NREL's Hydrogen and Fuel Cell Activities

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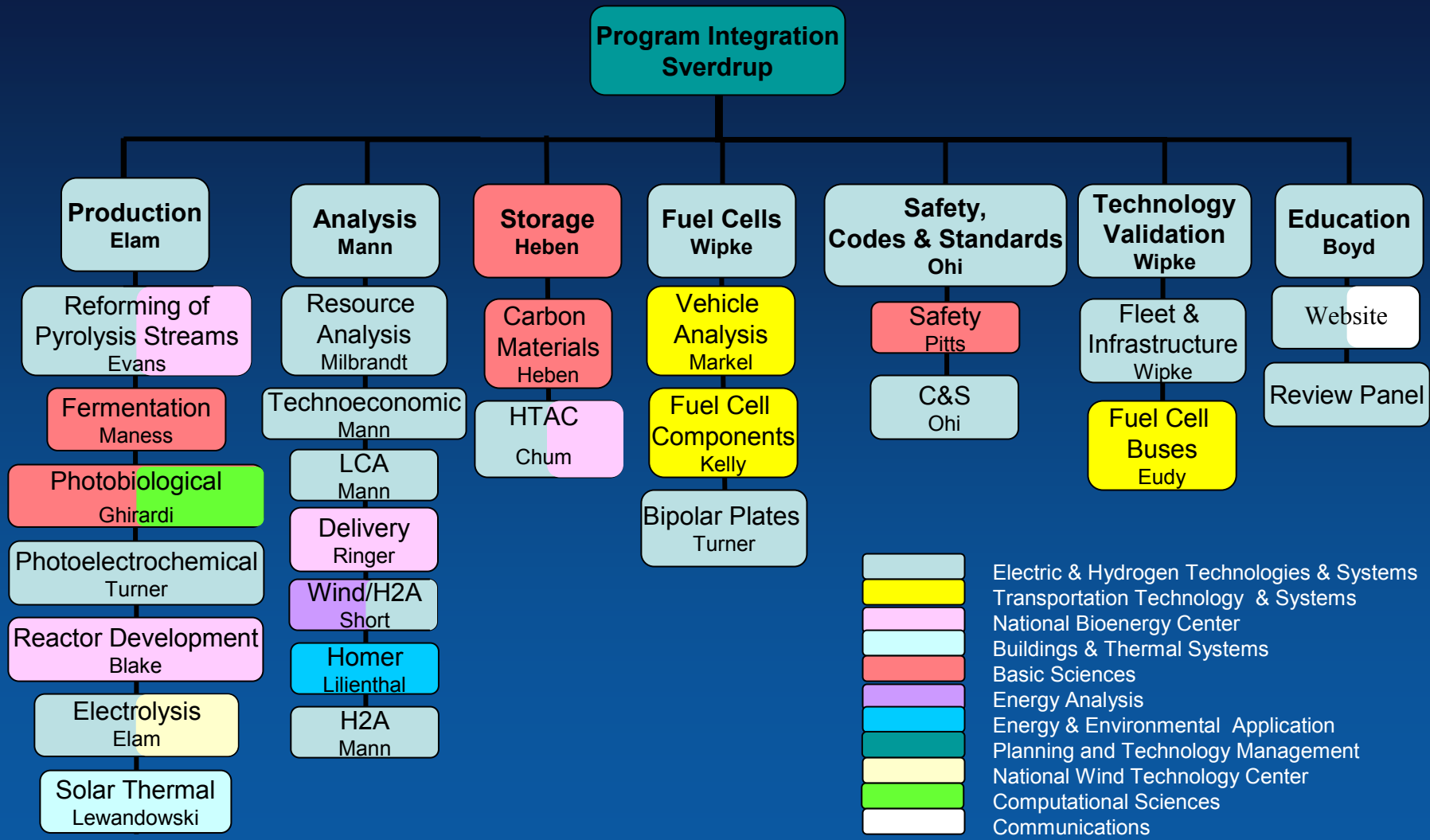
Hydrogen at NREL

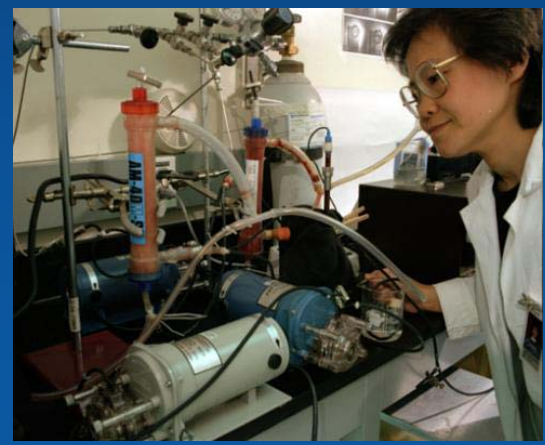
- Crosscutting nature of hydrogen research relies on and contributes to advances in PV, bioenergy, transportation, buildings, basic science, etc.
  - Benefits intermittent renewables
  - Opportunities for combined heat, power and fuel production
- NREL is the integration point for technical expertise in industry, universities, and other national laboratories for renewable systems

We Contribute to All Elements of DOE's Program Using NREL-Wide Resources

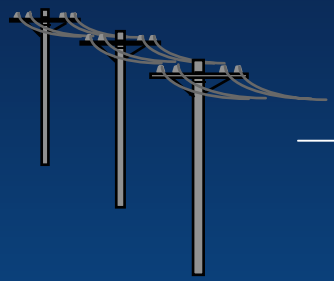


Hydrogen Production

- Photobiological production technique developed that produces measurable quantities of hydrogen using algae (for the first time anywhere in the world)
- Genetic and classical techniques being perfected for generation of oxygen-tolerant variants.
- Fermentation technologies for producing hydrogen from renewable biomass.
- World-record efficiency for directly splitting water with a photoelectrochemical device.



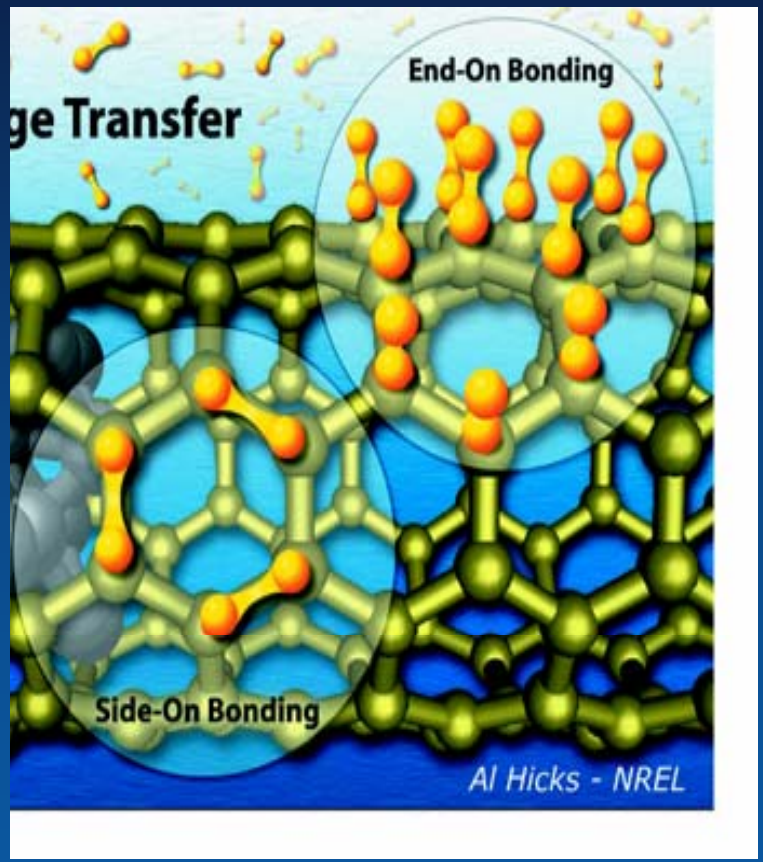
Integration of Hydrogen Production with Intermittent Renewables



Performance data used the develop shared power electronics package to reduce system cost and improve efficiency

Hydrogen Storage

- Leader in Carbon Nanotubes for Hydrogen Storage
- Synthesis, purification, cutting techniques, and measurement standards developed for high-purity samples and reproducible results



Technology Validation

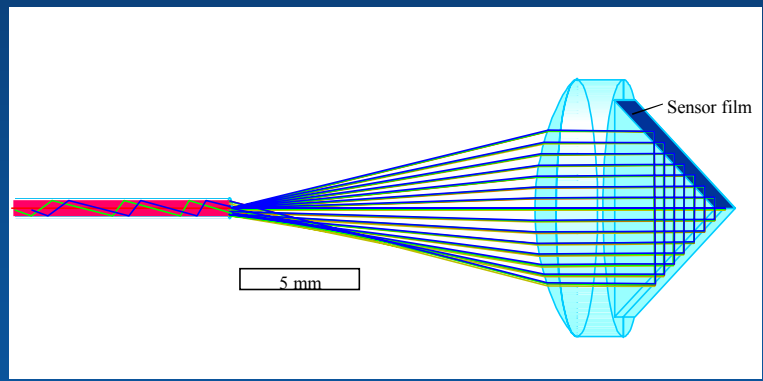
- Coordination and support for the Controlled Hydrogen Fleet and Infrastructure Demonstration and Validation Project solicitation
- Data acquisition plans and support for vehicle demonstrations
  - California Fuel Cell Partnership

Codes & Standards

- Coordination and support for the development of National and International Codes & Standards
- Produced “Blueprint for Hydrogen Infrastructure Development”
  - posted on website for public comments
  - workshop held to develop detailed plan
- Developed “Hydrogen Primer” for building and fire code officials
- Working closely with the natural gas infrastructure working group to build on their experiences

Hydrogen Safety

- Leader in renewable hydrogen production technologies
- Sensors for leak detection
  - leak detection for vehicles and buildings, and for hydrogen production, storage, and transport applications
  - weld integrity



Education

- Development of teaching materials and curriculum for K–12
- Expansion of education opportunities for teachers
- Content development and maintenance of DOE's hydrogen Web site