

Hydrogen Production and Delivery Program Element

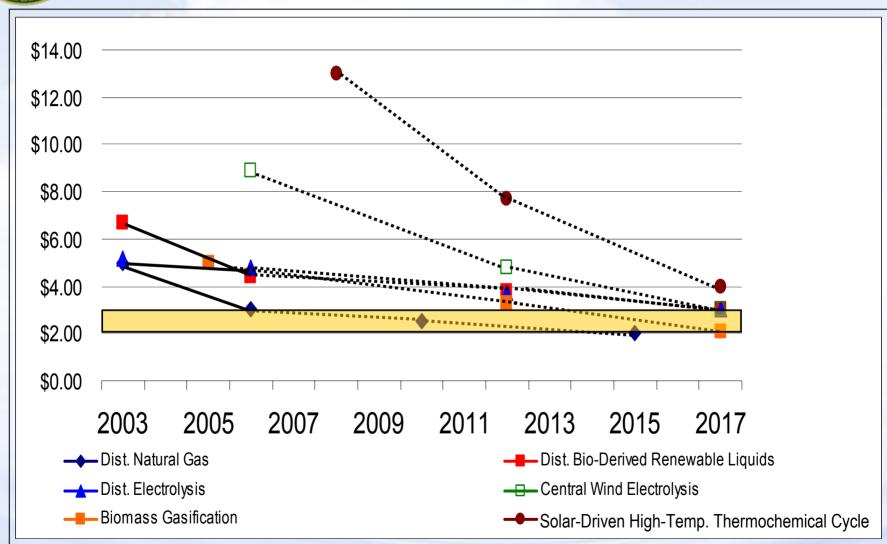
Roxanne Garland

2007 DOE Hydrogen Program

Merit Review and Peer Evaluation Meeting



Production Pathways & Targets (EERE)





Delivery Goals and Objectives

By 2017, develop technologies to reduce the cost of hydrogen delivery from the point of production to the point of use in vehicles or stationary power units to <\$1.00/kg of hydrogen

- By 2007, define the criteria for a cost-effective and energy-efficient hydrogen delivery infrastructure.
- By 2010, develop technologies to reduce the cost of compression, storage, and dispensing at refueling stations and stationary power sites to <\$0.80/kg of hydrogen. By 2015, reduce this cost to <\$0.40/kg.
- By 2012, develop technologies to reduce the cost of hydrogen delivery from central and semi-central production facilities to the gate of refueling stations and other end users to <\$0.90/kg of hydrogen. By 2017, reduce this cost to <\$0.60/kg.

Timing has been delayed by 2 years due to Congressional Earmarks and limited appropriations (except refueling site delivery).



Distributed Reforming Hydrogen Production Pathway Projects

Natural Gas

Low Cost Hydrogen Production Platform

Praxair

Low-Cost Hydrogen
Distributed Production
System
H2Gen

Integrated Hydrogen Production, Purification & Compression Linde (BOC)

Integrated Short Contact
Time Hydrogen Generator
GE Global Research

Bio-Derived Liquids

Bio-Derived Liquids
Reforming

PNNL

Biomass-Derived Carbohydrates via Aqueous-Phase Reforming

Virent

Investigation of Bio-Ethanol Steam Reforming Over Cobalt

Ohio State

Distributed Bio-Oil Reforming

NREL

High-Pressure Ethanol Reforming **ANL**

Separation and Purification

Zeolite Membrane Reactor for Water-Gas-Shift

Arizona State

Carbon Molecular Sieve Membrane Reactor

Media & Process

High-Performance, Durable, Pd-Alloy Membrane Pall Corporation

t an oorporation

I

ptograted Coromic

Integrated Ceramic Membrane System

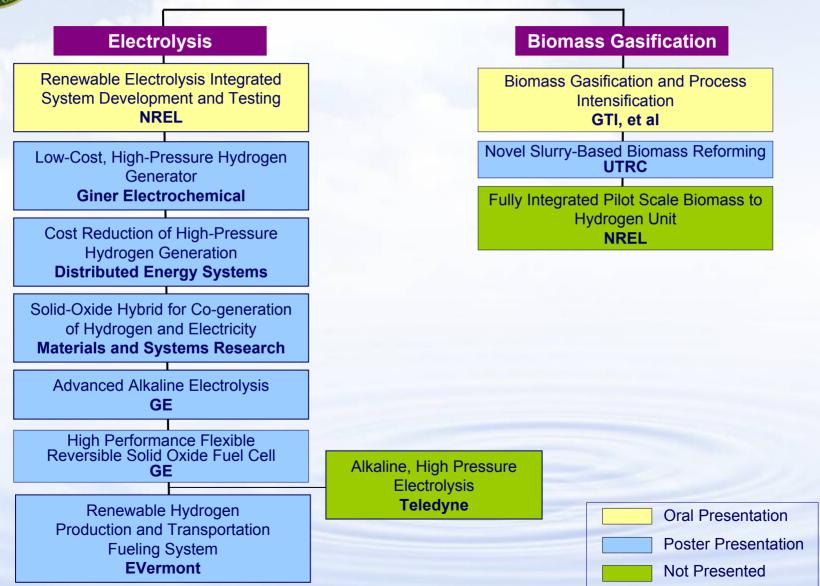
Praxair

Low-Temperature
Ion Transport Membrane
ORNL





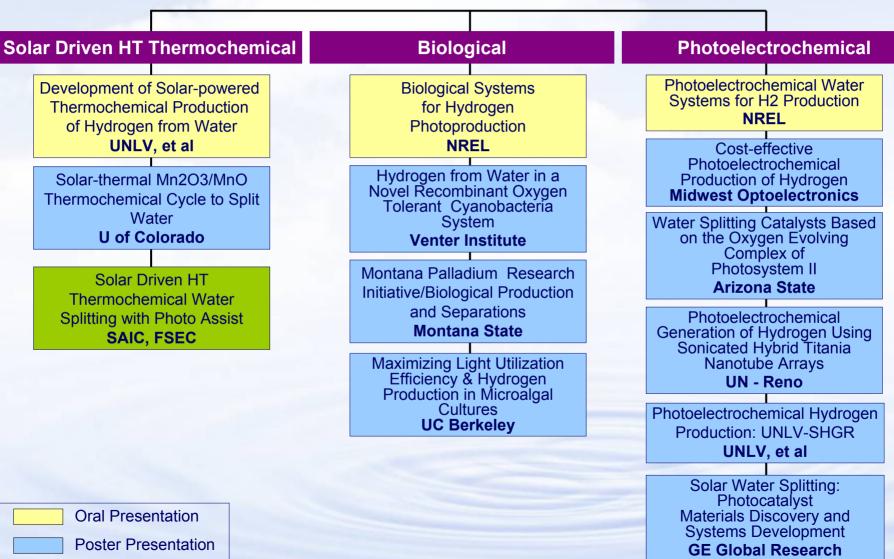
Electrolysis and Biomass Gasification Projects





Not Presented

Longer Term Pathway Projects





Coal Hydrogen Central Production Pathway Projects



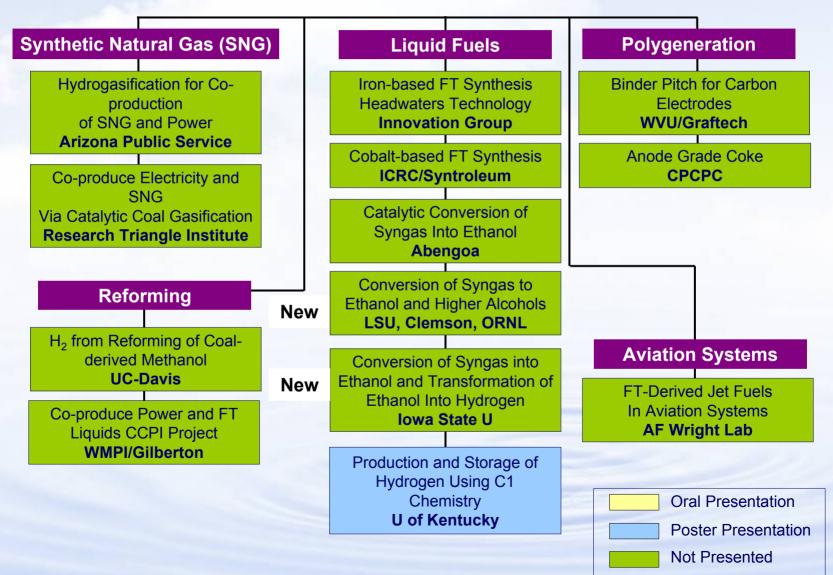
Oral Presentation

Poster Presentation

Not Presented



Coal Hydrogen Pathway Related Projects





Nuclear Hydrogen Production Pathway Projects

High Temperature Thermochemical

Sulfur-lodine Thermochemical Cycle Laboratory-Scale Experiment SNL/GA/CEA

Hybrid Sulfur Thermochemical Process Development SRNL

Evaluation of Alternative Thermochemical Cycles

ANL

Catalyst and Membrane Studies for Thermochemical Cycles INL

Corrosion Studies of Metallic Materials for Thermochemical Cycles

General Atomics

High Temperature Electrolysis

Laboratory-Scale High-Temperature Electrolysis System

INL/ANL/Ceramatec

Test of HighTemperature Electrolysis ILS Half Module Ceramatec

Modeling and Diagnostics of HTE Components

ANL

Materials Issues and
Experiments for HTE and
SO3 Electrolysis
ANL

Membrane Development for Hybrid Sulfur Electrolysis and Oxygen Separation SNL

System Interfaces Supporting Systems

Nuclear Reactor/
Hydrogen Process Interface
INL

HyPEP Model Development INL

UNLV High Temperature Heat Exchanger Development UNLV

Membrane Applications for Nuclear
Hydrogen Production Processes
ORNL





Hydrogen Delivery Projects

Delivery Analysis

Hydrogen Delivery
Infrastructure
Options Analysis and H₂A
Delivery Models
Nexant

Liquefaction

Advanced Liquid H2
Production Techniques
GEECo

Compression

DG Integrated Hydride Compression Linde (BOC)/HERA

Centrifugal Compressor MITI

Pipelines

Fundamentals and Modelling of Pipeline Hydrogen Embrittlement
University of Illinois

FRP Hydrogen Pipeline
ORNL/SRNL

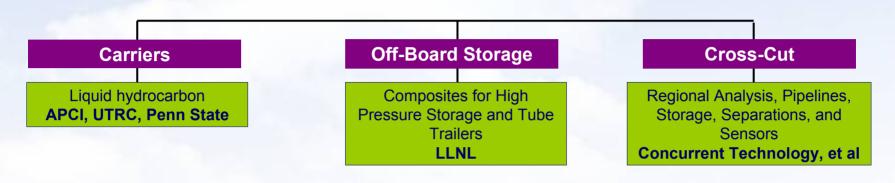
Materials Solutions for Hydrogen Delivery in Steel Pipelines SECAT Collaboration

H2 Permeability and Embrittlement of Welds/HAZ ORNL/SRNL





Hydrogen Delivery Projects





Additional Projects/Crosscutting

- Photobiological Hydrogen Research, FIU
- Developing Improved Materials to Support the Hydrogen Economy, Edison Materials Tech Center
- Production of Hydrogen for Clean and Renewable Sources of Energy for Fuel Cell Vehicles, University of Toledo
- Adapting Planar Solid Oxide Fuel Cells for Distributed Power Generation, Ohio University
- Production, Fuel Cell, and Delivery Research, University of South Florida
- Ohio Distributed Hydrogen Project, Ohio University
- Generation and Solid Oxide Fuel Cell Carbon Source Sequestration in Northwest Indiana, NiSource