Nuclear Hydrogen Initiative Overview

David Henderson

Office of Nuclear Energy, Science and Technology

DOE Hydrogen Program Review

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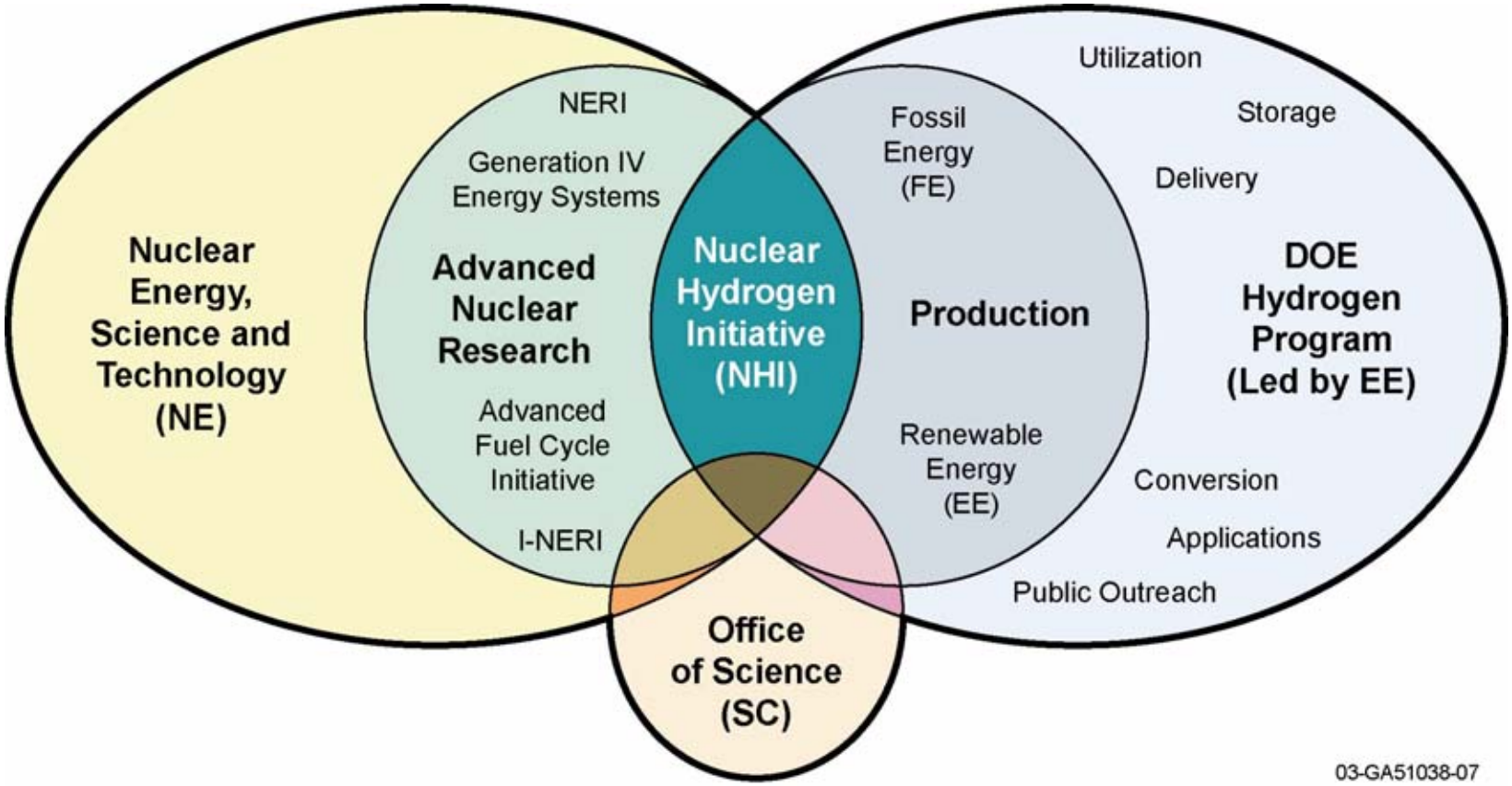
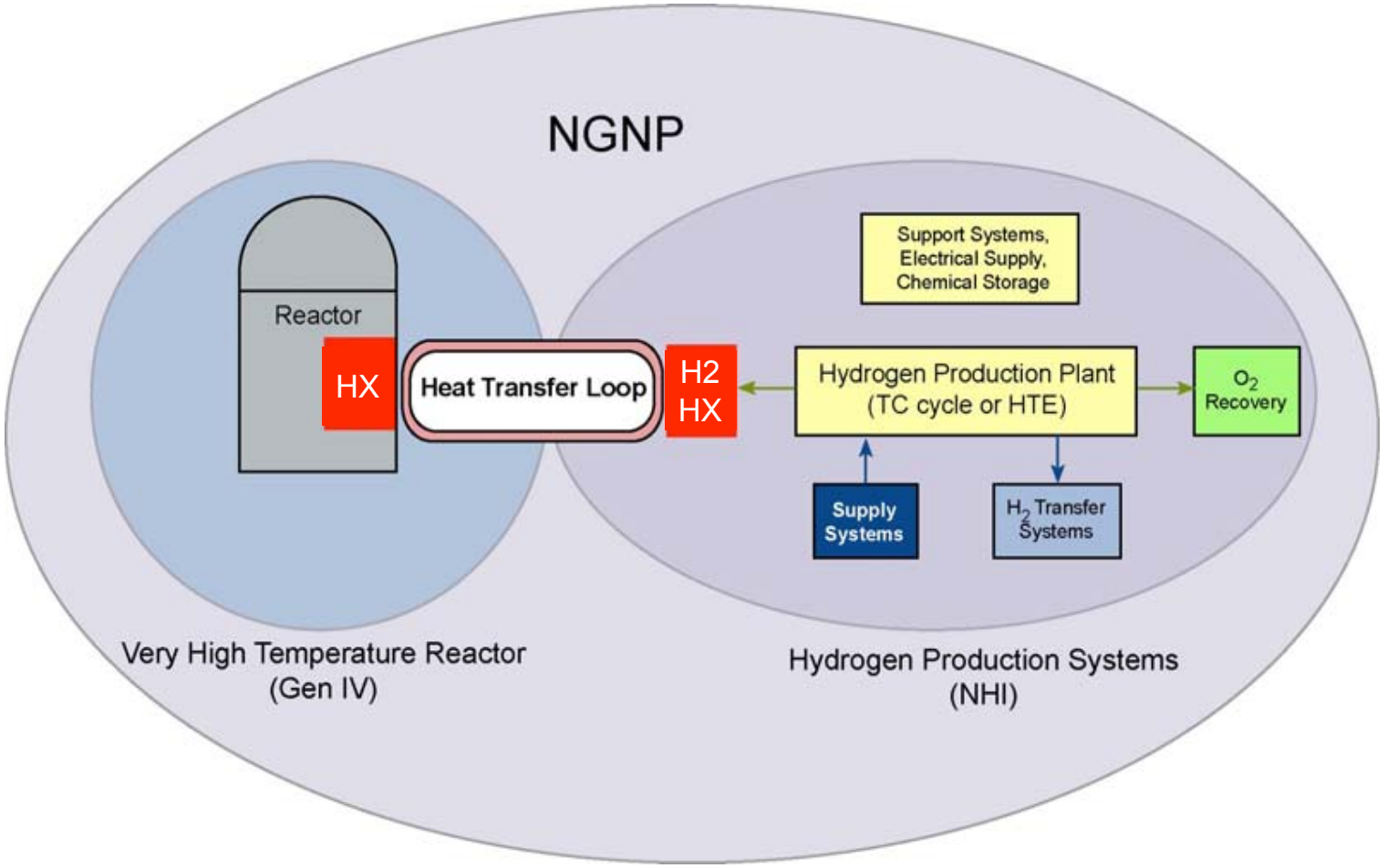
Nuclear Hydrogen Initiative

- **The goal of the Nuclear Hydrogen Initiative (NHI) is to demonstrate the commercial-scale production of hydrogen using nuclear energy by 2017.**

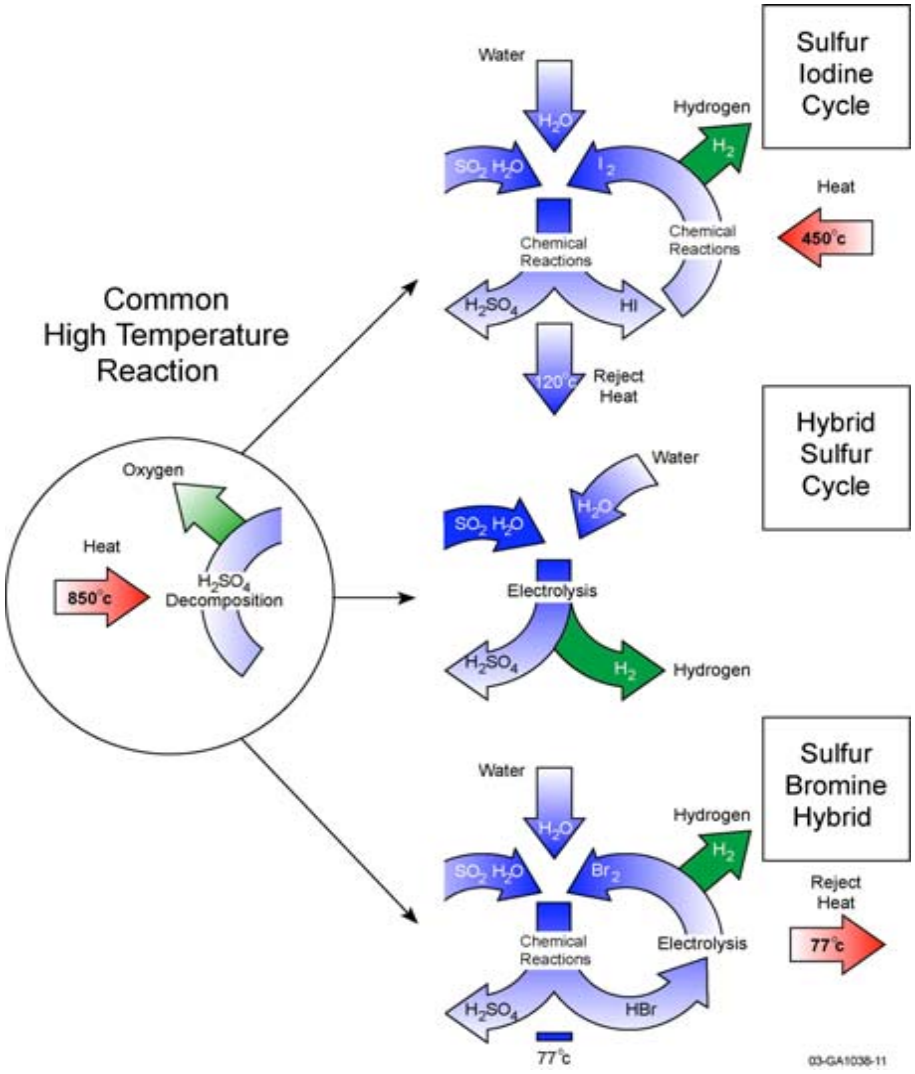


Coupled Nuclear-Hydrogen System



Methods for Nuclear Hydrogen Production

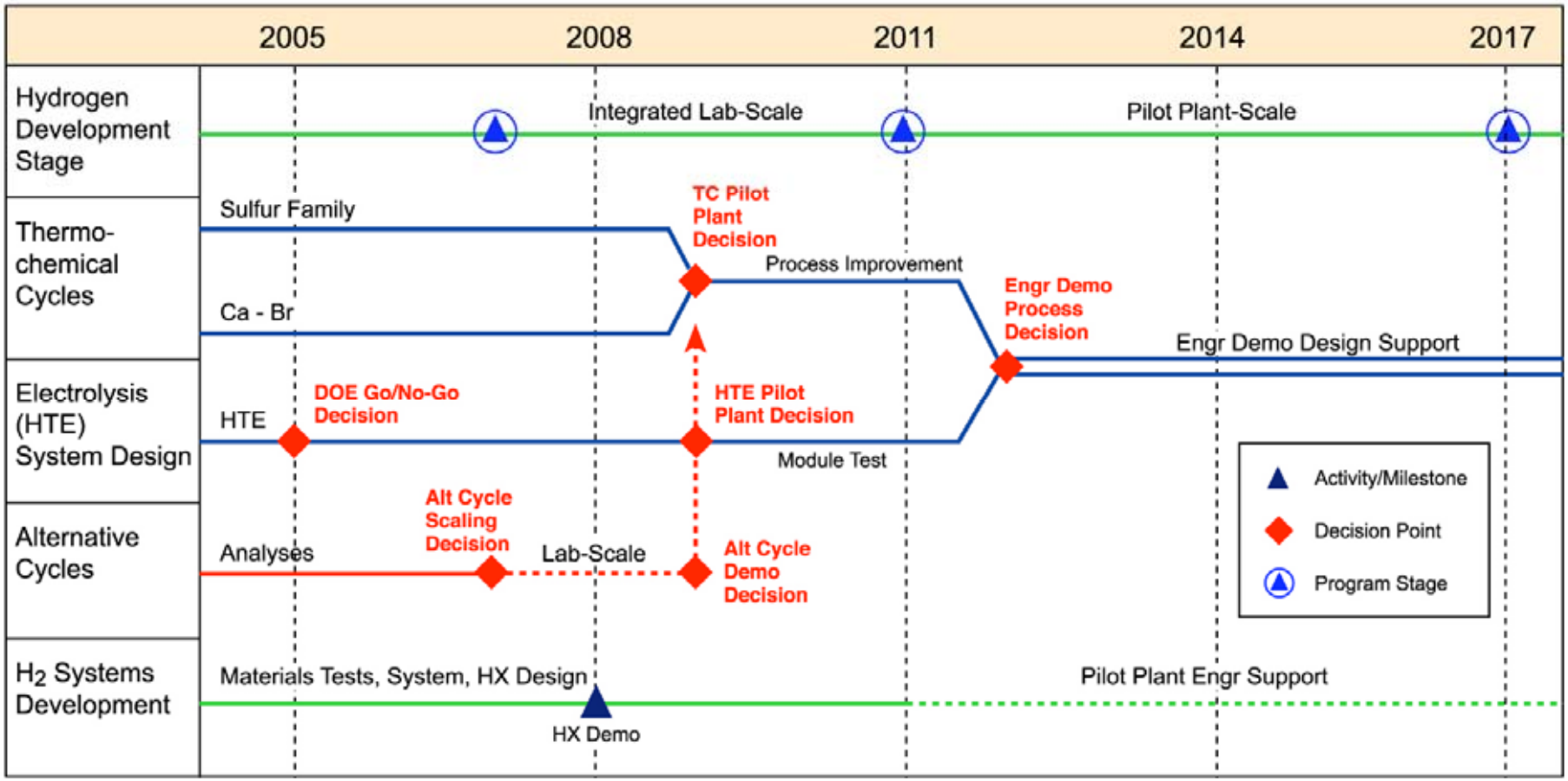
- **Electrolysis - Existing electric generation efficiencies of 33% in today's light water reactors will be improved to 40-50% through advanced and next-generation (Gen IV) reactors**
- **Steam-Methane Reforming - Heat from nuclear reactor would replace fossil heat source used in commercial process**
- **Thermochemical (TC) Cycles - Use high temperature heat from an advanced reactor to drive chemical reactions which break down water into H_2 & O_2**
- **Hybrid Cycles – Use electricity to electrolyze a chemical product using high temperatures from an advanced reactor.**



Nuclear Hydrogen R&D Plan

- **Completed in September 2003**
- **Primary topics discussed in the R&D Plan**
  - Thermochemical Processes
  - High-Temperature Electrolysis
  - Alternative Methods
  - Balance of Plant
- **Two-tiered approach to reduce development risk**
  - Baseline processes
  - Alternate processes
- **Three-phased scaling approach**
  - Laboratory-scale (<5 kW)
  - Pilot plant (500 kW – 1 MW)
  - Engineering-scale (20-50 MW)

Major R&D in the NHI



Principal Technical Barriers

- **High-temperature, corrosion resistant materials - R&D will be required to develop, test, and verify materials capable of performing at high temperatures (400-950°C) in the presence of caustic chemicals to ensure the safety and economics of the facility.**
- **High-temperature heat exchangers – Research is needed to design heat exchangers to transfer heat from an intermediate heat loop to the process at high temperatures, high pressures, and in harsh chemical environments**
- **Chemical reaction data - Research is needed on basic chemical reaction data (equilibrium constants, reaction rates, etc.) to better determine the operating parameters of the thermochemical system**
- **System design – Studies are needed to study the hydrogen plant and its relationship to the reactor, including configuration options and operating conditions, system isolation issues, and intermediate heat transfer loop design.**

NHI Program Funding

Fiscal Year	FY 2004 Appropriation*	FY 2005 Request
Thermochemical Cycles	$3.0	$5.0
High-Temperature Electrolysis	$2.0	$2.5
Systems Interface / Other	$1.1	$1.5
Total NHI R&D	$6.1**	$9.0

* $2 million earmark to University of Nevada, Las Vegas

**After Budget Reductions and SBIR