FOREST PRODUCTS
Project Fact Sheet

COMBINED CYCLE BIOMASS GASIFICATION

BENEFITS

- Decreases capital costs
- Increases throughput rates to >2,000 lb/hr-ft2 of reactor area
- Handles a wide range of biomass feedstocks
- Improves environmental performance, with fewer particulates and nitrogen oxides than in conventional systems
- Reduces or eliminates use of fossil fuels

APPLICATIONS

The pulp and paper industry has expressed an interest in adapting and integrating advanced biomass energy-conversion technologies into its mill operations. Industrial adoption of this new technology has the potential for higher efficiency, lower capital cost, and safer operation than conventional operations that burn biomass for cogeneration.

Biomass Gasification Offers Energy Self-Sufficiency to the Forest Products Industry

Biomass gasification combined cycle (BGCC) technology has the potential to generate process stream and electricity at a higher efficiency and with lower capital costs than conventional energy conversion technologies. With more than half of the pulp and paper industry's energy needs met by renewable and byproduct energy sources (e.g., hogged wood, bark, and spent black liquor solids), the industry is interested in integrating more advanced biomass gasification technologies into its operations. The gasifier selected for this project is particularly well-suited to a pulp mil environment since it produces a medium-Btu gas that can be readily used by existing oil- or gas-fired equipment, is tolerant of changes in feed quality, and requires less attention to fuel drying.

In addition to its efficiency and low capital costs, a gasification combined-cycle system would allow the use of locally grown biomass energy crops in addition to biomass wastes of the mill to generate electricity. The excess power that is generated can be sold to local customers. A majority of the recovery furnaces and conventional power boilers in existing pulp and paper plants are 20 to 30 years old and more than half of them will need to be replaced or upgraded in the near future. There is an opportunity to install new gasification technology in these plants during this capital replacement cycle.

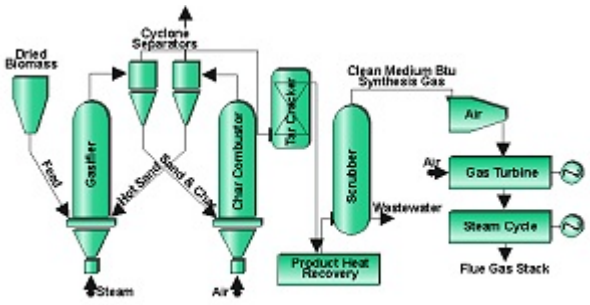

Figure 1. The two-zone biomass gasification combined-cycle system allows the heating value of the cleaned, cooled product to remain constant, independent of the moisture level of the feed.

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ENERGY EFFICIENCY AND RENEWABLE ENERGY • U.S. DEPARTMENT OF ENERGY

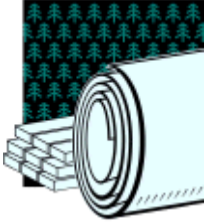
PROJECT DESCRIPTION

Goal: To assess an advanced biomass gasification technology, conduct site-specific engineering activities with the technology, and update an economic analysis of the system.

The biomass gasification combined cycle system, originally developed by Battelle Columbus Laboratory, works by contacting partially dried biomass residues with hot sand and a conveying stream of steam in a gasifier. Cyclones separate the product gas from the sand and hot char that are entrained in the gas stream. The sand and char are returned to a combustor where the char reacts with air to reheat the sand, which is then returned to the gasification vessel. The medium-Btu gas is passed through a heat recovery unit and a water scrubber to remove condensable organic matter. The cleaned gas can then be used directly as a fuel (e.g., in a boiler or kiln) or passed through a combined cycle gas turbine to produce electricity and steam. Waste heat is recovered at various points in the process for the generation of steam or for use in process heating applications.

PROGRESS & MILESTONES

- A demonstration of a 200 BDT/day unit was conducted at a generating station in Vermont.
- It was confirmed that the medium-Btu gas generated could be substituted for fossil fuels and is free of atmospheric nitrogen.
- A computer model was used to explore the economics of the biomass gasification, combined-cycle technology.
- A detailed implementation plan was prepared that included a commercial demonstration and the sustainable operation of a biomass gasification combined cycle plant.
- The project was completed, and commercialization of the technology is underway.



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