

## Advanced Energy Systems - Gasification Systems

### National Carbon Capture Center at the Power Systems Development Facility

**Performer:** Southern Company Services, Inc.

**Project No:** FE0000749

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#### Project Description

The objective of this project is to develop technologies under realistic conditions that will reduce the cost of advanced coal-fueled power plants with CO<sub>2</sub> capture. This technology development will include the design, procurement, construction, installation, and operation of a flexible facility for the testing of processes for pre-combustion CO<sub>2</sub> capture, post-combustion CO<sub>2</sub> capture and oxy-combustion. Components and systems that are appropriate for inclusion in the detailed test plan will be identified in collaboration with NETL. In addition to evaluating DOE sponsored projects; projects from industry, universities, and Electric Power Research Institute (EPRI) will be evaluated to assist in accomplishing the project objectives.

- [Project Fact Sheet](#)



National Carbon Capture  
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#### Program Background and Project Benefits

Gasification is used to convert a solid feedstock, such as coal, petcoke, or biomass, into a gaseous form, referred to as synthesis gas or syngas, which is primarily hydrogen and carbon monoxide. With gasification-based technologies, pollutants can be captured and disposed of or converted to useful products. Gasification can generate clean power by adding steam to the syngas in a water-gas-shift reactor to convert the carbon monoxide

to carbon dioxide (CO<sub>2</sub>) and to produce additional hydrogen. The hydrogen and CO<sub>2</sub> are separated—the hydrogen is used to make power and the CO<sub>2</sub> is sent to storage, converted to useful products or used for EOR. In addition to efficiently producing electric power, a wide range of transportation fuels and chemicals can be produced from the cleaned syngas, thereby providing the flexibility needed to capitalize on the changing economic market. As a result, gasification provides a flexible technology option for using domestically available resources while meeting future environmental emission standards. Polygeneration plants that produce multiple products are uniquely possible with gasification technologies. The Gasification Systems program is developing technologies in three key areas to reduce the cost and increase the efficiency of producing syngas: (1) Feed Systems, (2) Gasifier Optimization and Plant Supporting Systems, and (3) Syngas Processing Systems.

Gasifier Optimization and Plant Supporting System technologies under development are targeted at increasing gasifier availability and efficiency, improving performance, and reducing the capital and operating costs of advanced gasification plants. Ongoing R&D projects are developing more durable refractory materials, creating models to better understand the kinetics and particulate behavior of fuel inside a gasifier, and developing practical solutions to mitigate the plugging and fouling of syngas coolers. Future work will focus on the development of cutting edge gasifier technologies, which will start with multiple competing concepts and continue with support of the most aggressive and successful technologies being developed, both in the Gasification Systems program and other DOE programs, to reduce the cost of coal gasification. Future work will also aim to reduce the amount of water used in gasification plants and integrate technologies throughout the plant and beyond in a holistic approach to increase efficiency and reduce costs (e.g., the optimization of gasification plants to sell CO<sub>2</sub> for EOR applications).

The National Carbon Capture Center (NCCC), sponsored by the U.S. Department of Energy and operated by Southern Company Services, Inc., provides first-class facilities to test developers' technologies for extended periods under commercially representative conditions with coal-derived flue gas and syngas, produced on-site with a pilot-scale (50 tons of coal per day capacity) transport gasifier. The NCCC tests and evaluates CO<sub>2</sub> control technologies including CO<sub>2</sub> capture solvents, mass-transfer devices, low cost water-gas shift reactors, scaled-up membrane technologies, and improved means of CO<sub>2</sub> compression. The NCCC also pursues increased fuel flexibility (to use a wide variety of coal and biomass feedstocks in gasification) through improvements in coal handling equipment and an innovative coal/biomass feeding technology. Because of the ability to operate using a wide range of coal types, flow rates and process conditions, research at the NCCC can effectively evaluate a variety of technologies at various levels of maturity.

**Performer website:** [National Carbon Capture Center](http://www.nccc.energy.gov)