THE U.S. DEPARTMENT OF ENERGY'S OFFICE OF FOSSIL ENERGY

BUDGET IN BRIEF FY 14

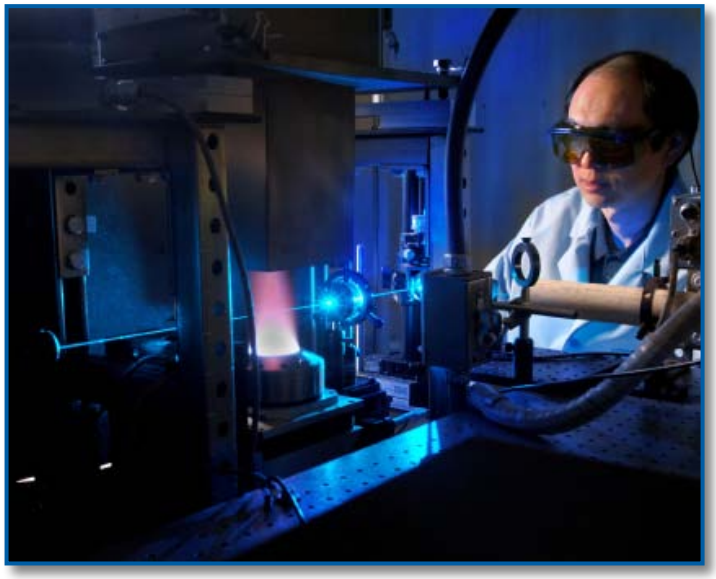
The Office of Fossil Energy (FE) programs are focused on activities related to the reliable, efficient, affordable and environmentally sound use of fossil fuels which are essential to our Nation's security and economic prosperity. FE manages DOE's Fossil Energy Research and Development Program, which includes the CCS Demonstration Programs; Carbon Capture and Storage and Power Systems Program; and Natural Gas Technologies R&D program. In addition, FE operates the Strategic Petroleum Reserve, the Northeast Home Heating Oil Reserve and the Naval Petroleum and Oil Shale Reserves. Each of these activities is in a separate appropriations account. A description of major programs, highlights and a synopsis of requested funding in the FY 2014 budget follows.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

Secure, affordable and environmentally acceptable energy sources are essential to the Nation's security and economic prosperity. The Fossil Energy Research and Development (FER&D) program leads Federal research, development, and demonstration efforts on advanced carbon capture, and storage (CCS) technologies to facilitate achievement of the President's climate goals. FER&D also develops technological solutions for the prudent and sustainable development of our unconventional domestic resources.

The Fossil Energy Research and Development programs create public benefits by:

- Performing and managing research that reduces market barriers to the environmentally sound use of fossil fuels;
- Partnering with industry and others to advance fossil energy technologies toward commercialization; and,
- Supporting the development of information and policy options that benefit the public.



Joe Yip, a researcher at the National Energy Technology Laboratory, utilizes laser-based Rayleigh light scattering to measure flame density and speed over a flat flame burner. Oxy-fuel combustion, using oxygen in place of air with diluents such as steam or carbon dioxide, can reduce pollutant emissions in advanced power cycles using gas turbines.

Increasing system efficiencies and reducing CCS capital costs is one focus area for FER&D.

Within the FER&D Appropriation, FE funds the Office of Clean Coal, focused on advancing CCS, and the Office of Oil and Natural Gas, focused on unconventional gas. FER&D efforts are fully aligned with the DOE Strategic Plan to enable prudent development of our natural resources, accelerate energy innovation through R&D, leverage domestic and international partnerships and help to sustain a world-leading technical workforce.

The mission of the Coal Program's CCS Demonstration Programs, and CCS and Power Systems R&D activities is to support secure, affordable and environmentally acceptable near-zero emissions fossil energy technologies. This will be accomplished via research, development, and demonstration to improve the performance of advanced CCS technologies. Commercial availability of CCS technologies will provide an option to use fossil fuel resources to provide energy and meet the President's climate goals.

The Coal Program is focused on the development of CCS technologies, advanced power generation technologies and cross-cutting efforts, such as computational modeling and simulation, and plant optimization. The program's goals support an R&D strategy that focuses on improving the performance of carbon capture technologies while continuing to advance our understanding of carbon storage and increase the efficiency of fossil energy systems.

The Clean Coal Power Initiative (CCPI) program has provided government co-financing for new coal technologies that have helped utilities cut sulfur, nitrogen and mercury pollutants from power plants and aims to reduce greenhouse gas emissions by boosting plant efficiencies and capturing and storing carbon dioxide. In addition to the CCPI program, FER&D manages two American Recovery and Reinvestment Act CCS demonstration programs: FutureGen 2.0 and the Industrial Carbon Capture and Storage program. The ability to demonstrate advanced technologies at scale that have been developed in the FER&D or other R&D programs is an important benefit of the demonstration programs. In addition, successful completion of the existing projects will help in meeting the President's broad national energy goal for reducing greenhouse gas emissions by 17 percent by 2020 and 83 percent by 2050, from a 2005 baseline.

The CCS and Power Systems program conducts R&D on technologies to significantly reduce coal power plant emissions and substantially improve efficiency to reduce carbon emissions, leading to viable near-zero atmospheric emissions coal energy systems and supporting carbon capture and storage. The core R&D efforts of this program focus on a variety of CCS technologies that can reduce the carbon footprint of existing and future fossil energy systems.

- The Carbon Capture activity is focused on the development of post-combustion and pre-combustion CO_2 capture and compression technologies for new and existing power plants. Post-combustion CO_2 capture technology R&D is focused on pulverized coal power plants, which is the current standard industry technology for coal-fueled electricity generation. The Natural Gas Capture subactivity is focused on facilitating the demonstration of the first commercial natural gas combined cycle power plant to capture and store 75 percent or more of the CO_2 emissions. Pre-combustion CO_2 capture is applicable to gasification-based systems such as Integrated Gasification Combine Cycle, a potential technology for future generation of electricity from coal-fueled plants.

- The overall goal of the Carbon Storage program is to develop and validate technologies to ensure safe and permanent geologic storage of captured CO_2. Development and validation of these technologies is critical to ensure industry and regulatory agencies have the capability to monitor and account for CO_2 and ensure the viability of carbon storage as an effective technology solution that can be implemented on a large-scale to mitigate carbon emissions. Applied R&D and field projects are being conducted in five primary storage types (saline formations, oil and gas reservoirs, unmineable coal seams, basalts, and organic shales) across eleven different geologic storage formation classes. Technologies developed and validated through this program will improve storage efficiency and reduce the overall cost of CCS with a goal of ensuring the cost effective ability to measure and account for 99 percent of injected CO_2 in all storage types while minimizing the environmental footprint of carbon storage activities.

- The Advanced Energy Systems (AES) sub-program is an integral part of FE's CCS and Power Systems R&D activities. The AES mission is to increase the availability and efficiency of fossil energy systems integrated with CO_2 capture, while maintaining the highest environmental standards. The program elements focus on gasification, oxy-combustion, advanced turbines, and other energy systems. While the primary focus is on coal-based power systems, improvements to many of these technologies will result in positive spillover benefits that also reduce the cost of converting other carbon-based materials, such as biomass, petcoke or natural gas, into power and value-added products in an environmentally-acceptable manner.

▶ The Cross-cutting Research activity serves as a bridge between basic and applied research by fostering the development of innovative systems for improving availability, efficiency, and environmental performance of fossil energy systems with carbon capture and storage. This crosscutting effort is implemented through the research and development of sensors, controls, and advanced materials. This program area also develops computation, simulation, and modeling tools focused on optimizing plant design and shortening developmental timelines. In addition, the Cross-cutting Research program area supports science and engineering education in minority colleges and universities.

The mission of FE Natural Gas Technology activity is to support DOE missions in energy, environment and national security. The Natural Gas Technologies Program has been reprioritized to launch a collaborative research and development initiative together with the Environmental Protection Agency and the Department of the Interior's U.S. Geological Survey. The purpose of this effort is to understand and minimize the potential environmental, health and safety impacts of natural gas development through hydraulic fracturing (fracking), consistent with the recommendations of the Secretary of Energy Advisory Board's August 2011 "Shale Gas Production Subcommittee Ninety-Day Report." The program also sponsors research projects to evaluate the occurrence, nature, and behavior of naturally occurring gas hydrates and the resulting resource, hazard, and environmental implications.

The Department of Energy, the Department of the Interior and the Environmental Protection Agency each has a role to play in promoting the responsible development of the nation's oil and natural gas resources. On April 13, 2012, the three agencies signed a Memorandum of Agreement (MOA) to formalize their collaboration on the highest priority research questions associated with safely and prudently developing unconventional shale gas and tight oil reserves. The budget request includes $12 million to support DOE's activities under the MOA.

- The primary goals of this multiagency research effort are to provide timely science and tools that support sound policy, to allow for informed unconventional oil and gas resource development decisions, and to advance technologies that will maximize the benefits of these domestic energy resources to the nation. Each of the three agencies has a unique set of core capabilities relevant to this scientific challenge.
- In addition, the interagency collaboration helps ensure that each agency is focused on those tasks that are most relevant to its skill sets, and that the agencies are effectively working together on tasks that require collaboration.

The SPR Bryan Mound site near Freeport, Texas.

PETROLEUM RESERVES

Strategic Petroleum Reserve

The Strategic Petroleum Reserve (SPR) protects the U.S. from future disruptions in critical petroleum supplies. The program fulfills U.S. obligations under the International Energy Program, which avails the U.S. of International Energy Agency assistance through its coordinated energy emergency response plans, and provides a deterrent against energy supply disruptions. Program provides for the management, maintenance, security and operational readiness of the SPR's oil storage and distribution facilities.

Northeast Home Heating Oil Reserve

The Northeast Home Heating Oil Reserve (NEHHOR) provides a short-term supplement to the Northeast systems' commercial supply of heating oil in the event of a supply interruption. It provides a buffer to assist the heating oil industry in mitigating short-term supply interruptions.

The NEHHOR Program funds Commercial Storage Leases, Information Technology Support, Quality Control and Analyses. It is a valuable component of America's energy readiness effort, separate from the Strategic Petroleum Reserve.

Naval Petroleum and Oil Shale Reserves

The NPOSR program manages a number of legal agreements that were executed as part of the 1998 sale of Naval Petroleum Reserve No. 1 (NPR-1) in California. These agreements direct post-sale work including environmental restoration and remediation, equity finalization, contract closeout and records disposition. The NPR-1 program continues to work towards closing out the remaining environmental findings, as required by the 2008 agreement between DOE and California.

DOE also operates NPR-3 and the Rocky Mountain Oilfield Testing Center (RMOTC), co-located near Casper, Wyoming. NPR-3/RMOTC will begin implementing a disposition plan with final disposition of the property estimated to occur in FY 2015. The site facilities will be utilized by production and testing operations in order to maintain asset value during preparation to transfer to potential new ownership. Production facilities will remain operational and done in a safe manner in accordance with environmental regulations. Production of 137 barrels of oil per day is forecast generating $4.2 million deposited into the U.S. Treasury.

Program Budget Highlights

Fossil Energy R&D

The mission of the Coal Program's CCS Demonstration Programs, and CCS and Power Systems R&D activities is to support secure, affordable, and environmentally acceptable near-zero emissions fossil energy technologies. This will be accomplished via research, development, and demonstration to improve the performance of advanced CCS technologies. Commercial availability of CCS technologies will provide an option to use fossil fuel resources to provide energy and meet the President's climate goals.

In FY 2014, the Coal Program will be working to achieve the following goals:

- Initiate construction of at least one Clean Coal Power Initiative demonstration project.
- Advanced Energy Systems with CO_2 capture at a 13 percent cost reduction per tonne of CO_2 captured (2011 dollars).
- Inject 5.0 million metric tons of CO_2 in large-volume field test sites.

Carbon Capture & Storage and Power Systems (FY 2014 Request: $276.6M)

► *Carbon Capture* (FY 2014 Request: $112.0M) – Increased funding (+$45.0M) is requested for Carbon Capture, which will include transitioning and scaling-up multiple, advanced CO_2 capture technologies pursued by the ARPA-E and EFRC programs between 2009 and 2013 to the Fossil Energy Carbon Capture Program. Additionally, $25.0 million is allocated to fund (through a competitive inducement prize or other appropriate funding mechanism) a solicitation to demonstrate the first commercial natural gas combined cycle plant to capture and store 75 percent or more of the CO_2 emissions.

► *Carbon Storage* (FY 2014 Request: $61.1M) – A decrease (-$51.0M) for Carbon Storage maintains a minimum level of funding for current activities and focuses budgetary resources on advancements in carbon capture.

► *Advanced Energy Systems* (FY 2014 Request: $48.0M) – Decreased funding (-$49.0M) for Advanced Energy Systems will focus on activities related to pressurized oxy-boiler and chemical looping combustion. Of the eight projects that were selected in FY 2012, four will be down-selected according to their performance and potential merits and Gasification Systems will continue to support the construction of the 100 TPD ITM oxygen plant and R&D activities in coal dry feed systems and hydrogen membrane separation. The Hydrogen Turbines program will focus on the development of advances in 2nd generation hydrogen turbine component technologies.

► *Cross-cutting Research* (FY 2014 Request: $20.5M) – Decreased funding (-$27.0M) requested reflects the shift in focus toward sensor technologies that have potential benefits to maximize plant efficencies and reduce emissions to both existing and new fossil-fueled power plants.

► *NETL Coal R&D* (FY 2014 Request: $35.0M) – The FY 2014 request supports the National Energy Technology Laboratory program specific activities in Carbon Capture, Carbon Storage, Advanced Energy Systems and Cross-cutting Research. The in-house research and development activities are conducted by a staff of scientists, engineers, technicians and administrative personnel.

Natural Gas Technologies (FY 2014 Request: $17.0M)

In FY 2014, the Natural Gas program supports a collaborative research and development initiative with the Environmental Protection Agency (EPA) and the Department of the Interior's U.S. Geological Survey (USGS) to understand and minimize the potential environmental, health, and safety impacts of natural gas development through hydraulic fracturing (fracking). The program also intends to conduct lab- and/or field-based research focused on increasing public understanding of methane dynamics in gas-hydrate bearing areas, and generate public data. These public sector-led efforts will be designed to evaluate the occurrence, nature and behavior of naturally occurring gas hydrates and the resulting resource, hazard, and environmental implications. The request includes an increase (+$7.0M) for Effective Environmental Protection ($12.0M total) and a decrease (-$4.7M) for Gas Hydrates ($5.0M total).

Petroleum Reserves

► *Strategic Petroleum Reserve* (FY 2014 Request: $189.4M) – The FY 2014 request is a 2 percent (-$3.3M) decrease from the FY 2012 current request of $192.7M due to fewer security positions, efficiencies realized in power contract renewals, and completion of the new Bayou Choctaw Cavern 102 development. These decreases were offset by increases in cavern remediation activities, technical support services, and updates to intra-site communication services. This request provides continuation of the base program for SPR operations, as well as the Casing Inspection and Remediation Program and degasification of crude oil.

► *Northeast Home Heating Oil Reserve* (FY 2014 Request: $8.0M) – The decrease (-$2.1M) is due to the reduction in NEHHOR from a 2 million barrel heating oil reserve to a 1 million barrel higher cost Ultra Low Sulfur Diesel (ULSD) reserve. FY 2014 request continues operation of 1 million-barrel reserve of ULSD to protect the Northeast against high vulnerability of winter-related supply shortages.

► *Naval Petroleum & Oil Shale Reserves* (FY 2014 Request: $20.0M) – An increase (+$5.0M) over the enacted FY 2012 is associated with accelerating environmental remediation responsibilities of NPR-1 to be responsive to the landowner development plan and meet compliance requirements of the California Department of Toxic Substances Control.

Fossil Energy Budget

Area	Program	Request (Thousand $)
Research & Development	CCS Demonstrations (CCPI, FutureGen 2.0, Industrial CCS)	$0
	CCS & Power Systems	
	Carbon Capture	$112,000
	Carbon Storage	$61,095
	Advanced Energy Systems	$48,000
	Cross-cutting Research	$20,525
	NETL Coal R&D	$35,011
	Total CCS & Power Systems	$276,631
	Natural Gas Technologies	$17,000
	Other R&D Programs, Dir. Mgmt. Support	$135,644
	Use of Prior Year's Funds	($8,700)
	Total, Research and Development	**$420,575**
Petroleum Reserves	Strategic Petroleum Reserve	$189,400
	Northeast Home Heating Oil Reserve	$8,000
	Naval Petroleum Reserves/RMOTC	$20,000
	Elk Hills School Lands Fund	$0
	Total, Petroleum Reserves	**$217,400**
	Total Fossil Energy Budget	**$637,975**