



Budget Overview FY 2021

The Fiscal Year (FY) 2021 Budget Request for the Department of Energy's (DOE) Office of Fossil Energy (FE) is guided by FE's commitment to addressing our Nation's energy and environmental challenges. The FY 2021 Budget Request focuses on early-stage research and development (R&D) and reflects an increased reliance on the private sector to fund later-stage research, development, and commercialization of energy technologies.

President Trump's FY 2021 Budget seeks \$930.7 million for FE. The President's request includes \$730.6 million for the Fossil Energy Research and Development (FER&D) program. It also includes \$200.1 million for the Office of Petroleum Reserves, including \$187.1 million for the Strategic Petroleum Reserve (SPR); \$0 for the SPR Petroleum Account (with a request for authorization to retain \$19 million from the sale of the Northeastern Gasoline Supply Reserve's 1 million barrels of gasoline blendstock); \$13 million for ongoing federal responsibilities at the Naval Petroleum Reserves; \$0 for the Northeast Home Heating Oil Reserve (NEHHOR); and \$0 for the Energy Security and Infrastructure Modernization (ESIM) Fund, which is offset by revenue raised through sales of SPR crude oil. The highlights of the President's FY 2021 Budget Request for the Office of Fossil Energy follow.

Fossil Energy Research and Development

The FER&D FY 2021 Budget Request is informed by the guiding principles of energy dominance, national security, strong domestic energy production, and advancing clean coal technologies through early-stage R&D to revitalize the coal industry. Driven by the Administration's support of the coal industry and the competitiveness of the existing coal fleet, the FER&D budget focuses on cutting-edge, early-stage R&D that will prepare innovative new technologies for the private sector to further develop, scale up, and deploy.

The FER&D program encompasses advanced fossil energy systems, crosscutting fossil energy research, and carbon capture, utilization, and storage (CCUS) technologies. FER&D also conducts research related to the prudent and sustainable development of domestic oil and gas resources, with a focus on natural gas technologies and unconventional resources. Finally, FER&D includes funding for the research, operations, and infrastructure of the National Energy Technology Laboratory (NETL).



Advanced Coal Energy Systems & CCUS (FY 2021 Request: \$546.15M)

This program's Budget Request is focused on solving the Nation's most pressing fossil energy challenges: advancing the Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative) initiative through R&D on technologies for coal plants of the future that are highly efficient and flexible, with zero to near-zero emissions; improving the performance, reliability, and efficiency of the existing coal-fired fleet; reducing the cost and risk of carbon capture for commercial deployment; and creating new market opportunities for coal.

Advanced Energy Systems (AES) (FY 2021 Request: \$321.9M)

This subprogram aims to increase the availability, efficiency, and reliability of fossil energy power systems, while maintaining environmental standards through early-stage R&D. Specific efforts will focus on seven activities:

1. Gasification Systems – This sub-activity will develop modular technologies that could overcome siting, operating, and logistical constraints that inhibit the deployment of large-scale plants. The budget also provides funding to continue R&D on innovative design development for a high-performance, low-cost gasifier as well as advance designs and fabrication of form refractories to provide better heat and temperature distribution inside a gasifier and lower capital costs.
2. Advanced Turbines – This sub-activity will focus on competitively funded new awards with industry to develop advanced steam turbines as well as supercritical carbon dioxide turbines. The budget also provides funding to advance early-stage pressure gain combustion R&D with the DOE National Laboratories.
3. Solid Oxide Fuel Cells (SOFCs) – This sub-activity will focus on advancing R&D with the DOE National Laboratories that addresses the technical challenges to SOFC commercialization, such as cell power

enhancement, advanced materials development for low temperature operation, materials characterization, and systems analysis.

4. **Advanced Sensors and Controls** – This sub-activity focuses on advanced controls, harsh environment sensors, and load following systems. In addition, the budget provides support for the National Laboratories to test lab-scale sensors in a relevant plant environment to enable technology transfer.
5. **Power Generation Efficiency** – This sub-activity continues to fund ongoing projects for the Coal FIRST initiative. The initiative is focused on early-stage R&D that benefits multiple technologies for use with different coal types and regions throughout the United States across a broader coal and power industry. This sub-activity will also continue to fund long-term advanced concepts at the National Laboratories for advanced combustion systems.
6. **Advanced Energy Materials** – This sub-activity focuses on developing cost-effective structural and functional materials for advanced fossil energy power production technologies, and reducing the cost and time needed to develop and commercialize new materials for FE applications in extreme operating environments. These advancements are used to promote technologies that enhance plant optimization that reduce operations and maintenance costs of both existing coal-fired plants and new fossil energy infrastructure.
7. **Advanced Coal Processing** – This sub-activity will focus on converting coal to high-value products, including high-performance carbon materials, and the development of novel lab/bench-scale coal utilization technologies.

Crosscutting Research (FY 2021 Request: \$65.25M)

This subprogram will continue R&D that bridges basic and applied research by targeting concepts with the greatest potential for transformational breakthroughs. The program also aims to obtain new knowledge regarding plant phenomena and operation that can be incorporated into a new generation of plant control technologies. Specific efforts will focus on the following activities:

- **Critical Minerals** – This sub-activity continues to develop technologies with the goal of enabling additional domestic supplies of rare earth elements (REEs) and critical materials (CMs), reducing environmental impact of coal REE production, and delivering technologies that can be manufactured within the United States.
- **Water Management R&D** – This sub-activity focuses on early-stage development of technologies that increase power plant efficiency and decrease water consumption, as well as field testing of promising technologies that reduce the energy requirements and operating costs of waste water treatment for power plants.
- **Modeling, Simulation & Analysis** – This sub-activity comprises of modeling, simulation, and techno-economic analysis to optimize—and reduce the cost—of areas such as water use, emissions, solid waste disposal, materials development, and power plant operations.
- **University Training and Research** – This sub-activity provides grants to colleges and universities to support research consistent with the goals of the Advanced Coal Energy Systems and CCUS program. This element provides a two-fold benefit: conducting directed energy research for the Department, while at the same time providing support for expanding the research capabilities and education of the next generation of scientists and engineers.
- **Advanced Energy Storage Initiative** – This initiative is a coordinated effort across DOE that will accelerate the development of energy storage and system flexibility technologies.
- **International Activities** – These activities support the deployment of U.S. technologies and fossil energy resources to international markets that are seeking advanced high efficiency power plants and carbon capture and utilization technologies. Funding will be used to support international efforts and technical studies with various partners in Europe, North America, Asia, and the Middle East through bi-lateral and multi-lateral agreements.

Carbon Capture, Utilization, and Storage (FY 2021 Request: \$123M)

This subprogram focuses early-stage research and development on post-combustion and pre-combustion carbon capture; utilization technologies to convert carbon dioxide (CO₂) into valuable products and commodities; and carbon storage to ensure safe and secure geologic storage of CO₂. Specific efforts will focus on the following activities:

- **Carbon Capture (FY 2021 Request: \$74M)** – This sub-activity represents a purposeful shift away from later-stage R&D—such as development and scale-up of 2nd generation capture technologies through small and large pilot projects—as incentives exist for industry to adapt, develop, and scale these technologies for cost-competitive deployment. Specifically, this activity focuses on early-stage pre- and post-combustion capture R&D on transformational gas separation technologies that can significantly reduce the cost of CO₂ capture.
- **Carbon Utilization (FY 2021 Request: \$15M)** – This sub-activity's focus is on early-stage CO₂ utilization technologies that develop additional markets for fossil energy resources. Areas of research include, but are not limited to, projects focused on the catalytic conversion to chemicals and polymers, mineralization to building products, and biological processes optimized for the conversion of coal-based carbon (CO₂ and methane) to higher value products such as nutraceuticals, bio plastics, and animal feed.

- *Carbon Storage (FY 2021 Request: \$30M)* – This sub-activity will concentrate on development of various monitoring tools and the utilization of advanced computational platforms, such as machine learning, that can lead to real-time decision-making capabilities. Technologies developed and validated through the Carbon Storage sub-activity will improve storage efficiency, reduce overall cost, decrease subsurface uncertainties, and identify ways to ensure that operations are safe, economically viable, and environmentally benign.
- *Emissions Control (FY 2021 Request: \$4M)* – This sub-activity will initiate new efforts on addressing non-CO₂ emissions (e.g., trace metals, etc.).

NETL Coal R&D (FY 2021 Request: \$36M)

The request of \$36 million funds the federal costs for NETL's in-house research efforts. Specifically, the funding supports the NETL staff of scientists and engineers who conduct in-house research activities for FER&D programs, including salaries and benefits, travel, personal protective equipment, and other employee costs.

Natural Gas Technologies (FY 2021 Request: \$15M)

This program's mission is to promote America's energy independence through the prudent development, distribution, and storage of our vast natural gas resources. The program comprises two subprograms: Natural Gas Infrastructure Research and Development, and Gas Hydrates.

The Natural Gas Infrastructure Research subprogram will focus on early-stage research on innovative sensors, materials, and systems that enable industry to detect and mitigate resource loss and improve the reliability and operational efficiency of natural gas supply and delivery infrastructure. The federal government will continue to have a significant role in addressing areas of public interest and concern, including pipeline safety and reliability, resource stewardship, and infrastructure security. Additionally, the subprogram will develop new technologies to reduce flaring and venting of natural gas through conversion to high-value, transportable products or electricity.

The Gas Hydrates subprogram, through DOE National Laboratory and university-led efforts, will continue early-stage R&D to evaluate the occurrence, nature, and behavior of naturally occurring gas hydrates and the resulting resource, hazard, and environmental implications. In FY 2021, the subprogram will focus on fundamental laboratory-based research while continuing to plan for a long-term reservoir response flow test on the Alaska North Slope in order to assess the viability of gas hydrates production as an energy resource.

Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies (FY 2021 Request: \$17M)

The program will conduct field research to improve the understanding of shale geology and fracture dynamics in

key and emerging shales, including the Marcellus, Utica, Eagle Ford, Appalachia, Delaware, Bakken, Alaska, and Tuscaloosa basins. These field projects conduct testing that aids research, modeling, and experimentation related to unconventional oil and natural gas development. This research addresses fluid flow and physio-chemical interactions in unconventional reservoirs and improves the technical understanding of fracturing dynamics that can contribute to increases in resource recovery factors. Field laboratory research will also improve enhanced oil recovery (EOR) methodologies, technologies, and processes in unconventional reservoirs.

The program will also conduct improved subsurface characterization, visualization, and diagnostics, including the development of predictive models and simulations using high-performance computing.

National Energy Technology Laboratory (FY 2021 Request: \$117.51M for NETL and an additional \$34.94M for HQ Program Direction and Special Recruitment)

FE is committed to supporting NETL's capabilities and competitiveness. NETL, whose primary funding source is FE, is the only federally owned and operated laboratory in the DOE National Laboratory system.

NETL Infrastructure (FY 2021 Request: \$43.1M)

The Budget Request supports the fixed costs of maintaining NETL's lab footprint in three geographic locations: Morgantown, WV; Pittsburgh, PA; and Albany, OR. These sites include approximately 240 acres of land, including 116 buildings with over 1,100,000 square feet of space.

NETL Research and Operations (FY 2021 Request: \$46M)

The Budget Request supports NETL's science and technology development and commercialization functions, including technical program management and strategic scientific planning and partnerships. Specifically, funding supports the NETL staff of engineers and technical project managers who conduct extramural research activities for FER&D programs, including salaries and benefits, travel, and other employee costs. This request also supports the variable operating costs of NETL's research sites.

NETL and HQ Program Direction and Special Recruitment Programs (FY 2021 Request: \$63.35M)

The Budget Request of \$63.35 million (\$34.04 million for Headquarters, \$28.41 million for NETL, and \$0.9 million for Special Recruitment) provides for the FER&D organization's federal workforce and contractor support in the Washington, D.C. area, including salaries and benefits, support service contracts, travel, training, the working capital fund, and other employee costs. This staff is responsible for the oversight and administration of the FER&D Programs and Natural Gas regulatory activities. In addition, funding for NETL federal

technical staff and contractor support that provide Acquisition, Finance and Legal functions is supported.

Petroleum Reserves

The President's Request seeks \$200.1 million for the Fossil Energy Petroleum Accounts, which consist of three energy security programs, one SPR modernization program, and post-sale remediation activities at Naval Petroleum Reserves Nos. 1 and 3. The SPR storage sites are located at four Government-owned Gulf Coast locations with oversight from the Project Management office in Harahan, LA, along with Headquarters personnel in Washington, D.C. Both the Northeast Home Heating Oil Reserve (NEHHOR) and the Northeast Gasoline Supply Reserve (NGSR) consist of Government-owned refined petroleum products stored in leased commercial storage in terminals in the Northeast, all of which are re-proposed for sale and closure given the lack of use for mission-based purposes. They represent a poor value to taxpayers.

Legacy environmental clean-up/remediation continues at the previously-sold Naval Petroleum Reserve No. 1 (Elk Hills, CA) and landfill remediation and closure continues as part of post-sale activities at Naval Petroleum Reserve No. 3 (Casper, WY).

Strategic Petroleum Reserve (FY 2021 Request: \$187.1M)

The SPR provides strategic and economic security against foreign and domestic disruptions in oil supplies via an emergency stockpile of crude oil. The program fulfills the United States' obligations under the International Energy Program, which provides the United States with assistance from the International Energy Agency through its coordinated energy emergency response plans, and provides a deterrent against energy supply disruptions. The program will perform cavern wellbore testing and remediation activities to ensure the availability of the SPR's crude oil inventory.

The Budget Request re-proposes to disestablish the Northeast Gasoline Supply Reserve (NGSR) in FY 2021. The NGSR has not been utilized since its establishment, and is not considered to be cost efficient or operationally effective.

Strategic Petroleum Account (FY 2021 Request: \$0)

The SPR Petroleum Account funds SPR petroleum acquisition, transportation, and drawdown activities.

The Department is requesting authorization to deposit into the SPR Petroleum Account up to \$19 million in proceeds from the proposed sale of 1 million barrels of refined petroleum product (gasoline blendstock) from the NGSR. Proceeds will

be used as a source of funding for drawdown costs related to Congressionally-directed, multi-year sales of crude oil from the SPR.

Naval Petroleum and Oil Shale Reserves (FY 2021 Request: \$13M)

The President's Request funds continued environmental cleanup responsibilities at NPR-1 in Elk Hills, CA. Cleanup and remediation activities under the Corrective Action Consent Agreement with the State of California Department of Toxic Substances Control (DTSC) have been ongoing since the 1998 sale of the government's interests in NPR-1.

Of the 131 Areas of Concern (AOCs) where DOE is responsible for environmental cleanup, as of January 2020, 98 AOCs have received No Further Action (NFA) certification from California's DTSC, and 4 AOCs are under DTSC review for NFA certification. The remaining 29 AOCs require remediation. This FY 2021 Budget Request includes funding that supports remediation of 3 sub-AOCs.

In addition to the \$13 million appropriation request, the Department is proposing a sale of 15 million barrels of SPR crude oil to raise funding for other Departmental priorities, including \$242 million needed to fund the completion of comprehensive remediation work at the NPR-1 site.

Northeast Home Heating Oil Reserve (FY 2021 Request: \$0)

The Budget Request re-proposes to disestablish the NEHHOR in FY 2021. The NEHHOR has never been used for its intended purpose to supplement heating oil supplies following a disruption since it was established, and the reserve is not a good use of taxpayer funds.

Energy Security and Infrastructure Modernization Fund (FY 2021 Request: \$0)

The ESIM Fund was established in Section 404 of the Bipartisan Budget Act of 2015 to finance modernization of the SPR. Sales of SPR crude oil will support Life Extension Phase II investments needed to ensure the SPR can maintain its operational readiness capability, meet its mission requirements, and operate in an environmentally responsible manner. The FY 2020 budget increment concluded the four-year (2017–2020) financing structure of multi-year crude oil sales that support an effective modernization program for the SPR. No budget request is made for FY 2021.