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GASIFICATION TECHNOLOGIES OVERVIEW

Status

The U.S. Department of Energy (DOE) Office of Fossil Energy and the National Energy Technology Laboratory have been instrumental in moving gasification technologies from the laboratory to the marketplace. Through government/industry partnerships, DOE/NETL is sharing the cost and risk of the research, development, and demonstration required to bring Integrated Gasification Combined Cycle (IGCC) for power generation to commercial fruition.

The cost-shared IGCC demonstration projects, representing a diversity of gasifier types and cleanup systems, are pioneering introduction of this new approach to power generation in the U.S. and providing invaluable performance data.

Two projects are currently operating in a commercial dispatch mode at 250 megawatt net capacity.

A third project, a 100 megawatt unit has initiated operation; and a fourth 400 megawatt IGCC project is in the planning stages.

Another project is demonstrating production of 80,000 gallons/day of methanol from gasified coal.

The demonstrations serve as building blocks for even more advanced systems. Paralleling the demonstrations is a research and development (R&D) program designed to take IGCC and gasification beyond market entry into broad-based deployment. Emphasis is placed on reducing cost, increasing efficiency, expanding feedstock and product flexibility, and achieving near zero pollutants.

Benefits

Gasification technologies represent the next generation of solid feedstock-based energy production systems. Gasification breaks down virtually any carbon-based feedstock into its basic constituents. This enables the separation of pollutants and greenhouse gases to produce clean gas for efficient electricity generation and production of chemicals and clean liquid fuels.

Commercial-scale IGCC plants operating in the United States, and others around the world, are signaling a new age in electric power generation. Market forces, which are replacing regulatory structures, and regional and global environmental concerns are resulting in expanded IGCC applications. IGCC is both feedstock and product flexible, produces almost no pollutant emissions, and facilitates CO₂ removal. As a result, single feedstock, single commodity, steam-powered electric generation is being replaced by more versatile integrated energy technologies.

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Benefits

IGCC leverages the advantages of combustion turbine/combined cycle (CT/CC) operation and vastly expands the fuel base beyond natural gas to include more abundant and lower cost resources. CT/CC combines highly efficient combustion turbines with steam turbines, by using the gas turbine exhaust to generate steam, which produces the most efficient and economic electricity available today. Currently, natural gas is the predominant fuel for CT/CC units. Integration of a gasifier allows use of coal, biomass and agricultural, forestry, municipal, and refinery wastes. This flexibility offers the potential to reduce cost and enhance the overall environmental benefits.

The capability to co-produce electricity and a slate of fuels and chemicals makes the technology economically attractive to a broad range of industrial applications. Product flexibility enables gasification technologies to be integrated into industrial applications for multiple commodity production and increased revenue. Gasifier technology applications include integration into chemical plants and refineries. The attributes of gasification make it particularly attractive in coal dependent Asia, where nearly half of the world's energy increase is seen to occur as Asia expands its industrial base over the next two decades.

Vision

The future of gasification is clearly impacted by changes in government policy. Continuing convergence of oil, gas, and electric power marketing with deregulation improves the potential for gasification. Increasing interest in improved energy efficiency, reduced emissions, and increased recycle of wastes also helps gasification.

Electric power generation is the key market for gasification. Demand for electricity is growing at a rate twice that of other end-use energy forms, such as natural gas and transportation fuels. Gasification will become more competitive in the long term as the current dominance of NGCC will lessen as natural gas prices increase. Gasification enables all feedstocks to meet the same emission levels as NGCC. Current pitch and petcoke gasification is a bridge to long-term coal gasification.

Technical trends, which help gasification, include improving gas turbines and co-production/polygeneration. Each increase in combined-cycle efficiency directly reduces the size and cost of the gasification facility required to fire that combined cycle. Advanced intercooled, recuperated, reheat gas turbines have the potential of power-to-cogeneration heat ratio that is an order of magnitude high than that possible with steam turbines. Polygeneration is unique to gasification and, with deregulation, this concept will develop. Gasification has strategic emission, efficiency, and economic flexibility for the future.



Future Energy Systems

*Gasification
has strategic
emission,
efficiency, and
economic
flexibility for
the future.*