SAND2010-6155P

IEA Hydrogen Annex 30: Global Hydrogen Systems Analysis
Experts Kick-off meeting
September 16, 2010

US Experts
Sandia National Laboratories: Dave Reichmuth, Katherine Guzman, Jay Keller
Longitude 122 West, Inc.: Susan Schoenung

US Department of Energy
Carole Read, Fred Joseck

Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Sandia National Laboratories

National Labs and Production Sites

Pacific Northwest

Idaho

Lawrence Berkeley

Lawrence Livermore

Sandia

Stanford Linear Accelerator Center

National Renewable Energy

Los Alamos

Sandia

Pantex

Ames

KCP

Fermi

Argonne

National Energy Technology

Y-12

Oak Ridge

Brookhaven

Princeton

Thomas Jefferson

SRP

Savannah River

KEY:

= Production Sites

= NNSA Labs

= Science

= Nuclear Energy

= Environmental Management

= Fossil Energy

= Energy Efficiency and Renewable

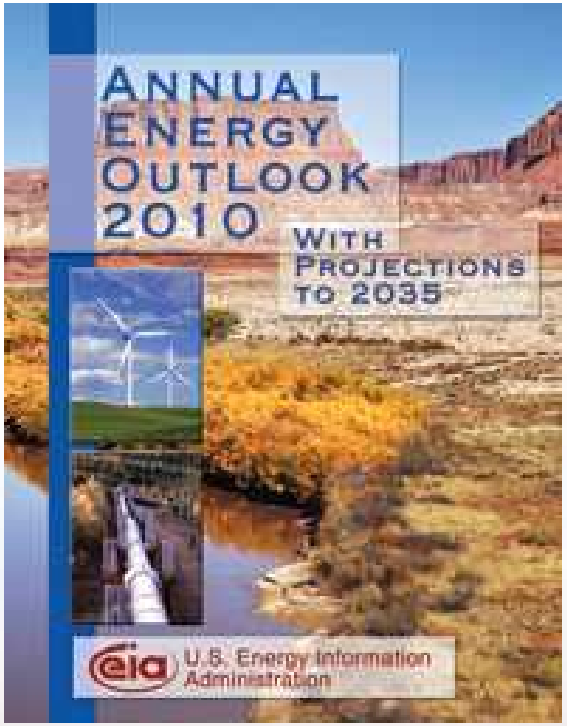
Expertise in Energy Systems Analysis

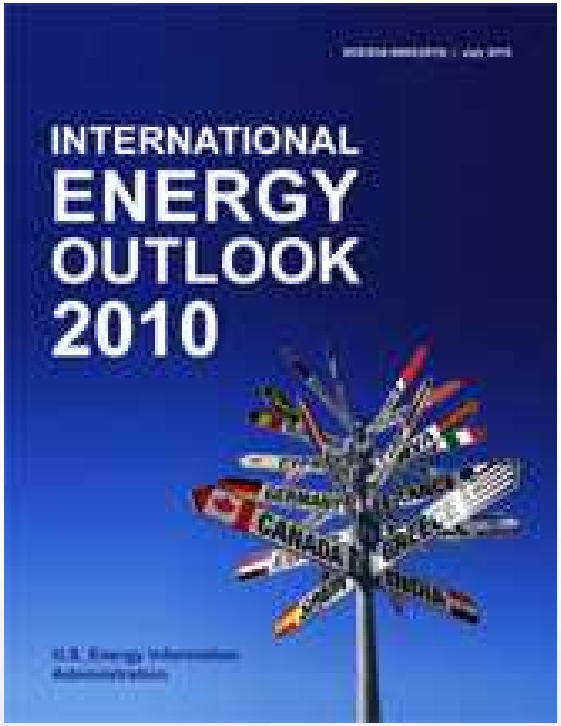
- **Previous/current work by this group:**
  - Supply-chain systems dynamics modeling
  - Energy pathways system dynamics modeling
  - Hydrogen infrastructure system dynamics modeling

- **US Department of Energy Laboratories have wealth of energy systems analysis experience**
  - Sandia National Laboratories
  - National Renewable Energy Laboratory
  - Oak Ridge National Laboratory
  - Argonne National Laboratory
  - Pacific Northwest National Laboratory
  - Lawrence Berkeley National Laboratory

United States Energy Data Sources

U.S. Energy Information Administration
Independent Statistics and Analysis





Many additional detailed reports on energy production, reserves, imports/exports, distribution, prices

Sandia National Laboratories

Potential for H_2 Production in the USA

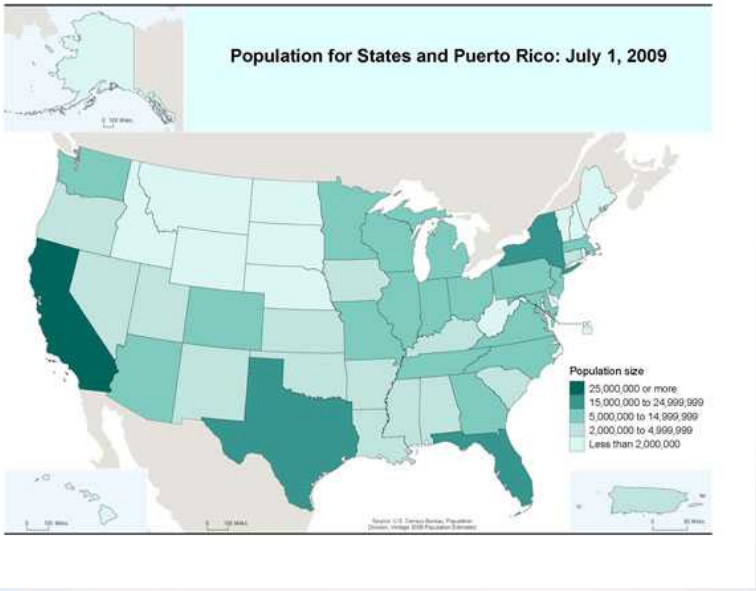
- **Hydrogen from domestic conventional energy sources**
  - Natural gas: 27 B kg/yr
  - Coal: 40 B kg/yr
  - Assumes 30% of current domestic production to hydrogen
- **Imported NG could provide H_2**
  - Provides ~15% current NG consumption
- **Low carbon domestic source technical potential:**
  - Solar: 700 B kg/yr
  - Wind: 94 B kg/yr
  - Biomass: 70 B kg/yr
  - Nuclear
  - Technical potential estimates are exclusive of other potential energy carriers (electricity, biofuels)

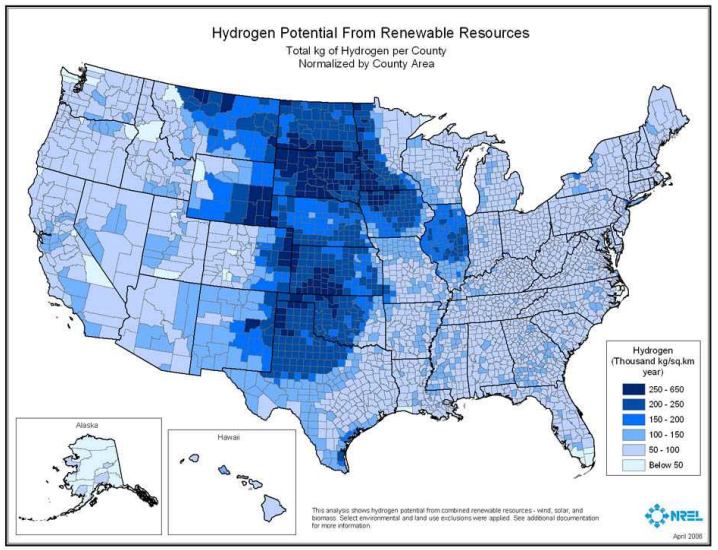
Source: Milbrandt & Mann, NREL

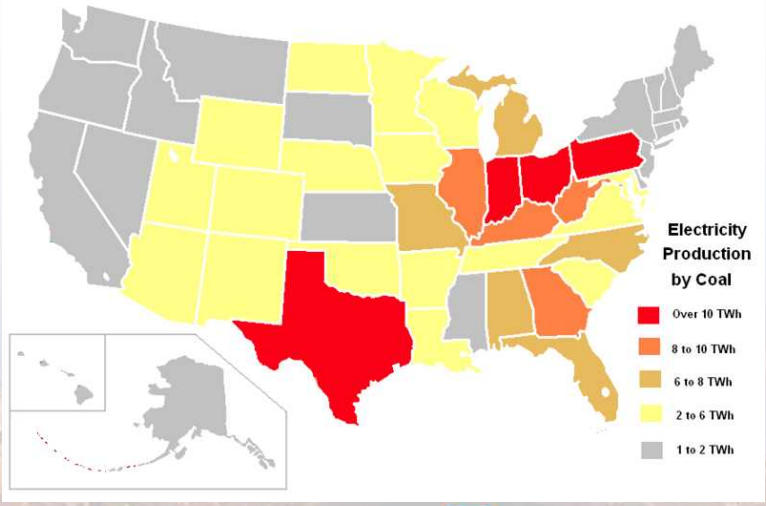
Potential for H_2-based transport

- **Current LDV segment: 230M vehicles, using ~140B gal/yr gasoline. Medium trucks, heavy trucks, off-road diesel uses ~ 55 B gal/yr**
- **Assuming HFV efficiency of 65 miles/kg, today's LDV fleet could be fueled with ~45 B kg/yr H_2**
- **Technical potential for H_2 production is much larger than possible transportation demand. Can we analyze key factors that affect the implementation of H_2-based transportation systems?**
  - Infrastructure constraints:
    - Energy sources for hydrogen production have a different geographic distribution than demand. Can H_2 be delivered from production areas to high demand locations?
    - Can infrastructure and vehicle systems evolve together to support transition away from petroleum?
  - Emission concerns:
    - Difference between HFV, EV and petrol-fueled vehicles depends on regional electricity & hydrogen production choices.

Regional differences in potential hydrogen supply and demand are significant







Sandia National Laboratories