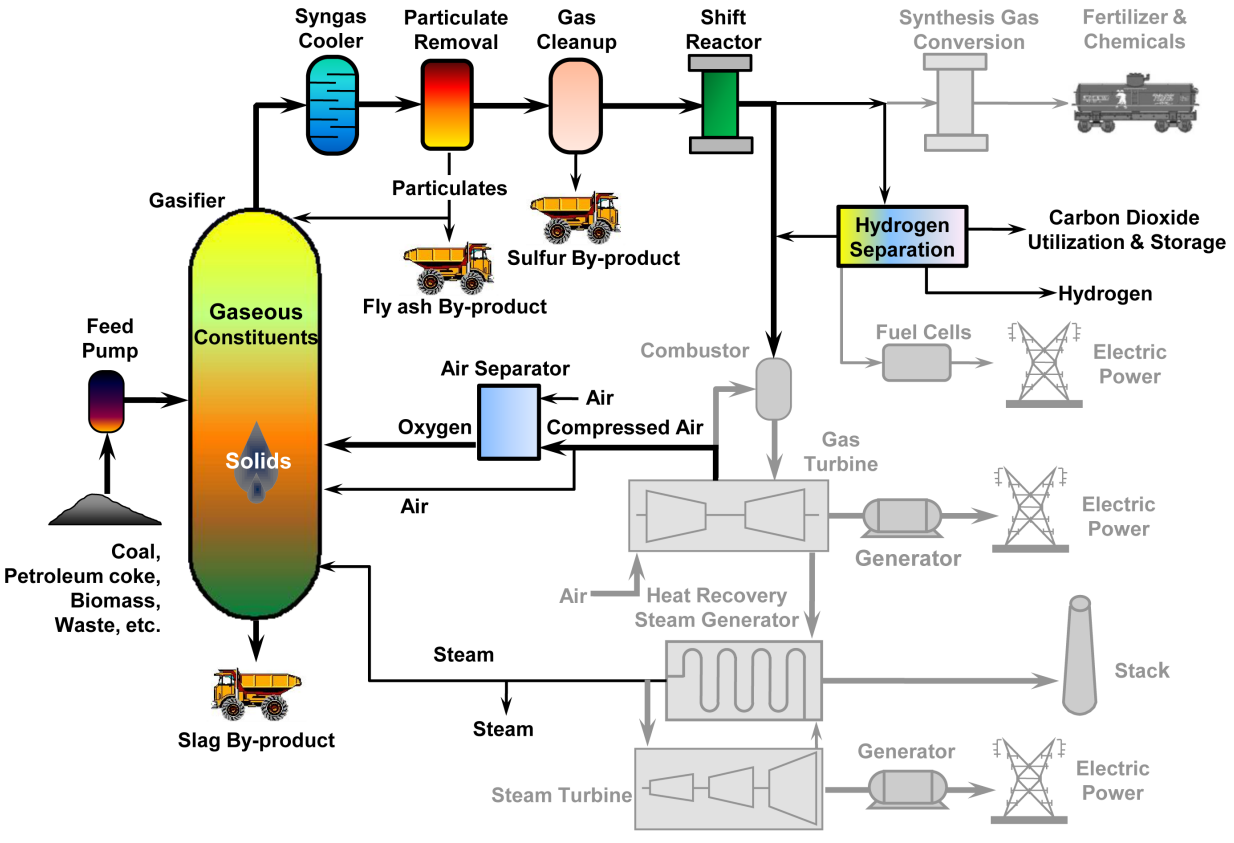
GASIFICATION SYSTEMS PROGRAM

- Reduce gasification costs so coal can support U.S. economic growth
- Ensure excellent environmental performance for coal gasification

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, potential pollutants can be captured and then disposed of or converted to useful by-products. To capture CO_2 and make clean power using gasification, steam is added to the syngas in a water-gas shift (WGS) reactor to convert the carbon monoxide to carbon dioxide (CO_2) and to produce additional hydrogen. The hydrogen and CO_2 are separated—the hydrogen is used to make power and the CO_2 is sent to storage or converted to useful product. For example, CO_2 can be used for enhanced oil recovery (EOR) or as a feedstock to make value-added products. In addition to efficiently producing electric power, a wide range of transportation fuels and chemicals can be co-produced from the cleaned syngas (as shown in the figure, below), 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.



Gasification Systems Program Research and Development Areas are in Color.
Grey sections are part of other closely aligned DOE/NETL Research Technology Programs.

The Gasification Systems Program is developing advanced technologies to reduce the cost and increase the efficiency of producing syngas, with carbon capture, in three key research and development (R&D) areas:

Gasifier Optimization, *Gas Cleaning*, and *Gas Separation*.

Gasifier Optimization R&D

Focuses on the development of technologies and models to improve the performance of advanced gasifiers, including high-pressure coal-feed pumps; low-rank coal utilization; new process instrumentation; improved reliability, availability, and maintainability (RAM); and advanced materials. A recent NETL systems analysis, "Current and Future Technologies for Gasification-Based Power Generation Volume 2: A Pathway Study Focused on Carbon Capture Advanced Power Systems R&D Using Bituminous Coal" shows that the primary benefit of Gasifier Optimization R&D is decreased capital cost and improved RAM.

Gas Cleaning R&D

Conventional methods for removing sulfur and other contaminants from syngas typically rely on chemical or physical absorption processes operating at temperatures of 100 °F or less. After contaminant removal, the gas has to be reheated and additional steam often needs to be added for downstream hydrogen production. These process swings adversely impact the plant's thermal efficiency and cost. The Gas Cleaning R&D approach focuses on the development of high-efficiency processes that operate at moderate to high temperatures and provide multi-contaminant control to extremely low levels.

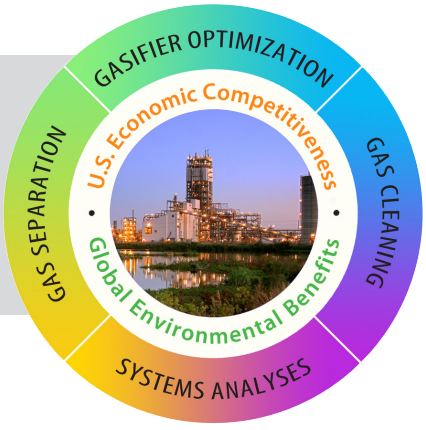
Gas Separation R&D

Gas separation unit operations represent major cost elements in gasification plants. Gasification-based energy conversion systems rely on two gas separation processes: (1) separation of oxygen from air for feed to oxygen-blown gasifiers; and (2) post-gasification separation of hydrogen from CO_2 following (or along with) the shifting of gas composition when CO_2 capture is required, or hydrogen is the desired product. The advanced gas separation systems being developed operate at elevated temperatures, thereby reducing the parasitic energy penalty associated with conventional technologies.

More information on Gasification Systems Program R&D, on how systems analysis supports the program, on the benefits of gasification, and on individual projects can be found at at the NETL website:

http://www.netl.doe.gov/technologies/coalpower/gasification/index.html

Or Google "Gasifipedia"



December 2011