NREL FCHT Program Introduction

DOE Electrolysis Workshop

February 27-28

Keith Wipke, Fuel Cell & Hydrogen Technologies Laboratory Program Manager
Dedicated Solely to Advancing Energy Efficiency and Renewable Energy

- Physical Assets Owned by the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy
- Operated by the Alliance for Sustainable Energy under Contract to DOE
- 2400 staff and world-class facilities
- More than 350 active partnerships annually
- Campus is a living model of sustainable energy
Scope of Mission

Energy Efficiency
- Residential Buildings
- Commercial Buildings
- Personal and Commercial Vehicles

Renewable Energy
- Solar
- Wind and Water
- Biomass
- Hydrogen
- Geothermal

Systems Integration
- Grid Infrastructure
- Distributed Energy
- Interconnection
- Battery and Thermal Storage
- Transportation

Market Relevance
- Industry
- Federal Agencies
- State and Local Governments
- International
NREL FY2012 Program Funding by Source

$352M

- Solar Energy, 67.6%
- Wind & Water Power, 43.1%
- Vehicle Technology, 24.2%
- Building Technologies, 34.7%
- Other Federal Agencies, 32.2%
- Electric Delivery & Energy Reliability, 3.8%
- Office of Science, 17.7%
- Other DOE, 6.8%
- Non Federal Funding (WFO), 19.3%
- Geothermal Technology, 4.6%
- EERE Pgm Support, 2.3%
- EERE Strategic Programs, 7.6%
- Federal Energy Mgmt Prg, 6.0%
- Other Federal Agencies, 32.2%
- Hydrogen Technologies, 15.9%
- Industrial Technology, 0.7%
- Weatherization & Intergovernmental Program, 2.4%
NREL FCHT Program Objectives

• Maintain a robust portfolio of technology development activity in hydrogen production, hydrogen delivery, hydrogen storage, and fuel cells that grows out of advances in scientific underpinnings and is informed by rigorous analysis.

• Enable more rapid penetration of fuel cell and hydrogen technologies into the marketplace by partnering with industry in evaluating and optimizing integrated energy systems and in helping to overcome barriers in codes and standards.

• Provide analysis to DOE to guide its portfolio selection, to NREL to guide our RD&D, and to the energy analysis and investment communities to convey the role of fuel cells and hydrogen in the national energy sector.
DOE Fuel Cell Technologies Office Structure

Basic & Applied Research and Technology Development

Hydrogen Fuel R&D
- Production
- Delivery
- Storage

Fuel Cell R&D

Technology Validation

Market Transformation

WIDESPREAD COMMERCIALIZATION ACROSS ALL SECTORS
- Transportation
- Stationary Power
- Auxiliary Power
- Backup Power
- Portable Power
NREL Fuel Cell & Hydrogen Technologies Program

- Hydrogen production and delivery
- Hydrogen storage
- Fuel cells
- Fuel cell manufacturing R&D
- Technology validation
- Market transformation
- Safety, codes and standards
- Systems analysis
Wind-to-Hydrogen at NREL

10 kW Photovoltaics

100kW Wind Turbine
Northern Power Systems

AC-DC Converter

Excess Grid-Compatible Electricity

Utility Grid

ASCO Transfer Switch

AC Power

60 kW ICE Genset
Hydrogen Engine Center

DC-DC Converter

H20GEN 40RE (PEM) Electrolyzer
Proton Energy Systems
2.2 kg/day

OR

AC-DC Converter

H-Series (PEM) Electrolyzer
Proton Energy Systems
13 kg/day

AC-DC Converter

Hydrogen Output (100-200psi)

Berkeley 10kW
Wind Turbine

Compression to 3500psi
Pressure Products Industries

115 kg Hydrogen Storage Capacity at 3500 psi
CP Industries

Compression to 6000psi
Pressure Products Industries

115 kg Hydrogen Storage Capacity at 6000 psi
FIBA Technologies

H2 Filling Station for FCEVs and H2 ICEs
Major ESIF Laboratories/Capabilities

View All Distribution Buses

Electricity Laboratories
1. Power Systems Integration
2. Smart Power
3. Energy Storage
4. Electrical Characterization
5. Energy Systems Integration

Research Electrical Distribution Bus (REDB) – AC and DC

Thermal Laboratories
6. Thermal Systems
7. Thermal Storage Materials
8. Optical Characterization and Thermal Systems

Thermal Distribution Bus

Fuel Laboratories
9. Energy Systems Fabrication
10. Manufacturing
11. Materials Characterization
12. Electrochemical
13. Energy Systems Sensor
14. Fuel Cell Development
15. High-Pressure Testing

Fuel Distribution Bus

Data, Analysis, and Visualization
16. ESIF Control Room
17. Visualization Room
19. High Performance Computing

Supervisory Control and Data Acquisition (SCADA) System

NATIONAL RENEWABLE ENERGY LABORATORY