Biomass Gasification for Clean, Efficient Power Generation

Project Update: Vermont Gasifier

A new demonstration biomass gasifier in Burlington, Vermont, is a major advance toward biopower systems of the 21st century. The purpose of the project is to verify design and operating characteristics of this gasification technology at an intermediate size. The Vermont gasifier is rated at 200 tons of biomass per day; previously, the inventor, Battelle, has successfully operated a pilot unit rated at 20 tons per day. This demonstration will allow further scale-up to a first-of-its-kind commercial gasifier to be demonstrated in the future at an industrial or utility scale.

THIS PROJECT DEMONSTRATES THAT BIOMASS GASIFIERS CAN FUEL MODERN, HIGH-EFFICIENCY GAS TURBINES.

Project Description

The project has been put together by a unique partnership between the U.S. Department of Energy, Battelle, the National Renewable Energy Laboratory (NREL), Burlington Electric Department—a municipal utility hosting the demonstration at the McNeil wood-fired power plant—and the Future Energy Resources Corporation (FERCO), a private firm committed to developing the gasifier for its commercial potential.

Warren Gretz, NREL/PIX04746

This country's first demonstration of a biomass gasifier—which supplies clean, renewable fuel from biomass to a utility power plant—is set to go on-line.

The Vermont project is demonstrating low-pressure, indirect gasification of biomass. The gasifier operates by heating wood chips to about 830°C (1526°F) in hot sand until the wood breaks apart into its constituent chemical components (see diagram on back). The result is a clean-burning gas with a medium heat-content (20 – 25 MJ/Nm^3 or approximately 500 Btu/ft^3) that can fuel an unmodified gas turbine.

Using biomass to fuel gas turbine combined-cycle systems will nearly double the electricity-generating efficiency typical of today's biopower industry. Such systems have garnered the interest of the pulp and paper industry, which will soon need to replace many of its power boilers and can benefit from higher efficiencies.

This gasifier is different from previous gasifiers producing medium-heat-content gas because it does not require a supply of pure oxygen and is, therefore, much less costly to build and operate. In addition, the Vermont gasifier has a high throughput (e.g., a smaller gasifier vessel is required for a given amount of biomass because it is processed more quickly). This, in combination with low-pressure operation, further reduces its construction cost.

Recent Accomplishments

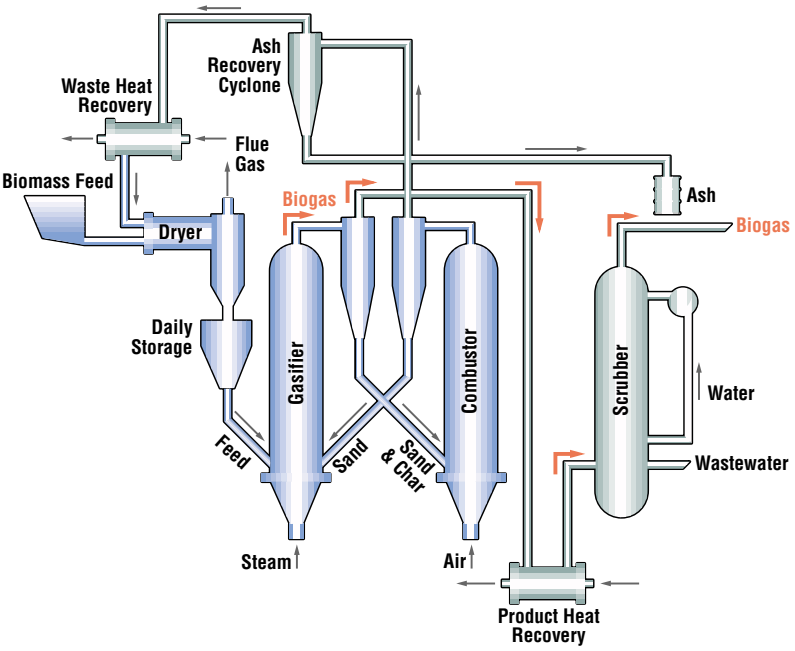
The project is divided into three phases. The first phase, design and construction of the gasifier, was completed in 1998. The second phase, gasifier start-up and shake-down testing, began in 1998 and will continue through 1999. The final phase involves long-term operation and testing.

Progress to date includes completion of testing and calibration of the components and subsystems, operation of the gasifier integrated with the power plant, and installing instrumentation to obtain performance data. NREL supplied technical support for gasifier design and engineering, and provides technical and analytic support during operation. To date, the gasifier has supplied fuel for generation of 100,000 kilowatt-hours (kWh) of electricity.

Short-Term Plans

Phase III involves completion of parametric testing to measure and establish the gasifier's baseline performance as well as its operating limits and specifications for particle size and moisture content of the fuel. These operating limits include maximum turn-up and turn-down ratios for bringing the plant on- and off-line, and determining the dynamic response of the system to transient events such as sudden increase in demand or sudden loss of load.

In 2000, work will begin on the final phase of the project—design of the gas turbine, scheduled for 2000, and installation, currently scheduled for 2000–20001. Following installation, long-term trials of the entire system will establish the most important parameters for system reliability and characterize system operation and performance. These trials will also yield data regarding the use of other biomass fuels with different compositions and physical characteristics.



Project Partners

- Battelle, Columbus, Ohio
- Burlington Electric Department, Burlington, Vermont
- Future Energy Resources Co. (FERCO), Atlanta, Georgia
- National Renewable Energy Laboratory, Golden, Colorado
- U.S. Department of Energy, Washington, D.C.

For More Information:

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