Nuclear Hydrogen Initiative Overview

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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 H₂ & O₂
- 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



03-GA51038-09



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