the ENERGY lab

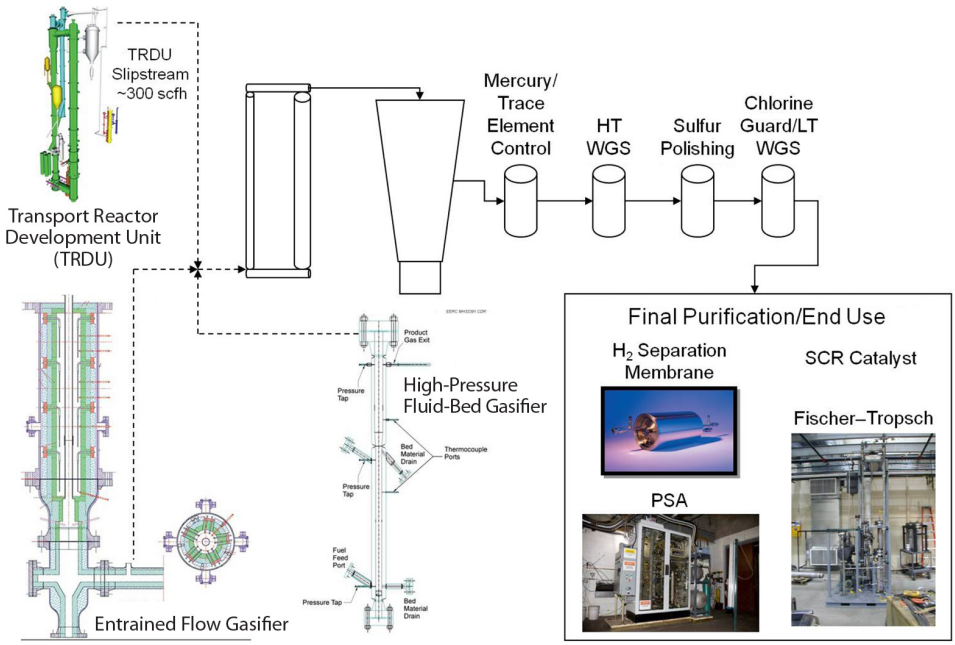
PROJECT FACTS

Fuels

National Center for Hydrogen Technology

Background

The U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) is committed to improving methods for co-producing power and chemicals, fuels, and hydrogen. The use of hydrogen as a source of energy for fuel cells, turbines, or internal combustion engines produces no harmful emissions; water is the only by-product. The successful use of hydrogen as an energy source will depend on the development of hydrogen technologies and additional energy infrastructure. NETL continues to partner with the University of North Dakota Energy and Environmental Research Center (EERC) to further these efforts at the National Center of Hydrogen Technology (NCHT). The EERC conducts research and development activities that are required to develop advanced hydrogen production and delivery technologies from fossil fuels. The EERC works with industry partners on the development of technology to improve the efficiency, costs, operation, and integration of hydrogen from coal systems.



Gas Cleanup and Hydrogen Separation

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PARTNERS

The NCHT Program currently exceeds 25 partners.

PROJECT DURATION

Start Date
06/01/2010

End Date
05/31/2012

COST

Total Project Value
$3,606,250

DOE/Non-DOE Share
$2,885,000 / $721,250

Project Description

The NCHT continues to build on the proven approach used and the accomplishments obtained during the first five years of the effort. This project encompasses the sixth year of NETL support for the NCHT. The project includes many activities performed by various teams of researchers organized under several broad technical objectives, or tasks: Coal Refining; Hydrogen Carriers; End of Pipe Reforming; and Project Management and Strategic Studies. The Center focuses on research and development activities required to advance hydrogen production using fossil fuels as well as on hydrogen purification and delivery technologies.

Goals and Objectives

The goal is to improve current technologies and make available new, innovative technologies that can produce and deliver affordable hydrogen from coal, the most abundant U.S. fuel resource, as well as from other fuels, with significantly reduced or near-zero emissions. Specific objectives include (1) studying coal ash behavior in reducing environments; (2) demonstration of hydrogen production from coal and hydrogen separation using membrane technologies at elevated temperatures; (3) material testing of coated alloys in a synthesis gas combustion environment; (4) fluidized-bed testing of GreatPoint Energy's direct oxygen injection catalytic gasification process for synthetic natural gas and hydrogen co-production; and (5) distributed hydrogen supply technology development.

NCHT activities address barriers to implementation of hydrogen technologies, such as the high cost of producing hydrogen from coal, and the lack of demonstration of novel technologies and hydrogen separation techniques. NCHT activities aimed at commercialization include guiding improved design and operation of commercial-scale facilities and performing scale-up, testing, and demonstration of advanced technologies. Anticipated real world applications for research results include co-production of hydrogen from coal with power, fuels and chemicals; advanced gasifier systems for coal, biomass, and other fuels; and advanced materials for hydrogen applications.

Accomplishments

The NCHT accomplishments center around development of technologies that align well with Advanced Fuels Program goals and, specifically, those described in the Hydrogen from Coal Program research, development, and demonstration plan. The range of accomplishments from the project is summarized below.

The NCHT project has now reached 836 membrane-hours of hydrogen separation testing exposing three hydrogen separation membranes to coal-derived syngas, and demonstrated the production of high-purity hydrogen from coal that can be used for the coproduction of hydrogen, fuels, chemicals, and power. The research team has completed gasification testing, data collection, and model equation development for the Coal Ash Behavior in Reducing Environments (CABRE) III Model. The CABRE III model will be used to reduce downtime and increase availability and efficiency of gasification systems. Under the fluidized-bed testing activity, the research team completed over 66 hours of fluidized-bed testing on GreatPoint Energy's direct oxygen injection catalytic gasification process for co-production of synthetic natural gas and hydrogen. The results led to a modification in the height of the reactor, which has been completed. Under the materials activity, the project team completed the fabrication of a heated coupon holder. The team used the coupon holder to expose four coupons to 103 hours of operation in the fluidized-bed gasifier. Under the Distributed Hydrogen Supply activity, the team assembled the integrated system including new features and performed shakedown testing and preliminary hydrogen production testing. Under the Outreach and Education for Hydrogen Production and Utilization activity, the team drafted a coal-to-hydrogen technical brief and developed and aired a documentary, *Hydrogen: Nature's Fuel*, on PBS on January 12, 2011, to educate the public on advances of hydrogen technology.

Hydrogen Separation Membrane Test Skid

Benefits

NCHT project successes will support expanded use of domestic coal to co-produce hydrogen with power, fuels, and chemicals. In conjunction with carbon management, hydrogen-from-coal technology can help meet the energy security, environmental, and economic goals of the U.S. energy sector. Coal can be a cornerstone for the diverse hydrogen supply mix, with integration of hydrogen production into co-production of power, synthetic fuels, and chemicals.