STATEMENT OF

CHRISTOPHER SMITH

ASSISTANT SECRETARY FOR
FOSSIL ENERGY (ACTING)

U.S. DEPARTMENT OF ENERGY

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Mr. Chairman, Madam Ranking Member, and Members of the Committee, it is my pleasure to appear before you today to discuss the Department of Energy's (DOE) Office of Fossil Energy's (FE) programs.

Our fossil fuel resources are essential to the Nation's security and economic prosperity. The Office of Fossil Energy's primary mission is to ensure that the U.S. can continue to utilize those traditional fuel sources for clean, affordable, reliable energy. Technology development is critical to this mission. FE's Research and Development (FER&D) program advances technologies related to the reliable, efficient, affordable, and environmentally sound use of fossil fuels.

FE also manages the Nation's Strategic Petroleum Reserve (SPR). The SPR, with a capacity of 727 million barrels, serves as the largest stockpile of government-owned emergency crude oil in the world. The SPR helps ensure U.S. energy security by providing protection against disruptions in U.S. oil supplies. It also allows the United States to meet, in combination with commercial stocks, its International Energy Agency (IEA) obligation to maintain emergency oil stocks.

In addition to the SPR, FE oversees the Northeast Home Heating Oil Reserve, which provides a short-term supplement to private home heating oil supplies in the Northeast in the event of a supply interruption. The Office also manages the Naval Petroleum Reserves.

Beginning with the FER&D program, I would like to provide an overview of FE's activities over the past year.

Carbon Capture and Storage (CCS) and Power Systems R&D

FER&D has concentrated on programs and projects to enable the efficient and sustainable use of the Nation's abundant fossil resources. In support of President Obama's Interagency Task Force on Carbon Capture and Storage recommendations to develop the technical capability to dramatically reduce carbon emissions from power production, the bulk of FE's R&D program activities were focused on:

1) Carbon dioxide (CO_2) capture technology applicable to both new and existing fossil-fueled facilities;

2) CO_2 storage, CO_2 monitoring, verification, accounting, and assessment;

3) Advanced systems utilizing fossil energy resources for power and high-value chemicals that support carbon capture and storage (CCS) and CO_2 utilization , including integrated gasification combined cycle (IGCC) and oxy-combustion technologies; and

4) Cross-cutting research to bridge fundamental science and engineering development.

These initiatives are designed to achieve the reduction of fossil energy power plant emissions (including CO_2) and substantially improve efficiency to reduce carbon emissions, leading to a viable near-zero atmospheric emissions fossil energy system and supporting carbon capture,

utilization and storage. While initiated with a focus on coal plants, many are applicable to natural gas plants with some further development. The program currently includes large-scale demonstration of carbon capture technologies through the Clean Coal Power Initiative (CCPI), FutureGen 2.0, and Industrial Carbon Capture and Storage (ICCS) activity, as well as large-scale demonstration of injection and storage in geologic formations and beneficial utilization of CO_2 through the Regional Carbon Sequestration Partnerships.

Carbon Capture. This sub-program is focused on the development of post-combustion and pre-combustion CO_2 capture technologies for new and existing power plants. 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.

FE's advanced carbon capture R&D activities have concentrated primarily on post-combustion technologies. This emphasis on post-combustion is due to the large installed base of pulverized coal combustion electricity generating plants. The successful development of advanced CO_2 capture technologies for post-combustion CO_2 capture is critical to reducing the carbon intensity of coal-based power generation in the U.S. and globally. The program has completed over 2,000 hours of post-combustion capture pilot-scale testing which has allowed novel and advanced technologies to be taken out of the laboratory and tested under real-world coal flue gas conditions. An example of the cutting edge technology being developed through FER&D is the Basic Immobilized Amine Sorbent (BIAS) process – a novel carbon capture technology developed by FE's National Energy Technology Laboratory (NETL) and an industry partner – which was recognized in 2012 by *R&D Magazine* as among the 100 most technologically significant products introduced into commercial marketplace within the past year.

Carbon Storage. The activities conducted under this sub-program are designed to benefit the existing and future fleet of fossil fuel power generating facilities by further refining the understanding of available storage opportunities that exist throughout the United States and by developing technologies/protocols that ensure the safe, permanent storage of CO_2 injected in geologic formations.

We have pursued projects designed to develop innovative, advanced technology and protocols for the monitoring, verification, accounting, and assessment (MVAA) of CO_2 storage in geologic formations as well as simulating the behavior of geologically-stored CO_2. MVAA of geologic storage sites is an important part of making geologic storage a safe, effective and reliable method of greenhouse gas control. These activities will culminate in a set of best practices for the deployment of carbon capture, utilization and storage technology.

The DOE's Regional Carbon Sequestration Partnerships (RCSPs) are an essential component of the carbon storage program. They unite more than 400 public and private entities in an effort to complete and evaluate CO_2 injection tests across the nation. In FY 2012, two RCSPs began large-scale projects that inject carbon dioxide for utilization and geologic storage. In addition, the RCSPs provided input for NETL's 2012 edition of the *Carbon Utilization and Storage Atlas (Atlas IV),* which illustrates that the U.S. potentially has

at least 2,400 billion metric tons of possible CO_2 storage resource in saline formations, oil and gas reservoirs, and unmineable coal seams.

CCS Demonstrations. Through demonstrations, the technical risks associated with scale-up and plant integration of advanced technologies are reduced, thereby, accelerating the deployment of new technologies into the commercial sector. Fully funded through The American Recovery and Reinvestment Act as well as prior year appropriations, this sub-program focuses on demonstrating CCS technologies integrated with retrofits to existing coal-fired power plants and to new plant builds such as the construction of advanced power generation plants such as IGCC, and carbon dioxide emitting industrial facilities. As such, this sub-program is comprised of two activities focused on coal-based power generation with CCS (CCPI and FutureGen 2.0) and one activity focused on industrial applications of CCS technologies (the ICCS program).

There have been important advances in several demonstration projects. For instance, construction of the Kemper County Mississippi Power IGCC project under the CCPI program is over 50 percent complete, while the Archer Daniels Midland ICCS project in Illinois is under construction and approximately 45 percent complete. In Texas, The Air Products and Chemicals, Inc. ICCS project began capture and CO_2 enhanced oil recovery operations. The project began capturing CO_2 from the first of two steam methane reformer hydrogen production plants in December 2012. Capture from the second unit is expected in the next few months.

FutureGen 2.0 successfully completed Phase I, which included identification of a sequestration site, preliminary characterization and test drilling, and a commitment from the Illinois Commerce Commission to cover the project's output under its purchasing plans. Phase II commenced on February 1, 2013, and the project is now focused on preliminary design and engineering.

Current demonstrations are focused on storing CO_2 in a variety of geologic formations. There are currently six projects employing CO_2 EOR and two projects employing saline storage underway across the U.S. As with saline storage projects, CO_2 EOR projects will be subject to rigorous MVAA procedures and technologies to ensure their safety and effectiveness.

Advanced Energy Systems. This activity is focused on improving the reliability and efficiency of power plants and other coal conversion facilities 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 power, chemicals, hydrogen, and electricity. Many of these technologies will have positive spillover effects on the conversion of other carbon-based materials, such as biomass, petcoke or natural gas, into power and value-added products.

Advanced Energy Systems R&D is currently focused on technologies that have potential benefits to both existing and new fossil-fueled power plants. Key achievements include the conclusion of 100 hours of testing to assess second generation design concepts for oxy-fired

boilers, as well as the completed construction, commissioning, and testing of one 12 cell-module in a 30-kw oxy-boiler. In addition, construction on a 100 tons per day (TPD) Ion Transport Membrane oxygen system is approximately 75 percent complete.

Other advances include the testing of a hydrogen turbine under full load condition with commercial scale pre-production hardware, as well as the testing of a novel, high-pressure dry coal feed pump for gasification systems designed for 600TPD. Finally, the recent American Society of Mechanical Engineers Boiler & Pressure Vessel Code approval of Inconel 740 high nickel alloy represents a significant milestone in the development of ultra supercritical boiler applications in pulverized coal plants.

Cross-Cutting Research. Cross-Cutting Research is concentrating on technologies that have potential benefits to both existing and new fossil-fueled power plants and serves as a bridge between basic and applied research. It fosters 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 improving the efficiency of Advanced CCS and Power Systems. The program focuses on the development of advanced materials that can withstand the higher temperatures and pressures demanded by future ultra-high efficiency energy systems. The program also develops computation, simulation and modeling tools focused on optimizing plant design and shortening developmental timelines. It addresses advanced and cross-cutting issues, including plant optimization technologies, environmental and technical/economic analyses, coal technology export, and integrated program support.

In addition, this sub-program supports university coal research and historically black colleges and universities education and training. It also supports international activities, including multilateral collaboration with organizations such as the International Energy Agency, the United Nations, the World Energy Council, and the Carbon Sequestration Leadership Forum, as well as bilateral activity with key countries such as China and India.

The Department has made noteworthy progress in Cross-Cutting Research. Highlights include the successful deployment and site acceptance testing of a new 3-D virtual immersive training system for IGCC power plants with carbon capture at the DOE's Advanced Virtual Energy Simulation Training and Research (AVESTAR) Center.

Researchers also completed initial prototype testing on fiber optic based sensors and piezoelectric sensors using NETL's thermal test rig. The sensor technologies were novel first-of-a-kind type sensors developed by universities. Initial designs and prototype were built to evaluate the sensors' initial performance and robustness in high temperature combustion conditions. Additional testing of ceramic-based micro sensors were completed using improved sensor designs that were developed by a small company in concert with NETL.

Natural Gas Technologies

The Natural Gas Technologies R&D program develops technological solutions for the prudent and sustainable development of our unconventional domestic resources. These resources, which include natural gas and oil contained in shale or other low permeability geological formations, are increasingly important components of our nation's energy portfolio.

The successful applications of horizontal drilling and hydraulic fracturing technologies have enabled production to be extended to vast volumes of unconventional natural gas and oil that was previously uneconomical to produce. In order to take full advantage of these natural gas resources, it is vital that development occur safely and responsibly, including addressing issues related to water quality and availability, air quality, greenhouse gas emissions, ecosystem integrity, human health, community well-being, and the prospects of inducing seismic events.

In 2012, the Department of Energy, Department of the Interior, and Environmental Protection Agency (EPA) signed a multiagency memorandum of agreement pledging to develop a focused, collaborative research effort to address high-priority challenges in safe and prudent development of these resources. The primary goal of this multiagency research effort is to provide timely science and tools that support sound policy, allow for informed unconventional resource development decisions at many levels –federal, state, tribal, and local; industry; and the public, and to advance technologies that will maximize benefits to the Nation. This collaborative multiagency approach will provide research efficiencies and utilize scarce resources effectively. DOE is implementing work in areas that include water quality and availability, air quality, induced seismicity, and mitigating the impacts of development.

The Natural Gas Technologies program is also focused on improving our understanding of methane hydrates. In 2012, the program – in partnership with ConocoPhillips and the Japan Oil, Gas and Metals National Corporation – successfully completed a long-term production test after drilling and testing a fully instrumented hydrate well in Alaska. The test demonstrated the ability to inject controlled gas mixes into natural gas hydrates and to sustain production during flowback for the available duration of the test site and provided large volumes of data available to the public for further evaluation.

These datasets include the rates and composition of gases both injected and produced, and information on changes in reservoir pressure and temperature during the test. The data are now fully available to all researchers and the public via the NETL website. (http://www.netl.doe.gov/technologies/oil-gas/FutureSupply/MethaneHydrates/rd-program/ANSWell/co2_ch4exchange.html)

Petroleum Reserves

The Office of Petroleum Reserves manages the Strategic Petroleum Reserve (SPR)**,** which provides strategic and economic protection to the Nation from disruptions in foreign and domestic petroleum supplies; the Northeast Home Heating Oil Reserve, and the Naval Petroleum and Oil Shale Reserves, involving the Department's environmental legacy responsibilities from the sale of the Naval Petroleum Reserve No. 1 (NPR-1) in California and the operation of the NPR-3 stripper oil field and Rocky Mountain Oilfield Testing Center, both located near Casper, Wyoming.

Strategic Petroleum Reserve. SPR completed its cavern replacement project at the Bayou Choctaw site, providing a new cavern (BC 102) to replace an existing problem cavern (BC 20). Transfer of oil to the new cavern is in progress. Additionally, DOE recently awarded a contract to move the degasification plant to the West Hackberry site, where 70 million barrels of oil currently unavailable for drawdown can be processed to mitigate high vapor pressures.

Northeast Home Heating Oil Reserve. The Northeast Home Heating Oil Reserve (NEHHOR) was established in 2000 to provide an emergency stockpile of home heating oil to address the Northeast's vulnerability to winter weather shortages. The Reserve provides a buffer for the Northeast against a supply disruption for approximately 10 days, the time required for ships to carry heating oil from the Gulf of Mexico to New York Harbor.

In FY 2011, NEHHOR sold its 2 million barrels of high sulfur heating oil for conversion to ultra-low sulfur diesel (ULSD). The Heating Oil Reserve was concurrently reduced from 2 million to 1 million barrels. In November 2012, more than 121,000 barrels of the Reserve's ULSD inventory was loaned to the Department of Defense in support of the Federal Emergency Management Agency's response to Hurricane Sandy aftermath.

Naval Petroleum and Oil Shale Reserves. Three of the four original Naval Petroleum Reserves (NPR-1, NPR-2, and NPR-4) have been sold or transferred to the Department of the Interior. The NPR-1oil field was sold in 1997 with residual requirements for equity finalization and environmental remediation.

The Department continues to work on the cleanup and closure of its NPR-1 environmental remediation responsibilities, focusing on the closing of 131 environmental cleanup/remediation Areas of Concern (AOC) identified by the 2008 consent agreement between DOE and the California Department of Toxic Substance Control (DTSC). In FY 2011, DOE established a technical baseline and schedule and has been conducting sampling and analysis resulting in DTSC certification for "no further action" on 9 AOCs. The plan for FY 2013 is to gain DTSC certification for "no further action" on an additional 30 AOCs based on sampling and laboratory analysis.

Naval Petroleum Reserve No.3 (NPR-3), the Teapot Dome oilfield near Casper, WY, is the only remaining oil reserve managed by the DOE. NPR-3 is now a stripper field that also serves as an oilfield technology testing center, the Rocky Mountain Oilfield Testing Center (RMOTC).

A disposition plan that was developed for NPR-3 during FY 2012 will be provided to Congress and DOE will begin implementing that plan, 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 they remain economic. The program will continue RMOTC testing of 100 percent funds-in projects that do not conflict with the disposition plan. Environmental remediation of NPR-3 facilities will continue to facilitate the

disposition of the property in a manner consistent with an approved property disposition plan. The regulatory consultation process required by the National Environmental Protection Act (NEPA) and the National Historic Preservation Act (NHPA) will be conducted in parallel beginning in FY 2013.

Conclusion

The Office of Fossil Energy is committed to developing the science and technology that will allow the Nation to use its abundant fossil energy resources in a way that meets the Nation's energy needs, including sustaining a robust economy and ensuring environmental responsibility. Through our management of the Nation's petroleum and oil reserves, we are also committed to ensuring the Nation's energy security against disruption in domestic supplies. Our programs have made good movement toward these goals over the past year. We believe that continued progress will help maintain DOE's leadership role in addressing issues of energy and environmental security, and ensure the maximum benefit to U.S. taxpayers.

Mr. Chairman, and members of the Committee, this completes my prepared statement. I would be happy to answer any questions you may have at this time.