



FOSSIL ENERGY RESEARCH BENEFITS

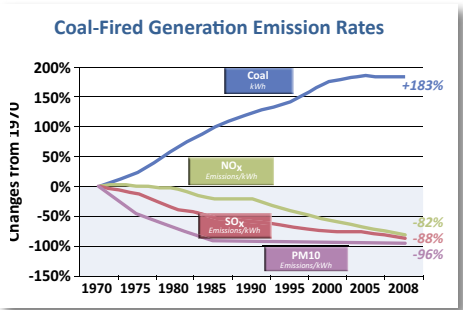
Return on Investment

Since its creation in 1977, the U.S. Department of Energy's (DOE) **Office of Fossil Energy (FE)** has established a legacy of **achievement, return-of-value, and tangible benefits** for the taxpayer dollars invested. Some of the highlights include:



Lower NO_x, SO₂ Emissions, Less Acid Rain

Improved **nitrogen oxide (NO_x)** and **sulfur dioxide (SO₂)** control technologies developed through research by FE and its partners have moved into the electric utility and industrial marketplace and now provide a cost-effective way to help meet air quality regulations.

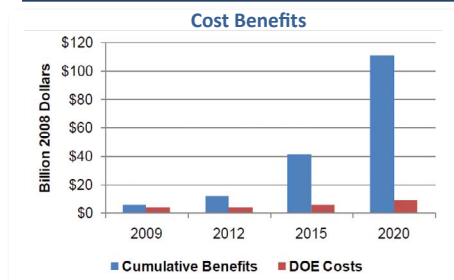


Source: Southern Company



Abundant Electricity Supply, Healthier Air Quality

Wide-scale commercial deployments of **flue gas desulfurization (FGD, or scrubbers)**, **Advanced Selective Catalytic Reduction (SCR)** and **low-NO_x burners**, which combined have helped to significantly reduce harmful emissions. Meanwhile, coal based generation has increased 183 percent since 1970.



Cost Savings, Avoided Environmental Costs, Job Creation



In addition to improving energy production and efficiency, and improved air quality, realize **ancillary benefits** from FE's Clean Coal Technology (CCT) Program.

Source: Management Information Services, Inc.,



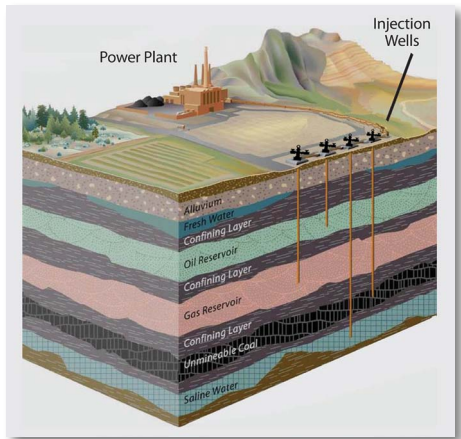
13-to-1 Return on Investment

In a 2009 study, Management Information Services estimated FE's CCT Program would deliver total **monetary benefits** of \$11 billion between 2000-2020, a 13-to-1 return for every taxpayer dollar invested.



Carbon Capture and Storage (CCS) Deployment

Experts believe affordable, commercial-scale CCS technology is an important option in reducing increased atmospheric carbon dioxide (CO₂) emissions linked to global climate change.



Accelerated Technology Advancement, Knowledge of Geologic Storage

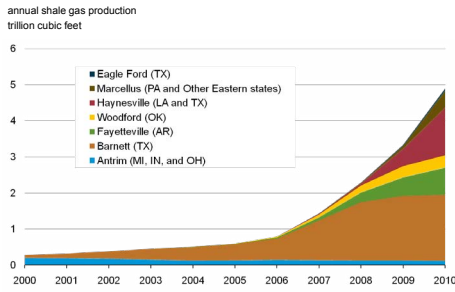
From its inception in 1997, the FE CCS program has invested over **\$785 million** (along with significant private sector funding) to develop pre- and post-combustion capture of CO₂ from electric generation and industrial processes for geologic storage. An additional **\$3.4 billion** from the American Recovery and Reinvestment Act is accelerating the demonstration and eventual deployment of CCS technologies.



Enhanced Gas Shale Production Technologies

FE research helps refine cost-effective **horizontal drilling** and **hydraulic fracturing** technologies, protective environmental practices and data development.

Over the last decade, U.S. shale gas production has increased 12-fold and now comprises about 25 percent of total U.S. production



Sources: EIA and Lippman Consulting, 2011. Newell, Richard; U.S. Energy Information Administration, "Shale Gas and the Outlook for U.S. Natural Gas Markets and Global Gas Resources," 2011.

Increased Domestic Natural Gas Supply



U.S. shale gas production grows **12-fold** between 2000–2010 and reserves triple. Shale gas, combined with production from coalbed methane (also advanced by FE research) and tight gas, now account for **58 percent** of U.S. natural gas production.

