Hydrogen Technologies

INTEGRATING HYDROGEN INTO OUR EVERYDAY LIVES

EERC
UND UNIVERSITY OF NORTH DAKOTA

THE EERC HAS A LONG HISTORY of developing, testing, and integrating technologies for production and utilization of hydrogen as a practical fuel. Capabilities include technology demonstration, testing and validation across the hydrogen supply chain of production, transport and use in fuel cells as an energy carrier, and chemical/fuel synthesis.

HYDROGEN FROM FOSSIL FUELS

The EERC has conducted a suite of projects to overcome the technical issues associated with producing, cleaning, and utilizing hydrogen from natural gas, lignite coal, and other fossil resources (shown is the Great Plains Synfuels Plant).

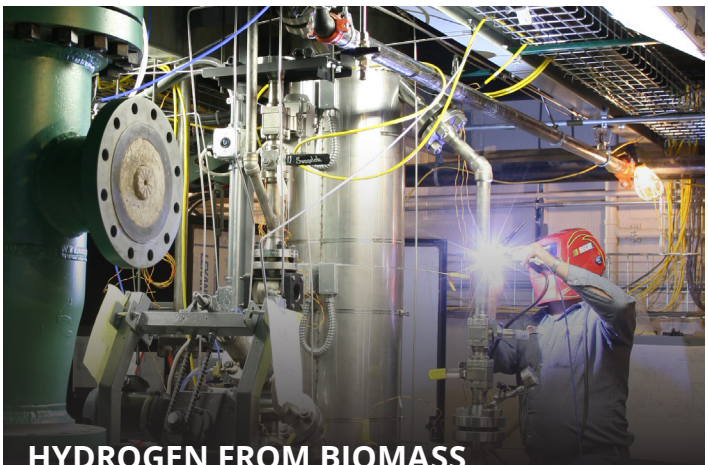
Hydrogen has a role in an all-of-the-above approach to energy production, strengthening the energy security of the United States. Hydrogen as fuel in a fuel cell, turbine, or combustion engine produces only water as an emission. Given the instability possible in the world's energy mix, the United States may need hydrogen cars on the road in the future. However, the reality is that, with the exception of only a few prototypes, much of the infrastructure for hydrogen does not exist and has not been demonstrated.

MEETING THE CHALLENGE

Significant advances have been made at the EERC to develop technologies dealing with the various aspects of hydrogen production, including generation, separation, purification, transportation, dispensing, and utilization. The challenge is to develop individual components, test various technologies, and put them to work from production through commercial deployment.

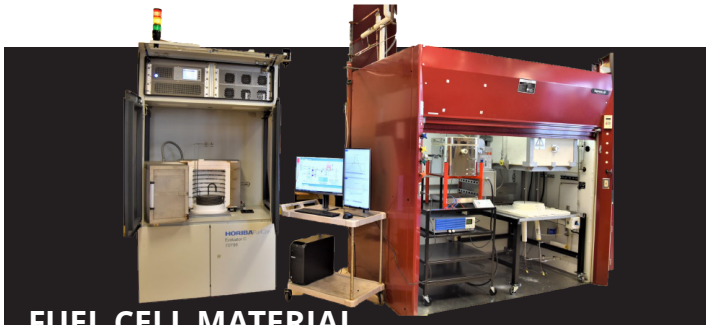
HYDROGEN-BASED ENERGY CONVERSION

Hydrogen and hydrogen-containing fluids like ammonia provide a pathway to a decarbonized energy future. The EERC has experience, patented technology and facilities to explore effective ways of producing hydrogen, storing it, and recovering the energy for power, transportation, or heat.



HYDROGEN FROM BIOMASS

The EERC's biomass gasifier produces hydrogen-rich gas for use in a solid oxide fuel cell (SOFC) system.



FUEL CELL MATERIAL

The EERC's state-of-the-art fuel cell test facility possesses the tools and expertise for advancing system- and component-level SOFC design, prototyping, testing, optimizing, and integrating fuel cell and electrolysis equipment to provide efficient energy solutions.

PROVIDING REAL-WORLD SOLUTIONS

EERC's National Center for Hydrogen Technology® (NCHT®) has over 65 years of expertise in hydrogen systems. The EERC operates comprehensive, world-class technology demonstration facilities and laboratories within its NCHT facility. The NCHT has led the way to produce hydrogen from a variety of fossil and renewable fuels with a variety of technologies; test fuel cells in conjunction with hydrogen production systems; develop a revolutionary, on-demand hydrogen production and dispensing system; utilize hydrogen in combustion engines and turbines; and demonstrate fuel cell vehicles and other end uses for hydrogen.

NCHT ACTIVITIES

- Development of fuel conversion technologies to produce hydrogen
- Research and development into technologies for converting intermediate fuels such as synthetic natural gas, methanol, and Fischer–Tropsch fuels into hydrogen
- Testing of advanced technologies for distributed production of hydrogen to minimize storage and transportation needs
- Testing of hydrogen compression and purification technologies for both stationary and mobile systems
- Testing of advanced materials and fuel cell systems for use with coal-derived hydrogen-rich fuels
- Development of education and outreach materials to bring hydrogen information to the workforce and future hydrogen users

INTEGRATED ETHANOL AND HYDROGEN PRODUCTION

The EERC developed a technology that could expand the use of ethanol with a process that produces pure, clean hydrogen from ethanol plants.

WIND TO HYDROGEN

The EERC, the U.S. Department of Energy (DOE), and Basin Electric Power Cooperative demonstrated hydrogen production from wind power for use in vehicles and farm equipment.

HYDROGEN ON DEMAND

The EERC-developed high-pressure liquid reforming technology allows distributed hydrogen production from liquid feedstocks. The technology leverages existing liquid fuel transportation infrastructure and helps overcome the cost of gas compression.

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