PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Hydrogen and Clean Fuels from Coal

10/2007

NOVEL HYDROGEN PURIFICATION DEVICE INTEGRATED WITH PEM FUEL CELLS

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Description

Given the inherent advantages of coal in the United States, such as its abundance, availability, and cost-competitiveness, it is likely to play a major role in hydrogen production for the 21st century. However, coal, when gasified, produces carbon dioxide along with hydrogen and, consequently, the carbon dioxide must be removed before the hydrogen can be used. Past work has shown membranes to be cost effective hydrogen separation devices for removing hydrogen from coal gasification gases (syngas). This project is an effort to utilize past membrane and substrate development work conducted by Praxair to design an optimum membrane for a purification system integrated with PEM fuel cells.

The project will be conducted in three Phases: Phase I will develop a fundamental computer model of hydrogen transport processes based on prior membrane and substrate work. The model will identify and quantify the importance of each step in the hydrogen transport process. The cost of building the integrated system will be estimated based on the testing and modeling results. Subsequently, a determination will be made as to whether or not to continue the project into Phase II based on these results.

During Phase II, the results of Phase I will be used to design the integrated process. Work will continue on improving the membrane, but that work will be reduced as the emphasis shifts from the fundamental science focus in Phase I to engineering and development in Phase II. A conceptual design of the integrated system and a more-detailed cost estimate will be developed. If continued system development looks promising based on demonstrated performance and economic projection, a determination will be made as to whether or not to continue into Phase III.

Phase III will use the results of Phase II to build and test the integrated hydrogen polishing system. Prototype testing will begin in the laboratory using a stationary system in a controlled environment. Dependent on sufficient early success, testing may be extended to vehicles where partners with connections to fuel cell vehicle manufacturers will be brought into the project at this stage.

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Primary Project Goals

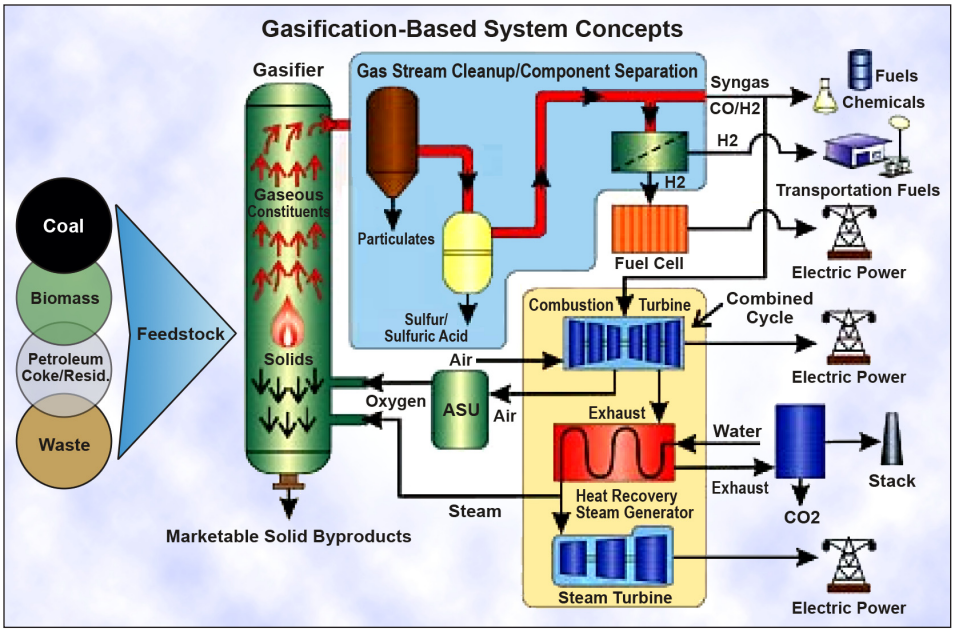
- Phase I - Demonstrate membrane performance and economic viability.
- Phase II - Demonstrate device design and economic viability.
- Phase III – Demonstrate prototype device performance.

Accomplishments

None at present – New project initiated in FY-2007

Benefits

The use of fundamental modeling reduces costs for performing experimental tests to understand hydrogen transport processes in membranes and to identify and quantify the importance of each step in the hydrogen transport process. The approach of using mathematical modeling to provide a basis for a preliminary cost estimate of the integrated system is an economical alternative to actual construction, operation, and evaluation.



Process Flow Diagram for Hydrogen Production from Coal Gasification