

PROJECT facts

Gasification Technologies

06/2006

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



ADVANCED GASIFICATION SYSTEMS DEVELOPMENT

Description

Rocketdyne will apply rocket engine technology to gasifier design, allowing for a paradigm shift in gasifier function, resulting in significant improvements in capital and maintenance costs. Its new gasifier will be an oxygen-blown, dry-feed, plug-flow entrained reactor able to achieve carbon conversions of nearly 100 percent by rapidly heating low coal particles at rates up to 2,000,000 °F/second. The gasifier's high heating rates make possible very short gasification residence times, increased thermal efficiency, and carbon conversions approaching 100 percent. Another result of the high heating rates is that the reactor is one tenth the size of an equivalent conventional gasifier, which will reduce capital costs.

CONTACTS

Gary J. Stiegel

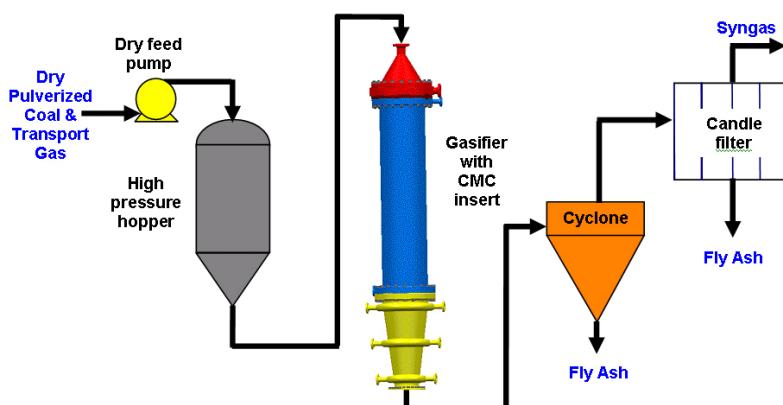
Gasification Technology Manager
National Energy Technology
Laboratory
626 Cochran's Mill Road
P.O. Box 10940
Pittsburgh, PA 15236
412-386-4499
gary.stiegel@netl.doe.gov

Jenny Tennant

Project Manager
National Energy Technology
Laboratory
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507
304-285-4830
jenny.tennant@netl.doe.gov

This project is the first step in realizing Rocketdyne's gasifier vision, and in removing the economic barriers that have prevented the widespread commercial deployment of coal-based gasification systems. The project objectives are to:

- Design a dense phase dry solids feed system for feeding high pressure pulverized coal to an 18-element dry coal feed injector system. The injector elements will be sized nearly full-scale (approximately 3 ton/hour flow rate each) with long-life rapid-mix features.
- Test mechanically cooled refractory liner coupons. This liner concept is expected to double the life of a gasifier's refractory liner. This will significantly reduce maintenance costs.



Conceptual drawing of Rocketdyne's gasification system



CONTACTS (cont.)

Alan Darby

Principal Investigator
Pratt Whitney & Rocketdyne
6633 Canoga Ave
B.O. Box 7922
Canoga Park, CA 91309
818-586-0975
alan.darby@pwr.utc.com

PARTNER

Pratt Whitney & Rocketdyne

COST

Total Project Value
\$9,225,971

DOE/Non-DOE Share
\$7,352,576 / \$1,873,395

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WEBSITE

www.netl.doe.gov

- Complete the preliminary design of a high pressure dry feed coal pump, with supporting engineering analysis to help predict pump performance.
- Perform a conceptual design and hardware definition of an 18 tons per day pilot plant gasifier embodying the Rocketdyne vision. This is the first step towards combining all of Rocketdyne's advanced, and economically beneficial, concepts into one integrated test unit.
- Complete preliminary design of a high pressure dry feed coal pump.

Both the long-life rapid-mix injectors and the actively cooled liners are based on Rocketdyne's rocket technologies. The injector design uses multi-element injection to rapidly mix the coal with hot steam and oxygen while rapidly dispersing the coal across the reactor's cross-section. Water cooling circuits are embedded inside the rocket engine style face plates to ensure long life of the injector unit – over one year. The liner also is actively cooled, using slots in the refractory to carry coolant through and heat away, resulting in a frozen layer of slag inside the gasifier. This frozen layer of slag has been shown in lab tests to protect the refractory underneath.

Primary Project Goals

- Test cooled refractory liner coupons in a slagging gasifier.
- Test injector durability and mixing potential in full flow cold tests.
- Complete the conceptual design of a novel 18 tons per day, highly efficient, long-life entrained flow gasifier, including long-life, rapid-mix injectors and the cooled refractory liner.

Accomplishments

- Cooled liner coupon tests are ongoing at the CANMET Energy Technology Centre (CETC) pilot-scale gasifier in Ottawa, Canada.
- The conceptual design for the 18 tpd pilot scale gasifier has been completed and submitted to DOE.
- Construction of the 400 tpd dry, high pressure feed system has begun at the University of North Dakota Energy & Environmental Research Center.
- A peer review of the PWR gasifier and feed system vision was held on 1/24/06. The peer reviewers believed that the PWR dense phase coal pump, uniform flow splitting and mechanically cooled liner are concepts that, if successfully developed, are likely to have a beneficial impact on the gasifier industry because they could be adapted for use with other gasifiers.



Benefits

A DOE system study was performed to compare the cost of the conceptual PWR compact gasifier to other commercial IGCC gasifiers. The results show the PWR gasifier has the potential to reduce the cost of electricity by up to 21%, and the cost of hydrogen by 25% over conventional technologies.