Corp.: Novel Gas Cleaning and Conditioning for IGCC

- 10 tons/day pilot plant test at Gas Tech. Inst.
- Pre-combustion gas-cleaning concept
- Reduced contaminant levels to 10-50 parts per billion by volume

### → NETL: Novel Hydrocarbon Reforming Catalyst for Synthesis Gas Production

- Demonstrated exceptionally stable performance of a hydrocarbon reforming catalyst
- Catalyst is expected to be more robust and tolerant of carbon and sulfur



# FY2006 Activities

- **Four new projects awarded in co-production to improve plant economics**
  - **Research Triangle Institute (H<sub>2</sub>-Electricity Co-production)**
    - Reduction and oxidation of iron-based catalysts to process coal-derived synthesis gas
  - **Research Triangle Institute (Substitute Natural Gas (SNG)-Electricity Co-production)**
    - Pre-processing conversion of coal to gaseous mixture followed by conversion to SNG
  - **Arizona Public Service (SNG-Electricity Co-production)**
    - Utilizing hydro-gasification technology
  - **West Virginia University Research Corp. (Novel products to improve economics)**
    - Utilizes small amount of produced hydrogen to co-produce high-value industrial products

# FY2006 Activities (cont.)

## ● Recent Solicitations

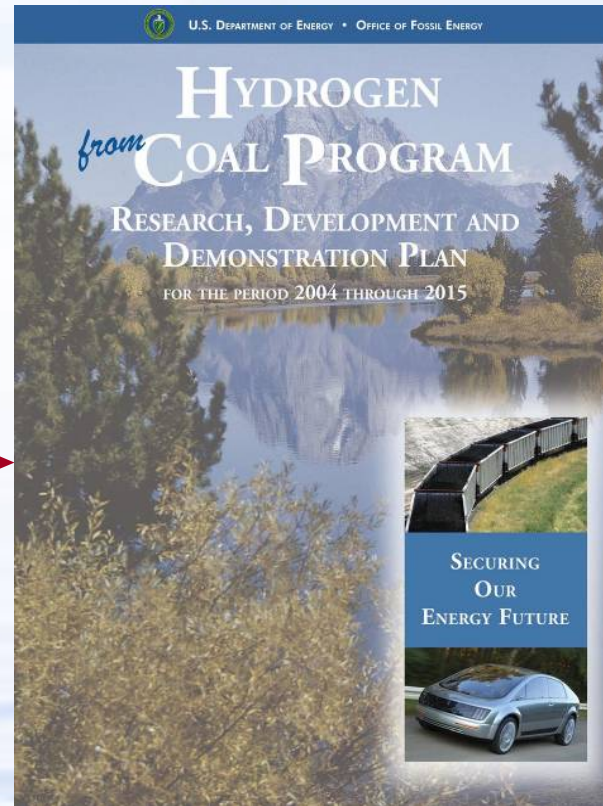
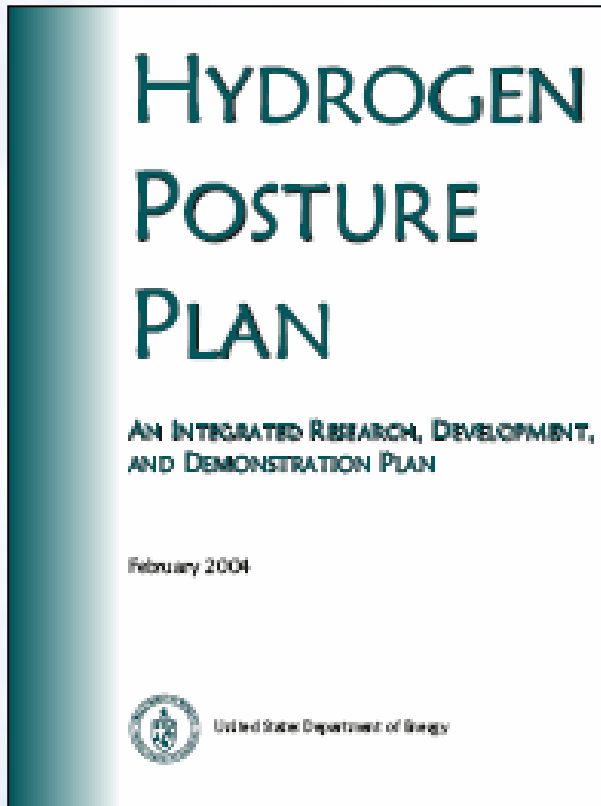
### → Central Production

- Two areas of focus: Novel polishing filters and process intensification
- Closes June 8, 2006

### → Alternate Production and Utilization

- Closed on May 11, 2006

# *Hydrogen from Coal – Clean, Secure, Affordable Energy for the Future*



<http://fossil.energy.gov/programs/fuels/>