U.S. DEPARTMENT of ENERGY

FECM's Gasification Systems Program Fact Sheet

The U.S. Department of Energy (DOE) is driving the rapid deployment of technologies and infrastructure to expand domestic energy production, lower costs for American families and businesses, and bolster the reliability and security of the nation's energy system. As a part of this effort, DOE's Office of Fossil Energy and Carbon Management (FECM) invests in research, development, and demonstration projects to strengthen U.S. energy and critical minerals security.

Integral to this strategy is FECM's Gasification Systems Program, which develops innovative designs and technologies to convert carbonaceous solid feedstocks into synthesis gas (syngas) to enable the low-cost production of hydrogen, transportation fuels, chemicals, electricity, and other useful products to suit market needs. Advancements in this area will enable syngas-based technologies and energy systems to be competitive in both domestic and international markets and spur the use of domestic resources as the Trump Administration aims to unleash American innovation.

What is gasification?

Gasification is a process that converts carbon-based raw materials—such as coal, biomass, petcoke, municipal solid waste, industrial wastes, and

Source: Wabash Valley Resources in West Terre Haute, Indiana

Source: Wabash Valley Resources in West Terre Haute, Indiana waste plastics—into syngas (a mixture of carbon monoxide and hydrogen). Gasification occurs in a gasifier, generally a high temperature and high-pressure vessel where oxygen (or air) and steam are directly contacted with the fuel causing chemical reactions that convert the feed to syngas and mineral residues, like ash and slag.

Syngas has a variety of uses. For example, the carbon monoxide in syngas can be converted into hydrogen and carbon dioxide by adding steam and reacting over a catalyst in a water-gas-shift reactor. When hydrogen is burned, it only creates heat and water, resulting in the ability to create electricity without carbon dioxide emissions. Furthermore, hydrogen made from coal or other solid fuels can be used to refine oil, or to make products such as ammonia and fertilizer.

Hydrogen-enriched syngas can be used to make gasoline, diesel, and aviation fuels. Polygeneration plants that produce multiple products are uniquely possible with gasification technologies. Carbon dioxide can be efficiently captured from syngas, preventing it from being emitted into the atmosphere and enabling its utilization, including enhanced oil or gas recovery, or geologic storage.

What are the advantages of gasification?

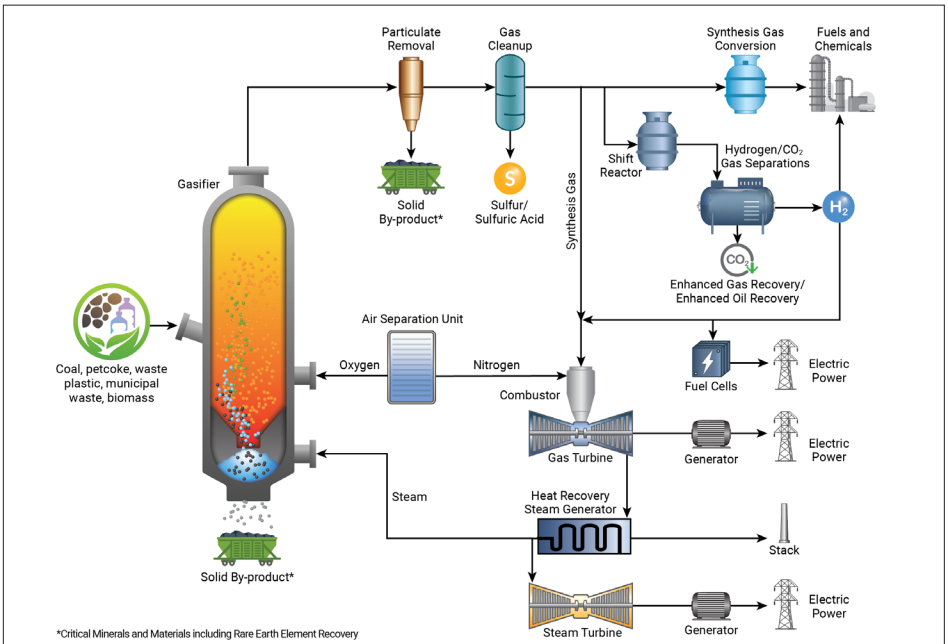
Gasification offers an alternative to more established ways of converting solid feedstocks like coal, biomass, and some waste streams into electricity and other useful products. The advantages of gasification in specific applications and conditions, particularly in clean generation of electricity from coal, may make it an increasingly important part of the world's energy and industrial markets. The abundant supply of coal throughout the world makes it a feedstock option for gasification technologies going forward.

What research is FECM focused on?

The FECM Gasification Systems Program's research and development efforts focus on three technology areas, aiming to contribute to increased efficiency, cost reductions, and greenhouse gas reductions of modular gasification/syngas-based systems.

An overview of these three technology areas include:

- **Process Intensification for Syngas & Hydrogen Production**: Research addresses control of chemical reactions in increasingly modular and intrinsically efficient reactors, allowing for smaller reactors and streamlined process systems for gasification, syngas cleanup, and syngas conversion.
- **Air Separation Technology**: Research focuses on the identification of new concepts and technologies for production of oxygen for use in gasification systems. Oxygen-blown gasification facilitates efficient carbon capture to enable decarbonized energysystems and hydrogen production.
- **Clean Hydrogen & Carbon Capture**: Research focuses on designs and strategies for modular gasification-based systems, which can reduce the carbon intensity of solid fuel-based systems, as can application of advanced technologies integrating carbon capture.



A representation of a gasification process for coal and solid waste streams, depicting feedstock flexibility along with the wide range of end products and applications where gasification technology can be utilized.

Are there any project successes?

As a part of DOE's research efforts, several projects have demonstrated promising advancements in gasification technology. One notable example is the FECM-funded Wabash Valley Resources project based in West Terre Haute, Indiana.

This project began development work in 2016, completing an advanced front-end engineering design (FEED) study to retrofit the existing gasification facility into a world-class, low carbon hydrogen and ammonia facility. After eight years of work and FECM funding, the Wabash project secured key regulatory permits (including underground injection control (UIC) Class VI well permits), identified partners, and conducted extensive due diligence necessary for project financing.

Once construction is complete, the project will provide a low cost, clean ammonia solution for fertilizer in a region with high demand for ammonia fertilizer and a limited supply. This project has the potential to put Indiana at the forefront of ammonia fertilizer production and industrial-scale carbon storage technology while creating jobs, helping farmers lower costs, reducing fertilizer supply chain risks, and attracting investment.

To keep up to date with future project updates and funding announcements, visit FECM's website and sign up for news alerts. ■

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energy.gov/fecm

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