U.S. DEPARTMENT OF ENERGY | Fossil Energy

Office of Clean Coal and Carbon Management

The U.S. Department of Energy's (DOE) Office of Fossil Energy (FE) research and development (R&D) efforts advance transformative science and innovative technologies that enable the reliable, efficient, affordable, and environmentally sound use of fossil fuels. Fossil energy sources constitute over 80 percent of the country's total energy use and are important to the Nation's security, economic prosperity, and growth. FE's Office of Clean Coal and Carbon Management R&D is focused on developing and demonstrating advanced power generation and carbon capture, utilization, and storage technologies for existing facilities and new fossil-fueled power plants by increasing overall system efficiencies and reducing capital costs.

In the near term, advanced technologies increase the power generation efficiency for new plants and technologies to capture carbon dioxide (CO_2) from new and existing industrial and power-producing plants. In the longer term, the goal is to increase energy plant efficiencies; make them more flexible, resilient, and reliable; and reduce both the energy and capital costs of CO_2 capture and storage from new, advanced plants and existing plants. These activities will help allow coal to remain a strategic fuel for the Nation while enhancing environmental protection.

The **Coal FIRST** (Flexible, Innovative, Resilient, Small, and Transformative) initiative will develop the coal plant of the future needed to provide secure, stable, and reliable power. This initiative is a top priority for the Office of Clean Coal and Carbon Management. This R&D will underpin coal-fired power plants that are capable of *flexible* operations to meet the needs of the grid; use *innovative* and cutting-edge components that improve efficiency and reduce emissions; provide *resilient* power to Americans; are *small* compared to today's conventional utility-scale coal; and will *transform* how coal technologies are designed and manufactured.

Research and Development Divisions

Advanced Energy Systems

The Advanced Energy Systems program focuses on improving the efficiency of coal-based power systems, enabling affordable CO_2 capture, increasing plant availability, and maintaining the highest environmental standards. The program supports the development of advanced turbine systems and gasification systems to convert coal into synthesis gas. That synthesis gas can then be converted into electricity, chemicals, hydrogen, and liquid fuels. The program also focuses on transformative power systems to meet the demands of the future electricity grid, solid oxide fuel cells to improve the competitiveness of coal, and the development of supercritical CO_2 power cycles for fossil fuels. For more information read here.

Crosscutting Research

The Crosscutting Research program serves as a bridge between basic and applied research by fostering the development and deployment of innovative systems through the R&D of instrumentation, sensors, and controls. The program is also active in the areas of computation, simulation, and modeling focused on optimizing plant design and shortening developmental timelines. This research improves efficiency and environmental performance and enhances the availability of advanced power systems while reducing costs. The program also supports R&D by looking for new markets and products from coal and the extraction of rare earth elements and critical materials. For more information read here.

Carbon Capture, Utilization, and Storage

The Carbon Capture, Utilization and Storage R&D program advances safe, cost-effective capture and permanent geologic storage or use of CO_2. The technologies developed and large-volume capture, utilization, and injection tests conducted through this program will be used to benefit the existing and future fleet of fossil fuel power generating facilities by:

1. Developing advanced technologies that reduce the cost of carbon capture;
2. Advancing technologies that transform CO_2 into valuable products; and
3. Creating tools to increase our understanding of geologic reservoirs appropriate for CO_2 storage and the behavior of CO_2 in the subsurface. For more information read here.