

Gasification Technology Expertise



INTRODUCTION

The Energy & Environmental Research Center (EERC) offers a comprehensive and unique suite of technical services in gasification technologies. Having partnered with almost every major manufacturer of gasification systems and support technologies, the EERC's expertise enhances the commercial guarantee for installing and successfully operating cost-effective gasification plants.

COMMERCIAL OPPORTUNITIES

Gasification converts carbonaceous materials, such as coal, petroleum coke, heavy oils, or biomass, into syngas—a mixture of carbon monoxide and hydrogen.

Although oil, gas, and conventional coal combustion will remain critical to the energy sector for a number of years, there are major opportunities to utilize gasification to convert carbon feedstocks into a range of products, including transportation fuels, chemicals, hydrogen, and electricity.

Current opportunities include coal gasification for production of electricity, hydrogen, chemicals, and fuels such as zero-sulfur diesel. The use of coal for production of transportation fuels is a significant commercial opportunity for meeting the increasing demand. Additionally, gasification can be used for converting lignocellulosic biomass into electricity for distributed power production, refinery residues such as petcoke into hydrogen for hydrotreatment and carbon dioxide for enhanced resource recovery, and municipal waste to heat.



Portable downdraft gasifier.



Advanced fixed-bed gasifier.

QUALIFICATIONS

Although the gasification process has been utilized since the early 1800s, until recently it was limited to niche applications. Thus the knowledge base of most experts in the field is limited specifically to technical areas and gasification technologies.

The EERC's 60-year history of working on a variety of gasification and support technologies sets it apart from other knowledge providers in the field. The EERC, which maintains numerous in-house demonstration facilities, was involved in the design and operational aspects of the Great Plains Synfuels Plant—North America's only gasification plant that manufactures synthetic natural gas.

The EERC understands the entire value chain of gasification: operational challenges and opportunities associated with feedstock preparation, gasification technologies, gas cleanup, syngas conversion, and by-product utilization. The latter, for example, includes leading the nation's largest carbon sequestration partnership (Plains CO₂ Reduction [PCOR] Partnership).

EERC GASIFICATION FACILITIES

The EERC maintains two large utility-scale systems, including a transport reactor and a carbonizer. The units are multistory, high-pressure-based systems. Further detail can be found on the EERC Web site.

Furthermore, the EERC maintains five laboratory- or bench-scale units used for a range of gasification experiments:

1. Integrated bench-scale gasifier (IBG) – the IBG is operated in batch mode to assess various production results. The unit provides a very cost-effective benchtop means to simulate conditions, including high temperatures and pressures.
2. Continuous fluid-bed reactor (CFBR) – the CFBR is a 1–4-lb/hr system designed for continuous feed. The unit is rated at 170 psig at 1500°F. The CFBR can be operated in various gasification modes and accept steam, oxygen, or air.
3. Advanced fixed-bed gasifier (AFBG) – the AFBG is a low-pressure, continuously fired downdraft gasifier with the capability of providing external heat. The AFBG was designed for scale issues relative to biomass gasification and provides a means to bench-test gas production from wet and dry biomass fuels.

4. Portable downdraft gasifier (PDDG) – the PDDG is a fixed-bed downdraft gasifier typically used for biomass gasification relative to heat and power production. The unit operates at low pressure and provides gas filtration. The gasifier is used to demonstrate material balance, energy balance, emissions, and gas utilization.
5. Thermogravimetric analyzer (TGA) – The EERC provides TGA and many other laboratory services for gasification investigations. EERC apparatuses are versatile to allow custom configurations for specific project objectives.



EERC Benefits

- Provides critical know-how and technologies for producing low-cost synfuels, as well as electricity and hydrogen, through gasification and subsequent liquefaction.
- Possesses demonstrated experience along the entire value chain of gasification.
- Has worked with almost every major manufacturer of gasification systems.
- Develops and maintains demonstration facilities for testing a variety of feedstocks and synfuels.
- Consistently achieves a high success rate in leveraging market-driven research dollars.

Market Potential

Gasification’s potential is significant, including opportunities for large-scale systems in main industries such as coal and oil and gas and for smaller distributed systems in industries such as forest products, agricultural processing, and secondary milling, which can benefit from the waste utilization features of gasification technologies. There is an estimated potential application for at least 100,000 small-scale gasification units in the United States.

Partners

Babcock-Hitachi; BEPCO; Chevron; ConocoPhillips; Dakota Gasification Company; Destec Energy, Inc.; Dow Chemical Company; ELCOGAS; Electric Power Research Institute; Energy Research Center of the Netherlands; Great River Energy; KEMA Netherlands; Krupp Uhde; Pratt & Whitney Rocketdyne; North American Coal Company; North Dakota Industrial Commission; Sasol; SenterNovem; Shell Development Company; U.S. Department of Energy; Texaco; and TXU

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