

The Legacy Continues...

Since its inception as part of DOE in 1977, FE's R&D mission has continued to evolve to reflect the nation's key energy supply, security and environmental needs.

Coal represents **93 percent** of total U.S. fossil fuel reserves and is the largest single source (**45 percent**) of electricity generation, both currently and projected for the foreseeable future.



It also is among the most carbon-intensive energy resources. Continuing the legacy of previous successes in the Clean Coal Technology Development Program, FE R&D today is focusing on ways to continue using this vital source of energy while minimizing atmospheric CO₂ emissions.

Through its **Clean Coal Research Program**, FE is in the forefront of global efforts to develop and demonstrate innovative processes that make coal use cleaner and more efficient while lowering costs. This includes:

- **Carbon Capture and Storage (CCS) Demonstration Program:** Clean Coal Power Initiative (CCPI), FutureGen 2.0 and Industrial CCS Demonstrations funded by the American Recovery and Reinvestment Act.
- **CCS and Power Systems Program:** Long-term, high-risk R&D focused on carbon capture, carbon storage, advanced energy systems and crosscutting research.

DOE's Office of Fossil Energy

FE's staff consists of about **1,000** scientists, engineers, technicians and administrative personnel, with headquarters in Washington, D.C., and Germantown, Maryland.

An important part of FE is the **National Energy Technology Laboratory (NETL)**, which manages the office's R&D, and has locations in Morgantown, West Virginia; Pittsburgh, Pennsylvania; Albany, Oregon; Fairbanks, Alaska; and Sugar Land, Texas.



FE also operates the vital **Strategic Petroleum Reserve (SPR)**, with headquarters in **New Orleans, Louisiana**, and the **Northeast Home Heating Oil Reserve**. These emergency stockpiles provide strategic and economic security against foreign and domestic disruptions in oil supplies.

For more information, see the R&D Benefits fact cards and timeline at www.fossil.energy.gov.

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FOSSIL ENERGY RESEARCH

A Legacy of Benefit



Fossil Energy Research: A Legacy of Benefit



FE research has provided numerous energy and environmental benefits.

Abundant, affordable and sustainable energy supplies are essential to modern life. Researching and developing innovative technologies that increase domestic energy, lower costs and improve environmental protection is a primary mission of the U.S. Department of Energy's (DOE) **Office of Fossil Energy (FE)**. Over more than three decades, FE research and development (R&D) has established a

legacy of **significant achievement** and return of **value and benefits** for the public funds invested. Among its notable accomplishments:

- Pioneering **Enhanced Oil Recovery (EOR)** technologies that today help provide about 13 percent of total U.S. oil production and a means for injecting and permanently storing carbon dioxide (CO₂) in geologic formations.
- Producing some 20 innovative technologies through the **Clean Coal Technology Development Program** (1986–93) that are now in the marketplace, benefitting energy production and air quality improvements.
- Advancing drilling, fracturing and environmental technologies that have helped oil and gas production from abundant **shale** resources increase significantly over the past decade.

- Developing **methane hydrate** (molecules of natural gas trapped in ice crystals) research to the point where U.S. resources have been identified, exploration models tested and confirmed, and production concepts refined and ready for initial field testing.
- Amassing extensive expertise and advisory capability in **ultra-deepwater** resource location, production, safety and environmental protection; these resources now account for 32 percent of U.S. crude oil production and 13 percent of total dry gas production.
- Achieving advances in numerous other areas critical to U.S. energy production and environmental protection, including **coal bed methane** (currently 8 percent of annual gas supply); the recycling and reuse (41 percent) of **solid waste materials** from coal combustion; transferring technological advances to small, independent (**stripper well**) oil and gas operators; proving the readiness of **activated carbon injection** to meet expected air quality regulatory standards for mercury; and pioneering advanced turbine technologies.

FE R&D has created viable energy technology options that have enhanced U.S. economic growth, environmental protection and energy security.



FE R&D programs have benefitted existing and future fossil energy resources, such as methane hydrate.

Benefit Highlights, by the Numbers

10-Fold

Increase over the past 25 years in the amount of EOR oil produced (270,000 barrels a day) using CO₂ injection technology pioneered by FE.

\$1.3 Trillion

Estimated benefits of the collaborative FE-industry R&D program using EPA values for health benefits associated with sulfur dioxide (SO₂) and nitrogen oxide (NO_x) emissions reductions.

88 Percent

Reduction in U.S. SO₂ emissions since 1970 for flue gas desulfurization (scrubber) systems installed on 60 percent of U.S. coal-based power plant capacity through 2010. R&D by DOE; coordinated and supplemented by work elsewhere.

82 Percent

Reduction in U.S. NO_x emissions since 1970 due largely to installation of low-NO_x burners and Selective Catalytic Reduction demonstrated through FE R&D.

183 Percent

Increase in U.S. coal-based electricity generation, 1970–2008.

14-Fold

Increase in the amount U.S. shale gas production has risen over the last decade, due to technology innovations led by FE R&D.

13-to-1

Estimated cumulative benefit return on FE Clean Coal Technology Program investment of \$8.5 billion between 2000 and 2020.

50-70 Percent

The amount NETL-managed R&D helped reduce the cost of mercury control at coal power plants over a 10-year period, saving industry \$4 billion–\$5 billion annually in implementation costs.