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

BUDGET IN BRIEF FY 13

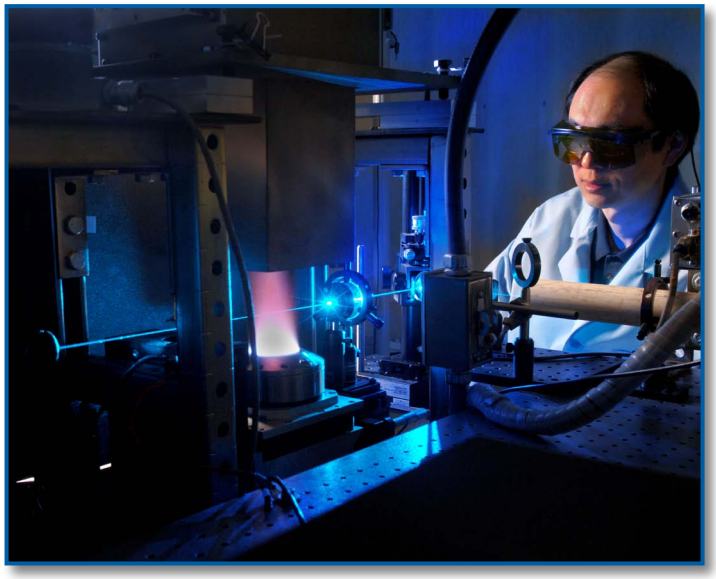
OFFICE OF FOSSIL ENERGY (FE) PROGRAMS ARE FOCUSED ON ACTIVITIES RELATED TO THE RELIABLE, EFFICIENT, AFFORDABLE AND ENVIRONMENTALLY SOUND USE OF FOSSIL FUELS, AND ENHANCING U.S. ECONOMIC, ENVIRONMENTAL AND ENERGY SECURITY. FE MANAGES DOE'S FOSSIL ENERGY RESEARCH AND DEVELOPMENT (FER&D) PROGRAM, WHICH INCLUDES THE CLEAN COAL POWER INITIATIVE (CCPI); CARBON CAPTURE AND STORAGE (CCS) AND POWER SYSTEMS PROGRAM; ADVANCED ENERGY SYSTEMS; THE CROSSCUTTING RESEARCH ACTIVITY; AND NATURAL GAS TECHNOLOGIES R&D PROGRAM. IN ADDITION, FE OPERATES THE STRATEGIC PETROLEUM RESERVE (SPR), THE NORTHEAST HOME HEATING OIL RESERVE, NAVAL PETROLEUM AND OIL SHALE RESERVES (NPOSR) AND ELK HILLS SCHOOL LANDS FUND. 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 2013 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 advances technologies related to the reliable, efficient, cost-effective and environmentally sound use of fossil fuels, which provide more than 80 percent of U.S. energy consumption. To help meet this demand, the program is developing fuel systems and practices that will provide current and future generations with clean, reasonably priced and dependable energy from the nation's abundant fossil fuel resources – coal, oil and natural gas.

Consequently, the mission of the program is to create technology and technology-based policy options for public benefit by enhancing U.S. economic, environmental and energy security. This mission is achieved by developing technologies to enable the clean use of domestic fossil fuels with the goal of achieving near-zero atmospheric emissions power production, including a specific focus on dramatic reductions of global carbon emissions at acceptable cost. FER&D will also address concerns associated with the environmental, health and safety risks of shale gas development.

The FER&D program supports the recommendations of President Obama's Interagency Task Force on Carbon Capture and Storage, as well as DOE's overall mission to achieve national energy security in an eco-



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.

nomic and environmentally sound manner by developing the technical capability to dramatically reduce carbon emissions to achieve near-zero atmospheric emissions power production. To achieve this goal, the program 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 that 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 are being developed. In the longer term, the goal is to increase energy plant efficiencies and reduce both the energy and capital costs of CO_2 capture and storage from new, advanced coal plants and existing plants. These activities will help allow coal to remain a strategic fuel for the nation while enhancing environmental protection.

Consequently, the core R&D of FE's Carbon Capture and Storage (CCS) and Power Systems program focuses on a variety of carbon capture, utilization and storage technologies for pulverized coal (PC), oxy-combustion and gasification plants: pre- and post-combustion CO_2 capture for new and existing plants, improved gasification technologies, improved turbines for future coal-based combined cycle plants and creation of a portfolio of technologies whose primary objectives is to capture and permanently store greenhouse gases.

The FE program is focused on meeting DOE's mission by:

- *Transforming Our Energy Systems* – Through development and deployment of cost-competitive carbon capture, utilization and storage technology; demonstration of technologies on commercial-scale plants; environmentally sustainable and safe development of unconventional oil and natural gas resources; and international partnerships for clean energy deployment.

- *Encouraging Science and Engineering Enterprise* – By supporting graduate and post-graduate research and internships; and advancing modeling and simulation to reduce the upfront cost and risk of carbon capture, utilization and storage.

- *Securing our Nation* – With technology innovations that enable fossil fuels to continue to be part of a diversified, low-carbon energy portfolio.

- *Maintaining Management and Operational Excellence* – By conducting FE-wide business review assessment for mission success.

The CCS Demonstration Program, including the Clean Coal Power Initiative (CCPI), FutureGen 2.0, and Industrial CCS Demonstrations, enables and accelerates the deployment of advanced CCS technologies to ensure clean, reliable and affordable electricity for the United States. CCPI is a cost-shared partnership between the government and industry to develop and demonstrate advanced coal-based power generation technologies at the commercial scale. The 2013 budget request does not provide any demonstration funds because these projects are already strongly supported through the 2009 American Recovery and Reinvestment Act, which provided $3.4 billion for CCS, $800 million of which supported CCPI demonstration projects.

The CCS and Power Systems program directly supports the mission of FER&D by providing research to significantly reduce coal power plant emissions (including CO_2) and substantially improve efficiency to reduce carbon emissions, leading to a viable near-zero atmospheric emissions coal energy system and supporting carbon capture, utilization and storage.

▶ The Carbon Capture sub-program is focused on the development of post-combustion and pre-combustion CO_2 capture technologies for new and existing power plants as well as industrial sources. Post-combustion CO_2 capture technology is applicable to pulverized coal power plants, which is the current standard industry technology for coal-fueled electricity generation. Pre-combustion CO_2 capture is applicable to gasification-based systems such as IGCC, a potential technology for future generation of electricity from coal-fueled plants. Industrial sources may provide unique challenges to CO_2 capture at these facilities.

▶ The Carbon Storage sub-program is focused on safe, cost effective, permanent geologic storage and/or beneficial use of CO_2. R&D in this area was previously funded under the Greenhouse Gas Control activities. The technologies developed through this activity will be used to benefit the existing and future fleet of fossil fuel power generating facilities by reducing the cost-of-electricity impacts and providing protocols for CCS demonstrations as they are designed to capture, transport, store and monitor the CO_2 injected in geologic formations. No funding is provided for reforestation or other terrestrial carbon sequestration.

► The Advanced Energy Systems sub-program focus is on reducing the cost of gasification and enabling affordable CO_2 capture, while increasing plant availability and efficiency, and maintaining the highest environmental standards. The program supports gasification-related R&D to convert coal into ultra-clean synthesis gas (syngas) that can, in turn, be converted into chemicals, hydrogen, liquid fuels and electricity.

► The Crosscutting Research sub-program serves as a crosscutting bridge between basic and applied research by fostering the development and deployment of innovative systems for improving efficiency and environmental performance through the research and development of instrumentation, sensors and controls targeted at enhancing the availability of advanced power systems while reducing costs of Advanced CCS and Power Systems. This program area also develops computation, simulation and modeling tools focused on optimizing plant design and shortening developmental timelines.

The Oil and Natural Gas Technologies R&D program will ensure the prudent development of our domestic oil and natural gas resources. The FY 2013 budget request will redirect oil and natural gas R&D within FER&D to support a coordinated, interagency effort by DOE, the Environmental Protection Agency (EPA) and the U.S. Geological Survey (USGS) to conduct research and development aimed at understanding and reducing the environmental, health and safety risks of natural gas and oil production through hydraulic fracturing. The program also is studying hydrates in the Arctic via controlled in situ depressurization and CO_2 injection. The Program recently drilled a fully instrumented hydrate well in Alaska at a cost of $8 million. Leveraging funding from Japan (up to $7 million) and $5 million from the FY 2011 Basic Energy Science budget (in DOE's Office of Science), the testing of this well will take place in 2012 and be completed in FY 2013. The program is also investigating natural gas hydrates in the Arctic as a potential fossil resource.

PETROLEUM RESERVES

Strategic Petroleum Reserve

SPR provides strategic and economic security against foreign and domestic disruptions in oil supplies via an emergency stockpile of crude oil. 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.

SPR Petroleum Account

The SPR Petroleum Account provides for the acquisition, transportation, and injection of petroleum into SPR, including U.S. Customs duties, terminal throughput charges, and other related miscellaneous costs. During an emergency drawdown and sale, the SPR Petroleum Account is the source of funding for the incremental costs of withdrawing oil from the storage caverns and transporting it to the point where purchasers take title. The sales receipts from the 2011 International Energy Agency-mandated drawdown were deposited into the SPR Petroleum Account.

The SPR Bryan Mound site near Freeport, Texas.

Northeast Home Heating Oil Reserve

Established in 2000, the Northeast Home Heating Oil Reserve is capable of assuring a short-term supplement to private home heating oil supplies in the Northeast during times of very low inventories or in the event of significant threats to immediate energy supplies. The reserve provides a supplemental emergency supply of heating oil for up to 10 days, which is the time required for ships to carry heating oil from the Gulf of Mexico to New York Harbor.

Naval Petroleum and Oil Shale Reserves

For much of the 20th century, NPOSR served as a contingency source of fuel for the nation's military. In 1998, Naval Petroleum Reserve No. 1 (NPR-1 or Elk Hills), was privatized, the first of a series of major organizational changes that leave only one of the original six federal properties in the program. For the two decades that FE managed NPOSR, the properties served valuable functions not only as a source of revenue for the U.S. Treasury, but also as a model of improved oil field practices.

Since it no longer served the national defense purpose envisioned in the early 1900s, Congress directed a reconfiguration of the NPOSR beginning in the mid-1990s. The National Defense Authorization Act for FY 1996 (P.L. 104-106) required the sale of the government's interest in NPR-1. To comply with this requirement, a competitive bidding process was held, and in 1998, the Elk Hills field was sold to the highest bidder, Occidental Petroleum Corporation. Through additional legislation, two of the Naval Oil Shale Reserves (NOSR-1 and NOSR-3) were transferred to the Department of the Interior's (DOI) Bureau of Land

Weyburn-Midale is a commercial-scale project recognized by the Carbon Sequestration Leadership Forum that will utilize CO_2 for enhanced oil recovery. Photo of CO_2 pipeline as it enters Weyburn from Beulah, N.D., courtesy of Petroleum Technology Research Centre.

Management, and the NOSR-2 site was returned to the Northern Ute Indian Tribe. The Energy Policy Act of 2005 transferred administrative jurisdiction and environmental remediation of Naval Petroleum Reserve 2 (NPR-2) in California to DOI, except for eight small unused drill sites in Ford City. DOE retains the Naval Petroleum Reserve No. 3 (NPR-3) in Wyoming (Teapot Dome field).

ELK HILLS SCHOOL LANDS FUND

The Elk Hills School Lands Fund provides a source of compensation for the California State Teachers' Retirement System as a result of a settlement with the State of California with respect to its longstanding claim to title of two sections of land within NPR-1. The Department of Energy and California entered into a settlement agreement in 1996 in which DOE agreed to compensate California for its claim. The agreement stipulates installments totaling 9 percent of the net proceeds from the sale be paid to California.

Program Budget Highlights

Fossil Energy R&D

Coal activities include research, development and demonstration of technologies that will improve the competitiveness of near-zero emissions coal-fueled electricity generation in future energy supply markets through technologies that cost-effectively capture, utilize, and store CO_2, providing a domestic, low-cost, low-CO_2 energy supply option.

In FY 2013 and through the Recovery Act, the Coal program continues aggressive funding for CCS activities, including large-scale demonstration of injection and storage in geologic formations or beneficial utilization of CO_2 through the Regional Carbon Sequestration Partnerships and large-scale demonstration of carbon capture technologies through the Clean Coal Power Initiative and Industrial CCS activity. [*Note: Budget figures are rounded*]

Carbon Capture & Storage (CCS) and Power Systems (FY 2013 Request: $275.9M)

▶ *Carbon Capture* (FY 2013 Request: $60.4M) – The decrease in funding (-$6.5M) for Post-Combustion goes to a level sufficient to maintain focus on the current scope of activities while the decrease in funding (-$2M) for Pre-Combustion Capture Systems represents program prioritization on post-combustion capture technology development. The program plans to achieve its pre-combustion capture targets later than previously projected.

▶ *Carbon Storage* (FY 2013 Request: $95.5M) – A decrease in funding (-$16.2M) for the Regional Carbon Sequestration Partnerships maintains funding for the Regional Partnerships and reduces the funding levels for small and large-scale field tests in other promising geologic storage classes. The decrease in funding (-$3.7M) for Geological Storage gives greater priority to near-term research areas to meet goals for safe, permanent storage.

▶ *Advanced Energy Systems* (FY 2013 Request: $55.2M) – For FY 2013, the decrease in funding (-$5.2M) for Advanced Combustion Systems R&D represents the shift in focus toward technologies that have potential benefits to both existing and new fossil-fueled power plants. The decrease in funding (-$7.1M) for Gasification Systems also represents a shift in focus toward technologies that have potential benefits applicable to both existing new fossil-based power plants, as does the decrease in funding (-$2.4M) for hydrogen turbines. No funds were requested for the Coal and Coal Biomass to Liquids Program (a decrease of -$5.0M) because no new activities are planned. The Solid Oxide Fuel Cells Program has prioritized near-term CCS technologies available for demonstration in the 2015 timeframe. As a result, 2013 funding for longer-term fuel cell technologies has not been requested (a decrease in funding of -$25M). The Solid State Energy Conversion Alliance (SECA) Core Technology R&D will complete existing work – no new Core Technology efforts will be initiated in 2013.

▶ *Crosscutting Research* (FY 2013 Request: $29.8M) – The overall decrease in funding (-$19.4M) represents the shift in focus toward technologies that have potential benefits to both existing and new fossil-fueled power plants. The funding request is broken down as follows: Plant Optimization Technology – $7.0M for sensors and controls; Coal Utilization Science –$17.2M for computation systems dynamics and computational energy science; Energy Analyses – $0.95M for environmental activities and technical and economic analysis; University Training and Research – $3.25M for university coal research, historically black colleges and universities education and training; and International Activities – $1.35M.

▶ *NETL Coal R&D* (FY 2013 Request: $35.0M) – The FY 2013 request supports the National Energy Technology Laboratory (NETL) program specific activities in Carbon Capture, Carbon Storage, Advanced Energy Systems, and Crosscutting Research. The in-house research and development activities are conducted by a staff of scientists, engineers, technicians and administrative personnel.

Oil and Natural Gas Technologies (FY 2013 Request: $17.0M)

This R&D program focuses on the sustainable development of the nation's ultra-deepwater, unconventional gas and methane hydrate resources. The increase in funding (+$2.0M) will be focused on continued implementation of a priority collaborative R&D initiative with EPA and USGS to understand and minimize the potential environmental, health, and safety impacts of shale gas development through hydraulic fracturing, consistent with the research recommendations received from the Subcommittee of the Secretary of Energy Advisory Board. President Obama directed Energy Secretary Steven Chu to form the Subcommittee as part of the President's "Blueprint for a Secure Energy Future," and it was charged with making recommendations to improve the safety and environmental performance of natural gas hydraulic fracturing from shale formations. The Department has been engaged with EPA and the USGS for several months to determine top priority research projects, divide work responsibilities, and continue collaboration to share data and planning. The total request in this area is broken down in the following manner: $12.0M for effective environmental protection/science; and $5.0M for gas hydrates.

Petroleum Reserves

▶ *Strategic Petroleum Reserve* (FY 2013 Request: $195.6) – The FY 2013 budget request provides for the management, operations and security of the four SPR storage facilities with a combined capacity of 727 million barrels. It will also allow the relocation of the degasification plant to maintain SPR crude oil stocks at safe vapor pressure levels, and cavern casing inspections and remediation as required to comply with state regulations and to assure storage integrity. The FY 2013 budget increase (+$2.9M) is attributable to moving the degasification plant from the Bryan Mound site to the West Hackberry site; a capacity maintenance program; enabling SPR to regain the cavern volume lost to geologically induced cavern creep and an increased cavern remediation program. The increase is offset by no additional funding required for the Bayou Choctaw cavern replacement project and a reduction in security and power costs.

▶ *SPR Petroleum Account*: The FY 2012 budget included a $500 million rescission of sales receipts from the 2011 drawdown. The FY 2013 budget proposes to permanently cancel $291 million of sales receipts.

Members of the Visualization Research Group in the National Energy Technology Laboratory's Office of Research and Development develop capabilities to visualize data and advanced power generation systems.

▶ *Northeast Home Heating Oil Reserve* (FY 2013 Request: $10.1M, $6M Discretionary Rescission) – In FY 2011, the Northeast Home Heating Oil Reserve completed the sale of all the high sulfur heating oil in commercial storage and awarded new contracts for commercial storage leases for 1 million barrels of ultra-low sulfur diesel (ULSD). The FY 2012 budget cancelled the net sale receipts in excess of the cost to purchase 1 million barrels of ULSD and other related costs. The FY 2013 budget request continues operation of the reserve, including the extension of the lease of commercial storage space in the New England area.

▶ *Naval Petroleum & Oil Shale Reserves* (FY 2013 Request: $14.9M) – The NPOSR program will continue to work towards closing out legal responsibilities of environmental remediation at NPR-1. Disposition activities will begin at NPR-3 with final disposition of the property estimated to occur in FY 2015. NPR-3 will be utilized for production and testing operations in order to retain asset value during preparation to transfer to potential new ownership. Production facilities will remain operational as long as economic. The program will continue Rocky Mountain Oilfield Testing Center (RMOTC) testing for 100 percent funds-in projects and those projects wholly funded by EERE's Geothermal Technology Program. Environmental remediation of NPR-3 facilities will continue to facilitate the sale/disposition of the property in a manner consistent with an approved property sale/disposition plan.

▶ *Elk Hills School Lands Fund* (FY 2013 Request: $15.6M) – The FY 2013 budget request provides $15.6 million for the final payment to the California State Teachers' Retirement System.

Fossil Energy Budget

Area	Program	Request (Thousand $)
Research & Development	CCS Demonstrations (CCPI, FutureGen 2.0, Industrial CCS)	$0
	CCS & Power Systems	
	Carbon Capture	$60,438
	Carbon Storage	$95,477
	Advanced Energy Systems	$55,193
	Crosscutting Research	$29,750
	NETL Coal R&D	$35,011
	Total CCS & Power Systems	$275,869
	Natural Gas Technologies	$17,000
	Other R&D Programs, Dir. Mgmt. Support	$135,644
	Use of Prior Year's Funds	($7,938)
	Total, Research and Development	**$420,575**
Petroleum Reserves	Strategic Petroleum Reserve	$195,609
	Northeast Home Heating Oil Reserve	$10,119
	Discretionary Rescission	($6,000)
	Total Northeast Home Heating Oil Reserve	$4,119
	Naval Petroleum Reserves/RMOTC	$14,909
	Elk Hills School Lands Fund	$15,580
	Total, Petroleum Reserves	**$230,217**
	Total Fossil Energy Budget	**$650,792**