DOE/CF-0140
Volume 3 Part 1

# Department of Energy
# FY 2019 Congressional Budget Request

**Electricity Delivery**
**Cybersecurity, Energy Security, and Emergency Response**
**Naval Petroleum and Oil Shale Reserves**
**Strategic Petroleum Reserve**
**Northeast Home Heating Oil Reserve**
**Southeastern Power Administration**
**Southwestern Power Administration**
**Western Area Power Administration**
**Bonneville Power Administration**
**Fossil Energy Research and Development**

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## FUNDING BY APPROPRIATION

($K)

| Department of Energy Budget by Appropriation | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted $ | FY 2019 Request vs FY 2017 Enacted % |
|---|---|---|---|---|---|
| **Energy and Water Development, and Related Agencies** | | | | | |
| **Energy Programs** | | | | | |
| Energy Efficiency and Renewable Energy | 2,034,582 | 2,040,249 | 695,610 | -1,338,972 | -65.8% |
| Electricity Delivery and Energy Reliability | 229,585 | 228,026 | 0 | -229,585 | -100.0% |
| Electricity Delivery | 0 | 0 | 61,309 | +61,309 | N/A |
| Cybersecurity, Energy Security, and Emergency Response | 0 | 0 | 95,800 | +95,800 | N/A |
| Nuclear Energy | 1,015,821 | 1,008,922 | 757,090 | -258,731 | -25.5% |
| **Fossil Energy Programs** | | | | | |
| Fossil Energy Research and Development | 421,154 | 425,093 | 502,070 | +80,916 | +19.2% |
| Naval Petroleum and Oil Shale Reserves | 12,005 | 14,848 | 10,000 | -2,005 | -16.7% |
| Strategic Petroleum Reserve | 222,605 | 221,485 | 175,105 | -47,500 | -21.3% |
| Northeast Home Heating Oil Reserve | 6,497 | 6,456 | 10,000 | +3,503 | +53.9% |
| **Total, Fossil Energy Programs** | **662,261** | **667,882** | **697,175** | **+34,914** | **+5.3%** |
| Uranium Enrichment Decontamination and Decommissioning (D&D) Fund | 767,929 | 763,106 | 752,749 | -15,180 | -2.0% |
| Energy Information Administration | 122,000 | 121,171 | 115,035 | -6,965 | -5.7% |
| Non-Defense Environmental Cleanup | 246,762 | 245,324 | 218,400 | -28,362 | -11.5% |
| Science | 5,390,972 | 5,354,362 | 5,390,972 | 0 | N/A |
| Advanced Research Projects Agency - Energy | 305,245 | 303,172 | 0 | -305,245 | -100.0% |
| Nuclear Waste Disposal (30M in DNWF 050) | 0 | 0 | 90,000 | +90,000 | N/A |
| Departmental Administration | 120,692 | 120,009 | 139,534 | +18,842 | +15.6% |
| Inspector General | 44,424 | 44,122 | 51,330 | +6,906 | +15.5% |
| Title 17 - Innovative Technology Loan Guarantee Program | 139 | 16,749 | 7,000 | +6,861 | +4,936.0% |
| Advanced Technology Vehicles Manufacturing Loan Program | 3,883 | 4,966 | 1,000 | -2,883 | -74.2% |
| Tribal Energy Loan Guarantee Program | 9,000 | 8,939 | -8,500 | -17,500 | -194.4% |
| **Total, Energy Programs** | **10,953,295** | **10,926,999** | **9,064,504** | **-1,888,791** | **-17.2%** |
| **Atomic Energy Defense Activities** | | | | | |
| **National Nuclear Security Administration** | | | | | |
| Federal Salaries and Expenses | 387,366 | 384,736 | 422,529 | +35,163 | +9.1% |
| Weapons Activities | 9,240,739 | 9,241,675 | 11,017,078 | +1,776,339 | +19.2% |
| Defense Nuclear Nonproliferation | 1,879,738 | 1,885,970 | 1,862,825 | -16,913 | -0.9% |
| Naval Reactors | 1,419,792 | 1,410,455 | 1,788,618 | +368,826 | +26.0% |
| **Total, National Nuclear Security Administration** | **12,927,635** | **12,922,836** | **15,091,050** | **+2,163,415** | **+16.7%** |
| **Environmental and Other Defense Activities** | | | | | |
| Defense Environmental Cleanup | 5,404,217 | 5,368,298 | 5,630,217 | +226,000 | +4.2% |
| Other Defense Activities | 781,703 | 778,676 | 853,300 | +71,597 | +9.2% |
| Defense Nuclear Waste Disposal (90M in 270 Energy) | 0 | 0 | 30,000 | +30,000 | N/A |
| **Total, Environmental and Other Defense Activities** | **6,185,920** | **6,146,974** | **6,513,517** | **+327,597** | **+5.3%** |
| **Total, Atomic Energy Defense Activities** | **19,113,555** | **19,069,810** | **21,604,567** | **+2,491,012** | **+13.0%** |
| **Power Marketing Administrations** | | | | | |
| Southeastern Power Administration | 0 | 0 | 0 | 0 | N/A |
| Southwestern Power Administration | 11,057 | 10,982 | 10,400 | -657 | -5.9% |
| Western Area Power Administration | 94,742 | 94,099 | 89,372 | -5,370 | -5.7% |
| Falcon and Amistad Operating and Maintenance Fund | 232 | 230 | 228 | -4 | -1.7% |
| Colorado River Basins Power ar eting und | -23,000 | -22,844 | -23,000 | 0 | N/A |
| **Total, Power Marketing Administrations** | **83,031** | **82,467** | **77,000** | **-6,031** | **-7.3%** |
| **Federal Energy Regulatory Commission (FERC)** | **0** | **0** | **0** | **0** | **N/A** |
| **Subtotal, Energy and Water Development, and Related Agencies** | **30,149,881** | **30,079,276** | **30,746,071** | **+596,190** | **+2.0%** |
| Uranium Enrichment D&D Fund Discretionary Payments | -563,000 | -559,177 | 0 | +563,000 | +100.0% |
| Defense EM Funded Uranium Enrichment D&D Fund Contribution | 563,000 | 559,177 | 0 | -563,000 | -100.0% |
| Excess Fees and Recoveries, FERC | -16,645 | -9,000 | -16,000 | +645 | +3.9% |
| Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt | -37,000 | -37,000 | -44,000 | -7,000 | -18.9% |
| Sale of Northeast Gas Reserve | 0 | 0 | -77,000 | -77,000 | N/A |
| Defense Programs Rescission of Balances (Undistributed) | -43 | -43 | 0 | +43 | +100.0% |
| Title 17 Loan Guarantee Program Rescission | -9,000 | -8,939 | 0 | +9,000 | +100.0% |
| **Total, Funding by Appropriation** | **30,087,193** | **30,024,294** | **30,609,071** | **+521,878** | **+1.7%** |

*Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

# Electricity Delivery

# Electricity Delivery

**Electricity Delivery**

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## Electricity Delivery
## Proposed Appropriation Language

*For Department of Energy expenses including the purchase, construction, and acquisition of plant and capital equipment, and other expenses necessary for electricity delivery activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, $61,309,000, to remain available until expended: Provided, That of such amount, $19,309,000 shall be available until September 30, 2020, for program direction.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Public Law Authorizations**

Public Law 95–91, "Department of Energy Organization Act", 1977

Public Law 109-58, "Energy Policy Act of 2005"

Public Law 110-140, "Energy Independence and Security Act, 2007"

Public Law 114-94, "Fixing America's Surface Transportation Act", 2015

## Explanation of Changes

The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery (OE) and Cybersecurity, Energy Security, and Energy Reliability (CESER).

- OE includes the Transmission Reliability and Resilience, Resilient Distribution Systems, Energy Storage, Transformer Resilience and Advanced Components, and Transmission Permitting and Technical Assistance programs.
- CESER includes the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs.
- Program direction funding is allocated between the two appropriations, with administrative, senior management, budget, procurement, contractual management and human capital support activities funded within OE under a service center approach that will support both appropriations.

**Electricity Delivery**
**($K)**

| FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR (Comparable)[a] | FY 2019 Request |
|---|---|---|---|---|
| 230,000 | 150,800 | 228,438 | 149,776 | 61,309 |

**Overview**

Electricity Delivery (OE) leads the Department's efforts to strengthen, transform, and improve energy infrastructure so that consumers have access to reliable, secure, and clean sources of energy. OE provides solutions to market, institutional and operational failures that go beyond any one utility's ability to solve.[c] To accomplish this critical mission, OE works with private industry and Federal, State, local, and tribal governments on a variety of initiatives to modernize the electric grid.

Grid modernization is critical to achieving public policy objectives, sustaining economic growth, supporting environmental stewardship, and mitigating risks to secure the Nation. The goal for the future grid is to deliver reliable, affordable, and clean electricity to consumers where, when, and how they want it.

Within the next decade, proactive, coordinated, and innovative steps are needed to address four critical challenges:

- Increasing challenges to the reliability and security of the electric infrastructure
- Changes in demand driven by population growth, adoption of more energy efficient technologies, dynamic economic conditions, and broader electrification
- Changes in the supply mix and location (centralized, distributed, and off-shore) of the Nation's generation portfolio
- Increasing variability and uncertainty from both supply and demand, including integration of variable renewables, more active consumer participation, and accommodating new technologies and techniques

Due to the critical role the electric grid plays across Federal, State, and local jurisdictions, OE programs work in an integrated manner in partnership with industry and other stakeholders as well as other DOE offices, to enhance key characteristics of the U.S. electric transmission and distribution systems:

- Reliability—consistent and dependable delivery of high quality power
- Flexibility—the ability to accommodate changing supply and demand patterns and new technologies
- Efficiency—low losses in electricity delivery and more optimal use of system assets
- Resilience—the ability to withstand and quickly recover from disruptions and maintain critical function
- Affordability—more optimal deployment of assets to meet system needs and minimize costs
- Security—the ability to protect system assets and critical functions from unauthorized and undesirable actors

Timely action is needed to perform the early-stage research and development that will enable industry to deploy a reliable electric power grid that supports the vitality of other critical sectors that depend on electricity, such as telecommunications, banking and finance, water, and public health and safety. A reliable and resilient power grid is critical to U.S. economic competiveness and leadership.

[a] The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery (OE) and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 and FY 2018 exclude amounts for the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs, and a portion of Program Direction funding, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017 and FY 2018.

[b] Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

[c] Examples include wide-area visibility, identified from the 2003 Northeast blackout, and faster modeling and analysis, identified in the 2011 Southwest blackout.

Within the appropriation, OE funds:

- Research and Development (R&D)—pursuing early-stage research for technologies to improve grid reliability, efficiency, flexibility and functionality
- Modeling and Analytics—developing core analytic, assessment, and engineering capabilities that can evolve as the technology and policy needs mature to support decision making within the Department and for stakeholders; analyses explore complex interdependencies among infrastructure systems, such as between electricity and natural gas systems.
- Institutional Support and Technical Assistance—building capacity in the industry and convening stakeholders to coordinate efforts to transform the electric grid; providing technical assistance to states and regions to improve policies, utility incentives, state laws, and programs that facilitate the modernization of the electric infrastructure.
- Coordination of Federal Transmission Permits—streamlining permits, special use authorizations, and other approvals required under Federal law to site electric transmission facilities.

**Highlights and Major Changes in the FY 2019 Budget Request**

The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: OE and Cybersecurity, Energy Security, and Energy Reliability (CESER). The CESER Overview is provided separately.

- OE includes the Transmission Reliability and Resilience, Resilient Distribution Systems, Energy Storage, Transformer Resilience and Advanced Components, and Transmission Permitting and Technical Assistance programs.
- Program direction funding is allocated between the two appropriations, with administrative, senior management, budget, procurement, contractual management and human capital support activities funded within OE under a service center approach that will support both appropriations.

The request continues OE's R&D focus on cutting-edge early-stage R&D.

**Transmission Reliability and Resilience** ($13,000,000; -$23,000,000) is focused on ensuring the reliability and resiliency of the U.S. electric grid through early-stage and foundational R&D on measurement and control of the electricity system and risk assessment to address challenges across integrated energy systems. The FY 2019 request supports development of new modeling-based capability for monitoring the long-term resiliency of our grid and identifying opportunities to improve resiliency and mitigate risks associated with the energy systems interdependencies.

**Resilient Distribution Systems** ($10,000,000; -$40,000,000) focuses on the development of innovative technologies, tools, and techniques to modernize the distribution portion of the electric delivery system. Results from the research in Advanced Distribution Management Systems (ADMS), microgrids, and Dynamic Controls and Communications (DC&C) will enable industry to strengthen the resilience of electrical infrastructure against adverse effects of future extreme weather phenomena and other unforeseen natural and man-made occurrences.

**Energy Storage** ($8,000,000; -$23,000,000) focuses on accelerating the development of new materials and device technologies that can lead to significant improvements in the cost and performance of utility-scale energy storage systems and accelerate the adoption of energy storage systems into the grid infrastructure. The request supports materials research on the next generation of battery chemistries, development of new materials and new device technologies for efficient power conversion, development of optimal design and control architectures for energy storage integration into the grid infrastructure, and development of open source models and software tools for system level energy storage planning and evaluation.

**Transformer Resilience and Advanced Components** ($5,000,000; -$1,000,000) supports modernization, hardening, and resilience of the grid by addressing the unique challenges facing transformers and other critical grid components that are responsible for carrying and controlling electricity from where it is generated to where it is needed. TRAC will continue research to support innovative concepts and designs for solid-state power substations, including advanced materials and system architectures. Research to improve asset monitoring capabilities and equipment performance under stress will enhance the portfolio of solutions available to industry to increase grid security, reliability, and resilience.

**Transmission Permitting and Technical Assistance** ($6,000,000; -$1,500,000) fosters and enables the development of reliable, affordable, and resilient electricity infrastructure. TPTA provides electricity policy technical expertise to state, regional, and tribal entities on all facets of the electric system, including generation, transmission, storage, distribution, or demand-side electricity resources. TPTA also implements a number of legal authorities, such as coordination of transmission permitting by Federal agencies, periodic transmission congestion studies, permitting of cross-border transmission lines,

authorization of electricity exports, and supporting actions by the Secretary of Energy during electricity emergencies. The request supports continued assistance to states considering changes for their jurisdictional electric utilities, including alternative ratemaking concepts and new regulatory and market regimes. TPTA will pursue topics flagged as meriting further research in the *Staff Report to the Secretary on Electricity Markets and Reliability*, such as valuation of essential reliability services, gauging the economic health and efficiency of the bulk power system, and obstacles to timely and needed infrastructure development for resilience and protecting defense critical electric infrastructure. TPTA will also continue to carry out its regulatory responsibilities and evaluate regulatory reform to reduce Federal burden associated with investing in our Nation's electricity infrastructure.

**FY 2017 Key Accomplishments**

**Streamlined Transmission Permitting**: OE issued a Record of Decision and Presidential Permit for two transmission projects. The Great Northern Transmission Line is a 224-mile overhead alternating current transmission line that will bring up to 883 megawatts of hydropower from Manitoba Power in Canada to Grand Rapids, Minnesota and deliver wind power generated in North Dakota to Manitoba Power in Canada. The New England Clean Power Link Transmission Line is a 154-mile underground and underwater direct current transmission line that will bring up to 1,000 megawatts of hydropower from Quebec, Canada to southern Vermont. The project has the potential to provide enough reliable, affordable, and carbon-free electricity to serve approximately 1 million residential customers in New England. These transmission lines are examples of the collaborative principles detailed in the Integrated Interagency Pre-Application Process (IIP), the rulemaking process finalized in September 2016 that streamlined permitting and siting by encouraging early engagement with local, state, and tribal communities on electric grid transmission projects. As a result, the reviews for both transmission lines were completed in 2.5 years. Large-scale infrastructure projects often take longer to complete.

**New Grid-Scale Battery Storage Technology Commercialized**: PNNL and UniEnergy Technologies (UET) received a 2017 Green Chemistry Challenge Award for their development and commercialization of an advanced vanadium flow battery. OE-funded researchers at PNNL cut the storage system cost in half, doubled its temperature window, and roughly doubled its energy density. Once the system was ready, PNNL licensed the technology to UET, which improved the manufacturing process, found financial partners, and commercialized the system.

**Application of Economic Analysis Leads to Cost-Effective Storage Application**: OE's Energy Storage Program partnered with the Massachusetts Department of Energy Resources on a resilient microgrid project in Sterling, MA that combined 2 MW of storage with 3.4 MW of existing photovoltaics. An analytical framework developed by Sandia National Laboratories identified the most effective benefit streams, leading to a 6.7 year simple payback. The project was recognized with a Grid Edge Award from Greentech Media.

**Grid Reliability Study**: Under the Secretary's direction, DOE undertook a comprehensive assessment of the stability and reliability of the electricity grid in the face of changing contributions from a range of generation sources. The report was led by OE with strong support from Energy Policy and Systems Analysis (EPSA) and the Offices of Energy Efficiency and Renewable Energy, Fossil Energy, and Nuclear Energy as well as the Energy Information Agency and DOE national labs. The report included an in-depth analysis of power plant closures over the past 15 years and found that the electricity grid continues to operate reliably and as intended, even as it is challenged by the addition of low-priced natural gas, regulatory impact on coal and nuclear plants, and an increase in renewable generation sources. Recommendations from the grid study will be used for a number of follow-on policy and study recommendations to ensure that electricity grid performance continues to be robust and affordable for U.S. consumers. The report and responses to it are available at https://energy.gov/staff-report-secretary-electricity-markets-and-reliability.

**Electricity Delivery**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR (Comparable)[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted (Comparable)[a] |
|---|---|---|---|---|---|---|
| Transmission Reliability and Resilience[c] | 36,000 | 36,000 | 35,756 | 35,756 | 13,000 | -23,000 |
| Resilient Distribution Systems | 50,000 | 50,000 | 49,660 | 49,660 | 10,000 | -40,000 |
| Cybersecurity for Energy Delivery Systems | 62,000 | … | 61,579 | … | … | … |
| Energy Storage | 31,000 | 31,000 | 30,790 | 30,790 | 8,000 | -23,000 |
| Transformer Resilience and Advanced Components | 6,000 | 6,000 | 5,959 | 5,959 | 5,000 | -1,000 |
| Transmission Permitting and Technical Assistance | 7,500 | 7,500 | 7,449 | 7,449 | 6,000 | -1,500 |
| Infrastructure Security and Energy Restoration | 9,000 | … | 8,939 | … | … | … |
| Program Direction | 28,500 | 20,300 | 28,306 | 20,162 | 19,309 | -991 |
| **Subtotal, Electricity Delivery** | **230,000** | **150,800** | **228,438** | **149,776** | **61,309** | **-89,491** |
| Rescission of prior year unobligated balances | -415 | -415 | -412 | -412 | 0 | +415 |
| **Total, Electricity Delivery** | **229,585** | **150,385** | **228,026** | **149,364** | **61,309** | **-89,076** |
| | | | | | | |
| **Federal Full Time Equivalent Employees (FTEs)** | **89** | **69** | **77** | **57** | **57** | **-12** |
| Additional FE FTEs at NETL supporting OE[d] | 29 | 20 | 22 | 13 | 13 | -7 |
| Total OE-funded FTEs | 118 | 89 | 99 | 70 | 70 | -19 |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $5,120; STTR: $720
- FY 2017 Enacted (Comparable): SBIR: $3,808; STTR: $536
- FY 2019 Total Request: SBIR: $1,152; STTR: $162

[a] The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery (OE) and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 and FY 2018 exclude amounts for the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs, and a portion of Program Direction funding, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017 and FY 2018.

[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

[c] Transmission Reliability and Resilience was titled Transmission Reliability in the FY 2018 Request to Congress.

[d] OE funds FTEs at FE's National Energy Technology Laboratory who are FE employees, but support OE activities. The FTEs are in FE's FTE totals and are not included in the OE FTE totals shown on the "Federal Full Time Equivalent Employees (FTEs)" line.

The tables below shows the funding allocation between the two offices under the prior and the proposed budget structures.

**FY 2017 Enacted Appropriation Comparability Matrix**
**($K)**

| New Structure / Old Structure | Electricity Delivery | Cybersecurity, Energy Security, and Emergency Response | **Total** |
|---|---|---|---|
| Transmission Reliability | 36,000 | … | **36,000** |
| Resilient Distribution Systems | 50,000 | … | **50,000** |
| Cybersecurity for Energy Delivery Systems | … | 62,000 | **62,000** |
| Energy Storage | 31,000 | … | **31,000** |
| Transformer Resilience and Advanced Components | 6,000 | … | **6,000** |
| Transmission Permitting and Technical Assistance | 7,500 | … | **7,500** |
| Infrastructure Security and Energy Restoration | … | 9,000 | **9,000** |
| Program Direction | 20,300 | 8,200 | **28,500** |
| **Total** | **150,800** | **79,200** | **230,000** |

**FY 2018 Annualized CR Comparability Matrix[a]**
**($K)**

| New Structure / Old Structure | Electricity Delivery | Cybersecurity, Energy Security, and Emergency Response | **Total** |
|---|---|---|---|
| Transmission Reliability | 35,756 | … | **35,756** |
| Resilient Distribution Systems | 49,660 | … | **49,660** |
| Cybersecurity for Energy Delivery Systems | … | 61,579 | **61,579** |
| Energy Storage | 30,790 | … | **30,790** |
| Transformer Resilience and Advanced Components | 5,959 | … | **5,959** |
| Transmission Permitting and Technical Assistance | 7,449 | … | **7,449** |
| Infrastructure Security and Energy Restoration | … | 8,939 | **8,939** |
| Program Direction | 20,162 | 8,144 | **28,306** |
| **Total** | **149,776** | **78,662** | **228,438** |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**FY 2019 Request to Congress Comparability Matrix**
**($K)**

| New Structure / Old Structure | Electricity Delivery | Cybersecurity, Energy Security, and Emergency Response | **Total** |
|---|---|---|---|
| Transmission Reliability | 13,000 | … | **13,000** |
| Resilient Distribution Systems | 10,000 | … | **10,000** |
| Cybersecurity for Energy Delivery Systems | … | 70,000 | **70,000** |
| Energy Storage | 8,000 | … | **8,000** |
| Transformer Resilience and Advanced Components | 5,000 | … | **5,000** |
| Transmission Permitting and Technical Assistance | 6,000 | … | **6,000** |
| Infrastructure Security and Energy Restoration | … | 18,000 | **18,000** |
| Program Direction | 19,309 | 7,800 | **27,109** |
| **Total** | **61,309** | **95,800** | **157,109** |

## Transmission Reliability and Resilience

### Overview

The Transmission Reliability and Resilience (TRR) program provides the electric sector with the necessary tools and analyses to assess risks, inform decisions, and improve power system planning and performance including mitigating the risks of large-scale blackouts. The TRR program is focused on ensuring the reliability and resilience of the U.S. electric grid through early-stage and foundational research and development (R&D) concentrated on measurement and control of the electricity system, as well as model development and validation for assessing risks across integrated energy systems. TRR brings together energy stakeholders from government, industry, and academia to generate ideas and develop solutions to the Nation's energy infrastructure challenges.

TRR's mission manifests itself in several key areas:

- Advancing early-stage and foundational research in electric grid measurements, models, mathematics, and computation
- Developing and validating early-stage proof-of-concept tools intended to enable the electricity system operators and planners to improve reliability, resilience, and security of the system
- Enhancing risk-based quantification to improve methods and models used to study power system resilience, recovery, and restoration

TRR directly engages energy stakeholders and decision makers to disseminate research results and promote innovation, and risk-informed energy system decisions. TRR activities also focus on advancing university-based power systems research, helping ensure an enduring strategic national capability for innovation in this essential area.

### Highlights of the FY 2019 Budget Request

The request supports TRR's goals to:

- Develop methods for validating power system models using real-time data (such as synchrophasor measurements) to support reliable grid operations and improve electrical power infrastructure security and resilience
- Develop the next generation of mathematical and statistical algorithms for improvement of the security, reliability, and resilience of the electric power system, including interdependencies and failure analysis
- Develop integrated risk-based, measurement-model approaches to improve detection, mitigation, and recovery/restoration from weather events and man-made attacks to the electric power system, and to enable the operation of degraded or damaged electricity systems while sustaining critical functionality

The request continues TRR's focus on developing early-stage algorithms, methods, and proof of concept tools to improve the resilience, reliability, and security of electric grid.

### Centers[a]

The request continues support for the Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks (CURENT), which is jointly funded by the National Science Foundation (NSF) and the Department and based at the University of Tennessee, Knoxville. CURENT seeks to develop fundamental knowledge in monitoring and modeling methodologies, control theory and transmission network architectures, that supports a nationwide, resilient electric power grid that is fully monitored and dynamically controlled in real time for high reliability, high efficiency, and low cost, while educating a new generation of electric power and energy systems engineering leaders with a global perspective coming from diverse backgrounds. Additional activities may be considered depending on programmatic needs in related research areas and the Center's unique capabilities for effectively addressing them. CURENT's programmatic and technical goals are to develop new systems methodologies to take advantage of advancements in wide-area measurement and communication; flatten the control and information structure so it is less hierarchical and can replace, at all levels of the power grid, traditional inflexible operations strategies; draw on high performance computing capability to realize large-scale and faster-than-real-time simulation for predictive control (and fast response) to ensure secure and reliable operation; and investigate use of widely allocated high power electronic actuator coupled with transmission level energy storage.

[a] Per the guidance on inclusion of centers in budget justifications in H.Rpt. 113–135, the House report for the FY 2014 Energy and Water Development appropriations.

**Transmission Reliability and Resilience Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Transmission Reliability and Resilience** | | | | |
| Transmission Reliability and Resilience | 15,000 | – | 13,000 | -2,000 |
| Advanced Modeling Grid Research | 17,000 | – | 0 | -17,000 |
| Energy Systems Risk and Predictive Capability | 4,000 | – | 0 | -4,000 |
| **Total, Transmission Reliability and Resilience** | **36,000** | **35,756** | **13,000** | **-23,000** |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $1,024; STTR $144
- FY 2019 Request: SBIR: $416; STTR $58

**Transmission Reliability and Resilience**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Transmission Reliability and Resilience**: The FY 2019 request supports development of new modeling-based capability for monitoring the long-term resiliency of our grid and identifying opportunities to improve resiliency and mitigate risks associated with the energy systems interdependencies. Funding targeted to industry-driven near-term software tool development is eliminated and DOE activity is refocused on foundational work using the synchrophasor measurement for model validation to increase resilience. Modeling activities, formerly included under the Advanced Modeling Grid Research subprogram, are refocused towards application of early-stage cutting-edge mathematical and computational research supporting the reliability, resilience, and security of the grid. | **-2,000** |
| **Advanced Modeling Grid Research**: Delineation of this subprogram is eliminated. Some modeling activities will continue under Transmission Reliability and Resilience, as described above. | **-17,000** |
| **Energy Systems Risk and Predictive Capability**: This subprogram is eliminated and no new activities are proposed. | **-4,000** |
| **Total, Transmission Reliability and Resilience** | **-23,000** |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. These amounts are shown only at the Congressional control level and above; below that level, a dash (–) is shown.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Transmission Reliability and Resilience $36,000,000** | **$13,000,000** | **-$23,000,000** |
| • Continue to support NASPI as a mechanism for joint problem solving and information exchange.<br>• Continue CURENT support as recommended by the NSF peer review panel<br>• Perform R&D on next-generation phasor measurement units<br>• Continue university-based R&D on power systems focused on measurement and data<br>• Sponsor Grid Science Winter School<br>• Enhance software library of mathematical methods and solvers for energy management systems<br>• Develop capability for grid software testing through the Grid Management Laboratory Consortium (GMLC)<br>• Advance risk and decision science for energy systems to enhance Federal, State, local, and industry knowledge for events | • Continue technical support for NASPI to advance model validation using synchrophasor measurements, as well as to conduct information sharing and joint problem solving among utilities, vendors, universities, and the Government<br>• Continue support for the university-led CURENT Engineering Research Center, in coordination with NSF<br>• Continue efforts in architecture and data analytics for turning the data into actionable information<br>• Continue to develop the next generation of mathematical and statistical algorithms for improvement of the security, reliability, and resilience of the electric power system<br>• Develop new modeling-based capability for monitoring the long-term resiliency of our grid and identifying opportunities to improve resiliency and mitigate risks associated with the energy systems interdependencies | • Reduction is due to technology maturity and the industry development of synchrophasor applications<br>• Application software tools developed and tested using an industry partner are no longer the focus of the program<br>• Activities are refocused on foundational work using real-time measurement for model validation, as well as advancements in mathematics and computation |

**Transmission Reliability and Resilience**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Transmission Reliability and Resilience—Demonstrate and implement technologies and tools that improve the monitoring of transmission system health and the ability of operators to respond quickly and effectively to address issues.** | | |
| Target | Develop and test methods for validating power system models using real-time data in a real-time environment to support operations and improve reliability. | Continue developing and testing methods for validating power system models using real-time synchrophasor data in a real-time environment to support operations and improve reliability and resiliency. | Develop and test the algorithmic methods for power system recovery/restoration to improve the resiliency of the electric power system. |
| Result | Met | TBD | TBD |
| Endpoint Target | Realization of a nationwide network of utility-owned synchrophasors with 100% sensor coverage of the transmission system by the end of FY 2020, allowing for complete, real-time monitoring of transmission system health. | | |
| Performance Goal (Measure) | **Advanced Modeling Grid Research—Development of capabilities in understanding, modeling, and predicting grid behavior in real-time.** | | |
| Target | Develop and test advanced computational capabilities for simulating power system behavior in a real-world environment. | N/A | N/A |
| Result | Met | N/A | N/A |
| Endpoint Target | Realization of advanced modeling capabilities, including dynamic operation, real-time analysis, and predictive response. | | |
| Comment | This performance goal is not continued into FY 2018. | | |
| Performance Goal (Measure) | **Energy Systems Risk and Predictive Capability—Provide Federal agencies, states, and sector stakeholders with independent and transparent analyses of risks to energy infrastructure systems and supply chain impacts.** | | |
| Target | Deploy initial analytical products assessing risk and improving decisions for energy infrastructure systems. | N/A | N/A |
| Result | Met | N/A | N/A |
| Endpoint Target | This subprogram develops tools and robust predictive analytic products which assist decision makers in assessing current and future risks to interdependent energy systems. | | |
| Comment | This performance goal is not continued into FY 2018. | | |

## Resilient Distribution Systems

### Overview

Reliable, safe, affordable electricity is a cornerstone for a strong economy and provides foundational support for communities to grow and attract new businesses. Today's electric grid is undergoing dramatic changes. While this provides new benefits and new opportunities, it also presents significant operational challenges to maintaining the safe and reliable delivery of affordable power to consumers. For the most part, the existing electrical distribution system—the infrastructure that takes power from the transmission system and delivers it to individual businesses and homes—was designed and built using engineering principles established over 100 years ago. Today, however, that same distribution system is being relied upon to perform in ways it was not intended nor designed to do. As states, municipalities, and local communities look for ways to increase resiliency of the grid, integrate distributed energy resources, and provide consumers with more choices for managing their energy consumption, distribution system operations have become increasingly complex and in many cases are challenged to maintain safety and reliability. As the electricity distribution system continues to evolve and its complexity increases, these problems will continue to grow unless new technologies are developed that enable changes to the way the electric grid is operated. In order for utilities to maintain reliable and resilient operations, they need to have the tools and capabilities to perform dynamic protection and control across all distribution system assets.

The Resilient Distribution Systems (RDS) program focuses on addressing the challenges facing the electric power grid by developing the innovative technologies, tools, and techniques to enable industry to modernize the distribution portion of the electric delivery system. RDS pursues strategic investments in early-stage research and development of innovative technologies and practices that improve reliability, resilience, outage recovery, and operational efficiency, building upon previous and ongoing grid modernization efforts.

The technological convergence of the electricity infrastructure with information and communication systems presents an enormous opportunity to improve overall system resilience and reliability through the integration of vast amounts of information/data from historically disparate systems. Information and communication technology advances have initiated opportunities to leverage increased data volumes as never before possible to begin addressing many distribution grid operation technical challenges, including increased demand and supply variability, bi-directional power flow, data management and security, interoperability between new and legacy technologies and devices, and the increasing interdependencies between distribution and transmission operations.

The focus of Advanced Distribution Management Systems (ADMS) early-stage research is to explore an innovative, new approach to the management and control of utility distribution grids. ADMS will enable a new level of visibility and control across a utility's entire service territory. Microgrid research investments have shown success in addressing reliability, resilience, and efficiency, particularly at the community level, and will continue to be a focus within the RDS program. New approaches and technologies will also be investigated, including Dynamic Controls and Communications research and development (DC&C, formerly named Control, Communication, and Analysis R&D) to enhance the Nation's electric distribution grid to harness flexibility across all distribution assets to withstand and recover from disruptions caused by extreme weather events as well as normal operations.

Results from the RDS research in ADMS, microgrids, and DC&C will enable industry to strengthen the resilience of electrical infrastructure against adverse effects of future extreme weather phenomena and other unforeseen natural and man-made occurrences.

### Highlights of the FY 2019 Budget Request

The request includes a continued investment in the development of an ADMS to support grid modernization. The ADMS effort is developing a new distribution "operating system" along with the interface requirements that will lay the foundation for the private sector to develop new applications, products and services that expand utility capabilities. Existing Distribution Management Systems (DMS) and ADMS are closed, proprietary, vendor-specific products that are costly and difficult to implement limiting access to a handful of utilities. In addition, today's DMS/ADMS:

- Struggle to manage the increased complexity of operating distribution grids required to meet increased levels of resilience and the growing levels of variability in both generation and load;
- Do not provide a holistic approach to coordinating and managing grid operations throughout the grid from transmission, to distribution, to local energy networks such as microgrids;

- Are limited in their use of real-time, spatial data of all connected devices to determine the grid state for improved operational planning, protection, control, and optimization; and
- Generally cannot easily and cost effectively integrate with legacy systems or new applications from different vendors.

The open-source platform approach for distribution system control could help alleviate many of the shortcomings of existing DMS/ADMS products and reduce implementation costs making them accessible to all utilities. As in other industries, embracing an open-source methodology will foster competition among existing vendors, encourage new market entrants, spur innovation, lower the cost of deployment, and expand the customer base. Utilities would gain the visibility and controllability over assets and devices needed to achieve cost-effective solutions for increased resilience and more efficient and optimal system operations in general. Open platforms would also benefit all vendors and increase the overall market while providing the future operational capabilities utilities will need. In FY 2019, the ADMS program, in accordance with the approved transition plan, will make progress toward releasing the final open source, distribution system, application development platform known as GridApps-D.

Microgrid R&D activities in FY 2019 will continue national laboratory R&D in two foundational areas:

- *Optimal Design & Operation (OD&O) tool for networked microgrids with control architectures to achieve optimized resilience, reliability, and economics*. A networked microgrid system, based on at least one use case, will be designed in FY 2019 using version one of the OD&O tool developed in FY 2018. The system design for an electrical distribution system model with tightly coupled microgrids controlled by a single entity will be developed and prepared for testing, via simulation, to validate performance results in meeting the defined metrics of resilience, reliability, and economics.
- *New control solutions—based on advanced control theory, topologies, and algorithms—for integrating control functions of microgrid and DMS products to enhance the resilience of distribution systems with high penetration of distributed energy resources (DER)*. The functional requirements and operation strategies for resilient distribution systems, developed in FY 2018, for individual controllers (DER, microgrid, and distribution system) and the integrated control system will be validated via simulations on models built on real distribution circuits. Specifically, initial simulation testing will be performed for resilient functions (such as fault location, isolation, and service restoration [FLISR], switch order management, network reconfiguration, and black start) in grid-connected and islanded modes under normal and extreme event conditions.

Both foundational areas aim to enhance integration of microgrids (singular or networked) with electric distribution systems. OE coordinates with the Office of Energy Efficiency and Renewable Energy through the Grid Modernization Initiative and regular programmatic outreach to ensure the programs support complementary R&D and avoid duplication.

In FY 2019, activities will support priorities on grid resiliency and dynamically sourced grid support services to help harden and evolve critical distribution grid infrastructure. A resilient energy system is a system that supplies controlled energy under any circumstances, using all the assets available to it. Resilience is the product of design and forethought, technology and assets, flexibility, and information. Information extends resilience beyond what a static system can achieve through flexibility, prediction, and adaptation—information allows systems to be dynamic. Design and planning allows the selection and placement of the most effective assets and technologies, tested in the lab and through simulation in a range of extreme and everyday scenarios.

In FY 2019, activities targeting the application of distributed control theory and new system protection methods to microgrids and distribution systems will be pursued. Historically, energy and information systems have relied on a centralized, hierarchical design that presents vulnerabilities in terms of resilience, thus both must be more distributed in the future.

Specifically, in FY 2019, the following activities will be supported.

- Communications networks with software defined networking, predictive data collection capabilities, and event-driven prioritization will be researched, which in turn may impose new meta-data requirements on sensors and assets. While enabling distributed, island-able, and resilient controls, the availability of data during extreme events could enable new fault location, isolation, and service restoration capabilities that could take advantage of interconnected microgrids and other distributed generation and energy storage systems to assure continuity of operations.
- Analysis activities will include efforts in several areas. Work will continue on a design/planning decision support tool and development of a suite of distribution system analysis tools will be advanced for all known extreme weather hazards, along with validated test results and quantification of the tool benefits. In addition to design/planning, resilience also benefits from the use of a relatively new discipline called Grid Architecture which will be employed in FY 2018–2019 to explore the theoretical implications of resilience on regulatory structures, organizational relationships,

and the relationships between technologies and assets owned by multiple parties. Electric grid resilience will also be addressed though the enhancement of mathematical simulation and analytical capabilities using an open source distribution system tool (GridLAB-D) to support critical end-use loads in cities/communities under hazards, and extended co-simulation with behavioral, cybersecurity and communications simulators. The foundational work will be done to prepare for validation in the subsequent years of an enhanced platform by exploring a scenario of dynamically sourced grid services, including blackstart and emergency load shed services.

- A structured resilience framework process will continue to be followed to provide stakeholders with a structured methodology to systematically assess, hypothesize, and implement grid resilience enhancements. Activities in FY 2019 will focus on R&D gap areas, identified by stakeholders, for enhancing existing tools and developing new prototype tools and technologies to advance operational capabilities and strengthen electric grid resilience. Work will be performed on the prototypes of new and/or enhanced tools in actionable exercises with various stakeholders (reliability coordinators, transmission and distribution companies, interdependent sector entities and communities) may be tested in subsequent years.

**Resilient Distribution Systems Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Resilient Distribution Systems** | **50,000** | **49,660** | **10,000** | **-40,000** |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $1,600; STTR $225
- FY 2019 Request: SBIR: $320; STTR $45

**Resilient Distribution Systems**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| • Terminate R&D activities related to microgrid controller demonstrations and Advanced Distribution Management System (ADMS) application development. Reduce efforts on transactive-based control approaches including standards development and demonstration projects. | **-20,000** |
| • The FY 2017 appropriation included Congressional direction of $5,000 for development of advanced, secure, low-cost sensors that measure, analyze, predict, and control the future grid during steady state and under extreme conditions. Work related to low-cost sensors will be completed using funding provided in FY 2017 and no further funding is requested in FY 2019. | **-5,000** |
| • The FY 2017 appropriation included Congressional direction of $15,000 for regional demonstrations of on-site generation and microgrids. The awarded demonstration projects were fully funded in FY 2017 and no further funding is requested in FY 2019. | **-15,000** |
| **Total, Resilient Distribution Systems** | **-40,000** |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Resilient Distribution Systems $50,000,000** | **$10,000,000** | **-$40,000,000** |
| • Integrate microgrid controllers with distribution management systems to meet the functional requirements defined in the DOE guidelines document<br>• Competitively down-select a national laboratory project, from the two projects awarded through the FY 2015 research call, to test and validate the performance of the developed design support tool and provide technical assistance to a remote community on the use of the tool<br>• Continue development and conduct laboratory testing of resilient distribution grid tools (one for system design and planning, and one for system restoration) that were developed through the FY 2015 Grid Modernization lab call<br>• Based on the specifications established in FY 2016, develop an integration platform, based on open source interoperability standards and advanced mathematical models at the distribution and transmission levels, to integrate the applications, test cases, and local inputs (such as weather, power flow, and asset conditions) to form a fully functional ADMS environment<br>• Utilize the environment to validate the benefits of ADMS capabilities that vendors can use to accelerate bringing ADMS to the market, that utilities can use to justify investments, and as the basis for training exercises for operators | • Complete preliminary design to prepare for the release of the full open source GridApps-D platform in accordance with approved transition plan<br>• Utilize version 1 of the OD&O tool to create a networked microgrid system design for microgrids controlled by a single entity<br>• Identify control objectives and control strategies for integrated DMS and microgrid control solutions<br>• Research advanced communications methods and apply them to decentralized data-rich control systems; propose viable legacy migration approaches<br>• Complete preliminary design of prototypes of new and/or enhanced tools for use in actionable exercises by stakeholders to advance operational capabilities and strengthen electric grid resilience<br>• Develop a methodology to demonstrate the ability to obtain firm forward resource commitments for four grid services critical to resilience (load shed, reactive power, deferred load pickup, and frequency response) through transactive mechanisms in high DER and microgrid environments | • FY 2019 activities build upon and extend work from FY 2018 and prior years<br>• Work scope of the open ADMS platform will be reduced and release of the open source GridApps-D platform will be delayed<br>• Scale down the work on networked microgrids OD&O tool and new control solutions, including a reduction in the number of uses cases studied<br>• Activities targeting the application of distributed control theory and new system protection methods will be scaled down |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • Improve the ability to model and run simulations of distributed controls and distributed (local) markets that leverage locational time-varying values<br>• Develop advanced simulations to evaluate stability of transactive control solutions in high DER scenarios, on time scales that are supported by existing technology | | |

**Resilient Distribution Systems**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Resilient Distribution Systems - Develop and validate the technical feasibility of integrated distribution control architectures to effectively provide resilient grid services from all types of distribution assets.** | | |
| Target | • Complete development of a design support tool that is used by at least one remote community for designing an AC or DC microgrid for off-grid applications. | • Complete development of the Advanced Distribution Management System (ADMS) core analytics engine for the open-source distribution system platform. | • Complete real-time simulation testing of a networked microgrid system design, and assess the value associated with resilient grid services. |
| Result | Met | TBD | TBD |
| Endpoint Target | Achievement of a resilient distribution system, with integration of networked microgrids and transactive control signals operating in coordination with the ADMS, that allows for integration of all types of energy resources by the end of FY 2030 | | |

## Energy Storage

### Overview

The Energy Storage program supports the modernization of the electric grid with early-stage research and development geared towards enabling industry to improve operational flexibility and resilience through increased deployment of energy storage systems throughout the infrastructure. The electric power grid is the backbone of our modern economy and success of the grid has rested on two key principles: reasonably predictable load and a measure of control over generation. However, with increasing deployment of variable and distributed generation resources combined with changing customer preferences, the electric grid is rapidly evolving from the traditional model of largely centralized generators serving predictable loads to one requiring greater levels of flexibility to effectively manage a much larger number of distributed and variable generators and participatory, responsive loads. This new model introduces many challenges faced by system operators in managing variable generation and loads. Energy storage is key to addressing this grid modernization challenge. Storage provides greater flexibility and reliability for grid operations by enhancing resiliency of the system and improving the ability of the grid to more effectively manage the diversity of generation and load profiles, while providing grid services including energy management, backup power, load leveling, frequency regulation, voltage support, and grid stabilization. Research will generate the knowledge upon which industry can commercialize and deploy need for reactive power devices associated with grid control and energy storage.

The Energy Storage program is designed to develop new and advanced technologies that will ensure the stability, reliability, and resilience of electricity infrastructure. The program focuses on accelerating the development of new materials and device technologies that can lead to significant improvements in the cost and performance of energy storage systems and accelerate the adoption of the energy storage into the grid infrastructure.

The U.S. electric grid with installed electricity generation summer capacity of just over 1 terawatt (1,000 GW) has roughly 32 GW of energy storage, of which 21 GW is provided by large pumped hydro energy storage plants. Thus, the equivalent of about one percent of installed generation capacity is provided by modular energy storage assets (such as batteries and flywheels) that offer the greatest potential for large scale deployment and operational flexibility. To enable the efficient deployment of energy storage technologies throughout the grid infrastructure, research efforts are focused on reducing the cost of, and improving the safety and long term reliability of utility-scale energy storage systems. In addition, the Energy Storage program works with industry and the national laboratories to develop analytic models that can facilitate greater understanding of technical and economic benefits energy storage can provide to utilities and grid operators. FY 2019 R&D efforts will be focused around three categories:

- Energy Storage Technology Development—perform advanced research on the development of novel materials and system components to resolve key cost and performance challenges with respect to novel flow, lithium, sodium, zinc, magnesium, and thermo-electrochemical batteries, electrode materials, membranes, electrolytes, interconnects, and supporting power electronics and power conversion systems.
- Safety and Reliability—continue establishing a scientifically derived knowledge base that will improve the understanding and predictability of energy storage systems and components, as well as support fostering greater confidence in the safety and reliability of energy storage systems.
- Energy Storage Analytics—develop analytic tools for utility customers and regulatory agencies to facilitate planning and implementation of energy storage onto the grid. Support the development of open-source tools for optimal sizing, placement, and valuation of energy storage and develop performance protocols for rapid adaption of energy storage.

### Highlights of the FY 2019 Budget Request

Grid energy storage is one of the key components for the development of a flexible and resilient electric grid infrastructure. The request supports materials research on the next generation of battery chemistries, development of new materials and new device technologies for efficient power conversion, development of optimal design and control architectures for energy storage integration into the grid infrastructure, and development of open source models and software tools for system level energy storage planning and evaluation.

The Energy Storage program's materials research has been successful in developing new electrochemical materials, devices, and component technologies. Efforts will focus on the development of high energy density electrolytes for flow batteries, advanced materials research in improving life and performance of sodium and zinc based batteries, the development of polymeric and ceramic ionic conductors, membranes with fast ion kinetics and enhanced mechanical and chemical stability, and the development of advanced materials and device topologies for power electronics and power conversion systems.

Redox flow battery research efforts will support innovative chemistries such as aqueous soluble organic electrolytes. The program will focus on the synthesis and development of low cost polymeric membranes as well as ceramic membranes to enable the development of safer, metal electrode batteries. The program will support the fundamental research to advance the development of batteries based on earth abundant materials such as sodium and zinc.

Safety and reliability of energy storage systems are critical for large scale deployment of storage technologies into grid infrastructure. The program will provide limited support for fundamental investigations into the degradation mechanisms affecting the safety and reliability of energy storage systems. New research activities will be initiated for the development of high fidelity models that significantly improve performance, safety, and reliability. The DOE Energy Storage Program will disseminate critical scientific discoveries in reliability and safety to the storage industry at large.

The program will provide limited support for R&D on the development of open access models for transmission and distribution level storage planning and evaluation tools along with efforts to refine techno-economic models based on field experience for improved valuation and planning tools.

**Energy Storage Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Energy Storage** | **31,000** | **30,790** | **8,000** | **-23,000** |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $992; STTR $140
- FY 2019 Request: SBIR: $256; STTR: $36

**Energy Storage**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| The request discontinues grid scale field validation support engagements with states and utilities, eliminates State and Federal regulatory body policy engagements to understand regional market barriers to energy storage deployment, reduces the number of university subcontracts, eliminates OE participation in industry led Safety Codes and Standards development, and discontinues the biannual Safety Forum. The request puts on hold the research into the benefits of storage for enhanced cyber security. | **-23,000** |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Energy Storage $31,000,000** | **$8,000,000** | **-$23,000,000** |
| • Continue development and accelerate validation of next generation redox flow batteries (RFBs) through industrial partnering with enhanced safety and reliability testing<br>• Support regional grid-scale testing and field evaluations with states, utilities, and storage providers to elucidate energy storage economic and technical benefits, understand grid integration and performance issues, and implement safety and performance protocols<br>• Incorporate and validate enhanced planning and evaluation tools for energy storage into commercially relevant distribution level planning models<br>• Assess strategies for incorporation of storage tools for transmission planning<br>• In collaboration with industry, establish an Energy Storage Reliability and Safety Initiative to support accelerated testing, characterization, and analysis of commercially relevant, grid-scale energy storage systems<br>• Working with utilities, regulators and industry, develop analysis tools for integrated resource planning to accurately value the services energy storage can provide<br>• Develop analytic tools and uniform model standards for energy storage that can accommodate regional diversity and risk attributes of energy storage along with primary, secondary and tertiary value stream recognition | • Aqueous Soluble Organic (ASO) redox flow battery development plan targeting phenazine/ ferricyanide systems capable of achieving 100 $mA/cm^2$ with a projected cost under $200/kWh (year 3 of ASO roadmap)<br>• Continued investigation of innovative chemistries such as reversible zinc, lithium, magnesium-based batteries, solid state electrolytes, and low cost polymeric membranes<br>• Mechanistic determination of battery materials degradation under grid duty cycles<br>• Fundamental materials investigations into energy storage failures and development of mitigation strategies for improved safety<br>• Develop novel state of health sensors and control algorithms for enhanced battery lifetimes | • Discontinue support for engagements with states, utilities, and storage providers for conducting grid-scale field tests and trails<br>• Eliminate Regulatory Environment thrust area and discontinue support for engagement with State and Federal regulatory officials on efforts to understand regional market barriers to energy storage deployment<br>• Eliminate Industrial Acceptance thrust area and validation of system performance and analysis of regional use-cases<br>• Discontinue support to States and regional entities on the procurement, commissioning, and techno-economic analysis of deployed systems<br>• Eliminate support for new collaborative test-bed and field trials<br>• Discontinue support for development of enhanced tools and data to U.S. industry for development and use of grid-scale batteries<br>• Eliminate participation in industry led Safety Codes and Standards development<br>• Eliminate DOE participation in international codes and standards development (IEC TC120)<br>• Eliminate biannual Safety Forum<br>• Reduce the number of university subcontracts |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • Conduct preliminary techno-economic analysis on potential demonstration sites for aggregated distributed energy storage systems<br>• Demonstrate potential for 2nd use lithium-ion battery systems for residential and commercial applications<br>• Develop industry standards for safety, reliability, testing and characterization of various energy storage technologies, and promulgation to international standards<br>• Continue to support Energy Storage Safety Forum meetings for the energy storage community nationally and internationally to increase acceptance of energy storage technologies and deployment<br>• Increase power conversion system performance for grid-tied energy storage systems applications<br>• Support industrial deployment of next generation flywheel technology with new carbon fiber reinforced nanoparticles | | |

**Energy Storage**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Energy Storage—Lower the cost of grid-scale (>1 MW) energy storage technologies.** | | |
| Target | Transition to new aqueous soluble organic flow systems with the goal of substantial future cost reductions. $350/kWh for a 4-hour system (aqueous soluble organic electrolyte) | $275/kWh for a 4-hour system (aqueous soluble organic electrolyte) | $225/kWh for a 4-hour system (aqueous soluble organic electrolyte); for a projected 1 MW/ 4 MWh system operating at 150 $mA/cm^2$ |
| Result | Met | TBD | TBD |
| Endpoint Target | By the end of FY 2025, the cost of a prototype redox flow battery system will be $100/kWh | | |

## Transformer Resilience and Advanced Components

### Overview

The Transformer Resilience and Advanced Components (TRAC) program supports modernization, hardening, and resilience of the grid by addressing the unique challenges facing transformers and other critical grid components (grid hardware) that are responsible for carrying and controlling electricity from where it is generated to where it is needed. As the electric power system evolves and the threat environment changes, early-stage R&D can help power system stakeholders understand the physical impact these changes have on vital grid components and the further adaptations that may be necessary to enable a more resilient and secure energy future. In the March 2017 Report to Congress on a Strategic Transformer Reserve, large power transformers (LPTs) are identified as one of the most vulnerable components of the grid, posing a significant risk to the Nation in the event of multiple failures, requiring innovative and cost-effective solutions beyond the spares, shares, and pooling that industry is pursuing on its own.[a] Research in advanced materials, components, and devices will provide the fundamental physical capabilities and enhancements required to accommodate a rapidly changing power system, ensure all-hazards resilience to a more complex threat environment, and encourage the adoption of new technologies and approaches. Research will ultimately support the need for reactive power devices associated with grid control.

Transformers, power lines, and substation equipment are often exposed to the elements and are vulnerable to an increasing number of natural and man-made threats. To enhance the security, reliability, robustness, and resilience of the electric power system, the next-generation of these individual grid components will need to be designed and built to withstand and rapidly recover from the impact of extreme terrestrial or space weather events, electrical disturbances, equipment failures, accidents and deliberate attacks, and other unknowns. Another important LPT characteristic is flexibility and adaptability to address the wide range of designs and specifications across these critical assets, facilitating interchangeability and sharing in emergency situations as highlighted in the July 2017 National Academies Report, *Enhancing the Resilience of the Nation's Electricity System*.[b] Greater deployment of distributed energy resources also introduces new stresses from reverse power flows, increased harmonics, and protection coordination that can impact the reliability and lifetimes of current grid hardware, requiring new and expanded capabilities in the next generation of grid equipment.

TRAC addresses these challenges associated with transformers and other grid equipment by focusing on materials research, analytical designs, and exploratory concepts that are inherently more secure and resilient, in close coordination with industry, to fill fundamental R&D gaps in a timely manner. The age of existing grid hardware degrades its ability to withstand physical stresses and may result in higher failure rates that can lead to widespread outages and long restoration times. For example, failure of a LPT (with 70% aged 25 years or older) can disrupt power to the equivalent of 500,000 homes and take over 12 months to procure an optimized replacement due to their custom engineering and design. As a large percentage of these assets will be replaced in the near future, the timing is ripe for innovation to avoid reinstalling outdated technologies that are long-lived, expensive, and less resilient. Results of the TRAC program will help prepare and harden the next generation of critical grid infrastructure by catalyzing advances in resilient materials, equipment, and devices.

### Highlights of the FY 2019 Budget Request

TRAC will continue research to support innovative concepts and designs for solid-state power substations (SSPS), including advanced materials and system architectures, based on gaps identified in the SSPS roadmap being developed.[c] Greater utilization of high voltage power electronics within a substation, including hybrid and solid-state transformers, can provide power flow control capabilities, reactive power support, limit fault currents, and increase system reliability and resilience. Continued efforts in this cutting-edge technology concept can enable more flexible and adaptable designs that are interoperable with legacy systems, help reduce the criticality of substations, and facilitate integration of energy storage for enhanced resilience. Additionally, research that improves asset monitoring capabilities and equipment performance under stress will be needed to advance the portfolio of solutions for SSPS and to increase grid security, reliability, and resilience.

[a] https://www.energy.gov/oe/downloads/strategic-transformer-reserve-report-congress-march-2017
[b] https://www.nap.edu/catalog/24836/enhancing-the-resilience-of-the-nations-electricity-system
[c] https://energy.gov/oe/downloads/solid-state-power-substation-roadmapping-workshop-june-2017

**Transformer Resilience and Advanced Components Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Transformer Resilience and Advanced Components** | **6,000** | **5,959** | **5,000** | **-1,000** |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $192; STTR: $27
- FY 2019 Request: SBIR: $160; STTR $23

**Transformer Resilience and Advanced Components Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| The request continues to catalyze material and design innovations that can be utilized to harden and protect critical grid equipment, focusing on technologies and concepts related to solid state power substations. | **-1,000** |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

## Transformer Resilience and Advanced Components

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Transformer Resilience and Advanced Components**<br>**$6,000,000** | **$5,000,000** | **-$1,000,000** |
| • Expand modeling and testing of vulnerabilities to GMD/EMP by including other critical components and technologies such as circuit breakers and relays. Increasing grid security and resilience will require a more comprehensive understanding of system vulnerabilities beyond transformers due to component interconnectivity<br>• Conduct magnetic materials research including characterization of soft magnetic materials for advanced convertor designs and exploration of advanced manufacturing techniques | • Fundamental research advances converter, control, and system architectures for modular and scalable solid-state power substation technologies and applications, including associated tools<br>• Exploration of reactive power and control devices that complement energy storage technologies<br>• Applied materials research furthers capabilities, packaging, and performance of devices such as high voltage power electronics | • Continue to support material and design innovations for critical grid equipment, focusing on technologies and concepts related to solid-state power substations |

**Transformer Resilience and Advanced Components**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Transformer Resilience and Advanced Components—Develop tools and technologies that enable the next-generation of grid hardware to be more adaptive, more flexible, self-healing, resilient to all-hazards, reliable, and cost-effective compared to technologies available today, and maximizes the value and lifetimes of current grid components.** | | |
| Target | N/A | Complete design of a large power transformer with variable impedance of +/- 5% to increase adaptability | Complete design tool for converters with 5% increase in soft magnetic model accuracy compared to benchmark |
| Result | N/A | TBD | TBD |
| Endpoint Target | By the end of FY 2030, next-generation transformers and converters will be developed that can be utilized in more than 80% of substations cost-effectively while increasing the transformer and converter flexibility and resiliency by 50%. | | |

## Transmission Permitting and Technical Assistance

### Overview

The Transmission Permitting and Technical Assistance (TPTA) program fosters and enables the development of reliable, affordable, and resilient electricity infrastructure. TPTA's priorities are focused around regulatory reform and infrastructure investment. TPTA provides electricity policy technical expertise to state, regional, and tribal entities on all facets of the electric system, including generation, transmission, storage, distribution, or demand-side electricity resources.

TPTA electricity policy technical assistance (to states, territories, regions, localities, and tribal entities), which is available upon their request, respects their sovereign authority over electricity system decision-making. TPTA does not advocate for or against particular electricity policies or technology solutions, but rather provides assistance in a neutral, unbiased, and informational manner.

TPTA also implements a number of legal authorities, such as coordination of transmission permitting by Federal agencies, periodic transmission congestion studies, permitting of cross-border transmission lines, authorization of electricity exports, and supporting actions by the Secretary of Energy during electricity emergencies.

The electricity system and markets in the United States are undergoing significant changes for a number of reasons. The changes arise from a range of challenges and opportunities created by new or improved technologies, changing customer and societal expectations, and structural changes in the electric industry. Some of these technologies are at the wholesale (bulk power) level, some are at the retail (distribution and customer) level, and some blur the line between the two. Other key factors driving current discussions include the continuing need for substantial utility investments and low load growth in many regions, changing policies and regulations across all jurisdictional landscapes, and new concerns about the structure of wholesale electricity markets. All of these challenges and opportunities must be balanced by regulators and other policy officials overseeing the electricity system against the continuing need for reliability, resiliency (including both physical security and cybersecurity), and affordability.

### Highlights of the FY 2019 Budget Request

Traditionally, steady growth in electricity demand has enabled utilities to raise the capital needed for new investment. Now, however, many parts of the U.S. are experiencing lower growth in electricity sales, in part due to increasing energy efficiency and customer- or third-party-owned generation technologies. At the same time, the need for new infrastructure investment by utilities is increasing to address aging assets, take advantage of new technologies, and respond to changing customer interests. Since many utilities' revenues are dependent chiefly on electricity sales volume, it can be difficult to finance new investments when revenues are stagnant or declining. Regulators in some states have begun to consider alternative ratemaking concepts to cover fixed costs and new regulatory and market regimes that link utility revenues to other performance indices, but this is a complex and challenging subject that will require attention and analysis over the next several years. Efforts in this area include continued assistance to those states that are considering these changes for their jurisdictional electric utilities.

TPTA supports transmission planning and related analysis by both electric industry planners and state-based groups in each of the three electricity regional interconnections. The Eastern Interconnection Planning Collaborative, Eastern Interconnection States Planning Council, Western Electricity Coordinating Council, Western Governors' Association (and its associated Western Interstate Energy Board) and Electric Reliability Council of Texas are continuing their efforts to inform future transmission and other electricity plans and policies that will shape the future of the electricity grid in their respective interconnections. TPTA will continue to support the work of these regional interconnection-wide bodies through technical assistance, such as planning tool development and additional topical studies that are helpful to their efforts.

DOE also issued a *Staff Report to the Secretary on Electricity Markets and Reliability* in August 2017, which included a number of recommendations. Building on that report, the Secretary proposed a rulemaking to FERC seeking to ensure baseload resources are appropriately compensated for the reliability and resilience benefits they provide to the grid. FERC did not approve the proposed rulemaking, but it has opened a new proceeding on grid resilience. Potential follow-on activities could include work with the national labs and other OE and DOE offices to prepare a DOE submission to the new FERC proceeding on grid resilience. In addition, TPTA will pursue other topics flagged as meriting further research in the Staff Report, such as valuation of essential reliability services, gauging the economic health and efficiency of the bulk power system, and obstacles to timely and needed infrastructure development for resilience and protecting defense critical electric infrastructure.

The issues affecting the grid are complex and have regional variations and levels of understanding. Therefore, additional technical and policy topics span a wide variety of current and future electricity-related issues, such as:

- Understanding the implication of interdependencies (such as gas/electric, electric/IT, and energy/water) on grid reliability and how that might inform electric utility planning and operations and potential infrastructure investments;
- State, regional, local, and tribal policies and regulations affecting the energy sector and new approaches to transmission planning and private sector infrastructure investment;
- Management of risks (including electricity policy uncertainty, changing markets, and extreme weather) by state electricity regulators and other state officials;
- Addressing resiliency and security (both physical and cyber) concerns in electric system processes; and
- Examining approaches to rate design and compensation to ensure robust industry models that can maintain a reliable, resilient, and affordable electric grid while responding to diverse public policies.

Work in these issue areas will result in the development of tools, reports, workshops, analyses, and interstate discussions that can help state, territory, regional, local, and tribal electricity officials, make better informed decisions about their respective elements of the electricity system.

TPTA will continue to work with experts from industry, the national laboratories, electricity sector state organizations, and universities to develop and deliver its electricity policy technical assistance.

TPTA will also continue to carry out its regulatory responsibilities and evaluate regulatory reform to reduce Federal burden associated with investing in our Nation's electricity infrastructure in these areas:

- Preparing and publishing DOE's annual *Transmission Data Review* and triennial national electric transmission congestion studies;
- Conducting environmental review and technical analyses needed for Federal authorization of transmission projects that cross the U.S. international borders;
- Coordinating Federal permitting by other agencies of new transmission infrastructure that involves Federal authorizations, as required by Section 216(h) of the Federal Power Act and in coordination with title 41 of the Fixing America's Surface Transportation (FAST) Act;
- Evaluating any new applications under Section 1222 of the Energy Policy Act of 2005, which authorizes DOE to participate in third-party-financed transmission projects within the Western Area Power Administration (WAPA) and the Southwestern Power Administration (SWPA) regions;
- Expanding the Regulatory and Permitting Information Desktop (RAPID) toolkit to include a portal for the Integrated Interagency Pre-Application (IIP) Process and to include a database of National Environmental Policy Act (NEPA) document information that can be used by transmission project developers when planning new projects;
- Supporting the Secretary of Energy during electricity emergencies when implementing Section 202(c) of the Federal Power Act; and
- Facilitating the Electricity Advisory Committee, established in accordance with the provisions of the Federal Advisory Committee Act (FACA).

**Transmission Permitting and Technical Assistance Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Transmission Permitting and Technical Assistance** | **7,500** | **7,449** | **6,000** | **-1,500** |

**Transmission Permitting and Technical Assistance Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| • The decrease results in fewer states, regions, and tribes receiving technical assistance<br>• Underlying tool development, reports, workshops and other forms of work to inform the technical assistance will either be delayed or eliminated | **-1,500** |

**Transmission Permitting and Technical Assistance**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Transmission Permitting and Technical Assistance** | | |
| **$7,500,000** | **$6,000,000** | **-$1,500,000** |
| • Maintain the suite of tools for grid scenario discussions at the Federal, state, and local levels<br>• Provide technical assistance on electricity-related topics, upon request, to states, public utility commissions, tribes, and other regional and Federal entities | • Implement recommendations identified from the Staff Report to the Secretary on Electricity Markets and Reliability (August 2017)<br>• Develop tools for grid scenario discussions at the Federal, state, and local levels | • The decrease results in fewer states, regions, and tribes receiving technical assistance<br>• Underlying tool development, reports, workshops and other forms of work to inform the technical assistance will either be delayed or eliminated |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Transmission Permitting and Technical Assistance**<br>**$7,500,000** | **$6,000,000** | **-$1,500,000** |
| • Implement statutory requirements pursuant to section 216(h) of the Federal Power Act<br>• National review of transmission plans and assess barriers to their implementation<br>• Produce white papers on key subjects relating to Regulated Utility Business Models | • Provide technical assistance on electricity-related topics, upon request, to assists states, regions, localities, and tribal entities by working with experts from industry, the national laboratories, electricity sector state organizations, and universities<br>• Continue transmission permitting coordination requirements pursuant to Section 216(h) of the Federal Power Act and under title 41 of Fixing America's Surface Transportation Act<br>• Prepare and publish DOE's annual Transmission Data Review and triennial national electric transmission congestion studies | |

**Transmission Permitting and Technical Assistance**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Technical Assistance—Number of states to which the program provides, upon request, assistance in designing and implementing electricity policies, statutes and regulations.** | | |
| Target | 45 states/tribes assisted | 50 states/tribes assisted | 40 states/tribes assisted |
| Result | Met - 45 | TBD | TBD |
| Endpoint Target | Increased access to reliable, affordable, and sustainable energy sources. | | |

## Program Direction

### Overview

Program Direction provides for the costs associated with the Federal workforce, including salaries, benefits, travel, training, building occupancy, IT services, security clearance, and other related expenses. It also provides for the costs associated with contractor services that, under the direction of the Federal workforce, support the Electricity Delivery (OE) mission.

**Salaries and Benefits** support Federal employees who provide executive management, programmatic oversight, and analysis for the effective implementation of the OE program. This includes staff at Headquarters and at the National Energy Technology Laboratory (NETL). While OE funds NETL staff within its budget, the NETL Federal employees are included within the full-time equivalent (FTE) total for the Fossil Energy Research and Development account.

**Travel** includes transportation, subsistence, and incidental expenses that allow OE to effectively manage research and development programs and projects in the field; to provide the Department's electricity-related outreach to regions, states, and tribes with regard to planning needs and issues, policies, siting protocols, and new energy facilities through TPTA.

**Support Services** includes contractor support directed by the Federal staff to perform administrative tasks and provide analysis to management. These efforts include issue-oriented support on science, engineering, environment, and economics that benefit strategic planning; technology and market analysis to improve strategic and annual goals; development of management tools and analyses to improve overall office efficiency; assistance with communications and outreach to enhance OE's external communication and responsiveness to public needs; development of program-specific information tools that consolidate corporate knowledge, performance tracking and inventory data, improve accessibility to this information, and facilitate its use by the entire staff; and also may include support for post-doctoral fellows (such as American Association for the Advancement of Science [AAAS] fellows) and Intergovernmental Personnel Act (IPA) assignments.

**Other Related Expenses** includes corporate IT support (DOE's Energy Information Technology Services [EITS] desktop services) and working capital fund (WCF) expenses, such as rent, supplies, copying, graphics, mail, printing, and telephones. It also includes equipment upgrades and replacements, commercial credit card purchases using the simplified acquisition procedures to the maximum extent possible, security clearance expenses, and other needs.

### Highlights of the FY 2019 Budget Request

The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: OE and Cybersecurity, Energy Security, and Emergency Response (CESER). Program direction for CESER is provided separately.

- OE includes the Transmission Reliability and Resilience, Resilient Distribution Systems, Energy Storage, Transformer Resilience and Advanced Components, and Transmission Permitting and Technical Assistance programs.
- Program direction funding is allocated between the two appropriations as described below:
  - Salaries and benefits for administrative, senior management, budget, procurement, contractual management and human capital support activities are funded within OE under a service center approach that will support both appropriations. Salaries and benefits for employees reporting directly to ISER or CEDS are included in CESER Program Direction.
  - Support service funding for ISER and CEDS, due to contractual obligations, is primarily funded through OE Program Direction, including all support service administrative functions.
  - All corporate IT support (EITS desktop services) and WCF expenses, such as rent, supplies, copying, graphics, mail, printing, telephones and security clearance expenses for ISER and CEDS are funded in the OE Program Direction request.
  - Funding for headquarters security clearances, previously funded centrally by DOE, is funded in OE starting in FY 2019, consistent with Congressional direction, including for ISER and CEDS employees.

## Program Direction Funding
## ($K)

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR[b] (Comparable)[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted (Comp) |
|---|---|---|---|---|---|---|
| **Program Direction Summary** | | | | | | |
| **Washington Headquarters** | | | | | | |
| Salaries and Benefits | 13,562 | 10,023 | – | – | 9,813 | -210 |
| Travel | 650 | 361 | – | – | 217 | -144 |
| Support Services | 3,364 | 3,235 | – | – | 2,466 | -769 |
| Other Related Expenses | 4,004 | 3,229 | – | – | 4,109 | +880 |
| **Total, Washington Headquarters** | **21,580** | **16,848** | **–** | **–** | **16,605** | **-243** |
| **National Energy Technology Laboratory** | | | | | | |
| Salaries and Benefits | 5,720 | 2,880 | – | – | 2,144 | -736 |
| Travel | 300 | 183 | – | – | 180 | -3 |
| Support Services | 550 | 132 | – | – | 122 | -10 |
| Other Related Expenses | 350 | 257 | – | – | 258 | +1 |
| **Total, National Energy Technology Laboratory** | **6,920** | **3,452** | **–** | **–** | **2,704** | **-748** |
| **Total Program Direction** | | | | | | |
| Salaries and Benefits | 19,282 | 12,903 | – | – | 11,957 | -946 |
| Travel | 950 | 544 | – | – | 397 | -147 |
| Support Services | 3,914 | 3,367 | – | – | 2,588 | -779 |
| Other Related Expenses | 4,354 | 3,486 | – | – | 4,367 | +881 |
| **Total, Program Direction** | **28,500** | **20,300** | **28,307** | **20,162** | **19,309** | **-991** |

[a] The FY 2019 Budget Request proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: OE and CESER. To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 and FY 2018 exclude amounts of Program Direction funding equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017 and FY 2018.

[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. These amounts are shown only at the Congressional control level and above; below that level, a dash (–) is shown.

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR[b] (Comparable)[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted (Comp) |
|---|---|---|---|---|---|---|
| **Federal FTEs** | **89** | **67** | **77** | **57** | **57** | **-10** |
| Additional FE FTEs at NETL supporting OE[a] | 29 | 17 | 22 | 13 | 13 | -4 |
| Total OE-funded FTEs | 118 | 84 | 99 | 70 | 70 | -14 |
| | | | | | | |
| **Support Services and Other Related Expenses** | | | | | | |
| **Support Services** | | | | | | |
| Technical Support | 1,607 | 1,388 | – | – | 927 | -461 |
| Management Support | 2,307 | 1,979 | – | – | 1,661 | -318 |
| **Total, Support Services** | **3,914** | **3,367** | **–** | **–** | **2,588** | **-779** |
| | | | | | | |
| **Other Related Expenses** | | | | | | |
| Other Services | 600 | 433 | – | – | 233 | -200 |
| EITS Desktop Services | 603 | 471 | – | – | 745 | +274 |
| WCF | 3,151 | 2,582 | – | – | 3,389 | +807 |
| **Total, Other Related Expenses** | **4,354** | **3,486** | **–** | **–** | **4,367** | **+881** |

## Program Direction

**Activities and Explanation of Changes**

| FY 2017 Enacted (Comparable) | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $20,300,000** | **$19,309,000** | **-$991,000** |
| **Salaries and Benefits $12,903,000** | **$11,957,000** | **-$946,000** |
| • Salaries and Benefits support 118 FTEs at HQ and NETL that provide executive management, programmatic oversight, and analysis for the effective implementation of the OE program | • Salaries and Benefits support 70 FTEs at HQ and NETL that provide executive management, programmatic oversight, and analysis for the effective implementation of the OE program[b] | • Reductions are due to changes in workforce composition |

[a] OE funds 13 FTEs at FE's National Energy Technology Laboratory who support OE activities. The 13 FTEs are in FE's FTE totals and are not included in the OE FTE totals shown on the "Federal FTEs" line.

[b] Funding for all administrative, senior management, budget, procurement, contractual management and human capital support activities remains funded within OE under a service center approach that will support both appropriations.

| FY 2017 Enacted (Comparable) | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Travel $544,000**<br>• Travel includes transportation, subsistence, and incidental expenses that allow OE to effectively facilitate its mission | **$397,000**<br>• Travel includes transportation, subsistence, and incidental expenses that allow OE to effectively facilitate its mission[a] | **-$147,000**<br>• Reductions are attributed to the increased use of web-based meetings and better travel management and oversight by Federal managers |
| **Support Services $3,367,000**<br>• Support Services includes contractor support directed by the federal staff to perform administrative tasks and provide analysis to management. Support Services may include support for post-doctoral fellows and Intergovernmental Personnel Act (IPA) assignments | **$2,588,000**<br>• Support Services includes contractor support directed by the federal staff to perform administrative tasks and provide analysis to management. Support Services may include support for post-doctoral fellows and Intergovernmental Personnel Act (IPA) assignments[b] | **-$779,000**<br>• Reductions are driven by decreasing administrative work by contractors and better management by Federal contract managers |
| **Other Related Expenses $3,486,000**<br>• Other Related Expenses includes EITS desktop services and WCF expense, such as rent, supplies, copying, graphics, mail, printing, and telephones. It also includes equipment upgrades and replacements, commercial credit card purchases using the simplified acquisition procedures to the maximum extent possible, and other needs | **$4,367,000**<br>• Other Related Expenses includes EITS desktop services and WCF expense, such as rent, supplies, copying, graphics, mail, printing, and telephones. It also includes equipment upgrades and replacements, commercial credit card purchases using the simplified acquisition procedures to the maximum extent possible, security clearance expenses and other needs[c] | **+$881,000**<br>• Increases are driven by estimated Working Capital Fund and EITS costs<br>• Funding for headquarters security clearances, previously funded centrally by DOE, is funded in OE Program Direction starting in FY 2019, consistent with Congressional direction, including for ISER and CEDS employees |

[a] Travel funding for all administrative, senior management, budget, procurement, contractual management and human capital support activities remains funded within OE.

[b] Due to contractual obligations, most support service funding for ISER and CEDS remains funded through OE Program Direction. All support service administrative functions are funded through OE Program Direction.

[c] All EITS desktop services and WCF expenses for ISER and CEDS remains funded in the OE Program Direction request.

**Electricity Delivery**
**Research and Development**
**($K)[a]**

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[b] | FY 2018 Annualized CR[c] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|---|
| Basic | 7,762 | 4,278 | – | 5,000 | -2,762 |
| Applied | 87,137 | 49,469 | – | 32,297 | -54,840 |
| Development | 55,200 | 51,716 | – | 15,254 | -39,946 |
| Total, R&D | 150,099 | 105,463 | – | 52,551 | -97,548 |

[a] R&D reporting includes a proportional share of program direction funding in addition to direct R&D funding. Program direction funding was not included in the R&D reporting in the FY 2016 and prior year budget justifications.

[b] The FY 2019 Budget Request proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 exclude amounts for the Cybersecurity for Energy Delivery Systems program, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017.

[c] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. These amounts are shown only at the Congressional control level and above; below that level, a dash (–) is shown.

**Electricity Delivery**

**Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR)**

**($K)**

| | FY 2017 Transfer | FY 2017 Transfer (Comparable)[a] | FY 2019 Request Projected Transfer | FY 2019 Request vs FY 2017 Transfer |
|---|---|---|---|---|
| Transmission Reliability and Resilience | | | | |
| SBIR | 1,024 | 1,024 | 416 | -608 |
| STTR | 144 | 144 | 58 | -86 |
| Resilient Distribution Systems | | | | |
| SBIR | 1,600 | 1,600 | 320 | -1,280 |
| STTR | 225 | 225 | 45 | -180 |
| Cybersecurity for Energy Delivery Systems | | | | |
| SBIR | 1,312 | 0 | 0 | -1,312 |
| STTR | 184 | 0 | 0 | -184 |
| Energy Storage | | | | |
| SBIR | 992 | 992 | 256 | -736 |
| STTR | 140 | 140 | 36 | -104 |
| Transformer Resilience and Advanced Components | | | | |
| SBIR | 192 | 192 | 160 | -32 |
| STTR | 27 | 27 | 23 | -4 |
| Total, SBIR | 5,120 | 3,808 | 1,152 | -3,968 |
| Total, STTR | 720 | 5,36 | 162 | -558 |

[a] The FY 2019 Budget Request proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 exclude amounts for the Cybersecurity for Energy Delivery Systems program, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017.

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Electricity Delivery and Energy Reliability | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Ames Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 120 | 120 | 120 |
| **Total, Ames Laboratory** | **120** | **120** | **120** |
| **Argonne National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 2,301 | 2,600 | 1,495 |
| Resilient Distribution Systems | 4,233 | 5,956 | 1,775 |
| Cybersecurity for Energy Delivery Systems | 3,498 | 654 | 0 |
| Energy Storage | 399 | 0 | 0 |
| Transformer Resilience and Advanced Components | 104 | 0 | 50 |
| Transmission Permitting and Technical Assistance | 190 | 277 | 250 |
| Infrastructure Security & Energy Restoration | 125 | 125 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **10,850** | **9,612** | **3,570** |
| **Total, Argonne National Laboratory** | **10,850** | **9,612** | **3,570** |
| **Brookhaven National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 581 | 650 | 433 |
| Resilient Distribution Systems | 91 | 122 | 85 |
| Cybersecurity for Energy Delivery Systems | 233 | 200 | 0 |
| Energy Storage | 8 | 0 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **913** | **972** | **518** |
| **Total, Brookhaven National Laboratory** | **913** | **972** | **518** |
| **Chicago Operations Office** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 74 | 0 | 0 |
| **Total, Chicago Operations Office** | **74** | **0** | **0** |
| **Golden Field Office** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Resilient Distribution Systems | 25 | 0 | 0 |
| **Total, Golden Field Office** | **25** | **0** | **0** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Electricity Delivery and Energy Reliability | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Idaho National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 149 | 0 | 0 |
| Resilient Distribution Systems | 3,131 | 536 | 0 |
| Cybersecurity for Energy Delivery Systems | 15,172 | 5,672 | 0 |
| Energy Storage | 141 | 0 | 0 |
| Transformer Resilience and Advanced Components | 500 | 0 | 150 |
| Infrastructure Security & Energy Restoration | 300 | 300 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **19,393** | **6,508** | **150** |
| **Total, Idaho National Laboratory** | **19,393** | **6,508** | **150** |
| **Idaho Operations Office** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Permitting and Technical Assistance | 0 | 46 | 25 |
| **Total, Idaho Operations Office** | **0** | **46** | **25** |
| **Lawrence Berkeley National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 3,180 | 2,760 | 578 |
| Resilient Distribution Systems | 2,449 | 1,537 | 250 |
| Cybersecurity for Energy Delivery Systems | 1,428 | 1,050 | 0 |
| Energy Storage | 1,269 | 0 | 0 |
| Transformer Resilience and Advanced Components | 276 | 0 | 50 |
| Transmission Permitting and Technical Assistance | 3,214 | 2,700 | 1,995 |
| Infrastructure Security & Energy Restoration | 175 | 175 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **11,991** | **8,222** | **2,873** |
| **Total, Lawrence Berkeley National Laboratory** | **11,991** | **8,222** | **2,873** |
| **Lawrence Livermore National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 2,178 | 1,725 | 1,156 |
| Resilient Distribution Systems | 1,913 | 1,466 | 0 |
| Cybersecurity for Energy Delivery Systems | 4,075 | 1,900 | 0 |
| Energy Storage | 386 | 0 | 0 |
| Transformer Resilience and Advanced Components | 219 | 0 | 0 |
| Infrastructure Security & Energy Restoration | 200 | 200 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **8,971** | **5,291** | **1,156** |
| **Total, Lawrence Livermore National Laboratory** | **8,971** | **5,291** | **1,156** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Electricity Delivery and Energy Reliability | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Los Alamos National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 3,980 | 1,841 | 1,444 |
| Resilient Distribution Systems | 1,567 | 1,873 | 600 |
| Cybersecurity for Energy Delivery Systems | 2,632 | 200 | 0 |
| Energy Storage | 34 | 0 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **8,213** | **3,914** | **2,044** |
| **Total, Los Alamos National Laboratory** | **8,213** | **3,914** | **2,044** |
| **National Energy Technology Lab** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 4,202 | 8,104 | 0 |
| Resilient Distribution Systems | 3,770 | 7,995 | 0 |
| Cybersecurity for Energy Delivery Systems | 8,671 | 17,524 | 0 |
| Transformer Resilience and Advanced Components | 106 | 4,845 | 500 |
| Transmission Permitting and Technical Assistance | 1,494 | 1,200 | 1,250 |
| Infrastructure Security & Energy Restoration | 647 | 647 | 0 |
| Program Direction | 6,484 | 6,873 | 4,688 |
| **Total, Electricity Delivery and Energy Reliability** | **25,374** | **47,188** | **6,438** |
| **Total, National Energy Technology Lab** | **25,374** | **47,188** | **6,438** |
| **National Renewable Energy Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 1,097 | 600 | 0 |
| Resilient Distribution Systems | 4,201 | 4,826 | 250 |
| Cybersecurity for Energy Delivery Systems | 1,104 | 1,050 | 0 |
| Energy Storage | 1,185 | 0 | 0 |
| Transformer Resilience and Advanced Components | 100 | 0 | 0 |
| Transmission Permitting and Technical Assistance | 777 | 443 | 220 |
| **Total, Electricity Delivery and Energy Reliability** | **8,464** | **6,919** | **470** |
| **Total, National Renewable Energy Laboratory** | **8,464** | **6,919** | **470** |
| **Oak Ridge Institute for Science & Education** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 50 | 0 | 0 |
| Resilient Distribution Systems | 50 | 0 | 0 |
| Transformer Resilience and Advanced Components | 101 | 0 | 0 |
| Program Direction | 25 | 0 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **226** | **0** | **0** |
| **Total, Oak Ridge Institute for Science & Education** | **226** | **0** | **0** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Electricity Delivery and Energy Reliability | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Oak Ridge National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 4,147 | 2,250 | 1,589 |
| Resilient Distribution Systems | 4,687 | 2,789 | 900 |
| Cybersecurity for Energy Delivery Systems | 7,110 | 1,450 | 0 |
| Energy Storage | 5,034 | 2,430 | 600 |
| Transformer Resilience and Advanced Components | 3,615 | 0 | 1,500 |
| Transmission Permitting and Technical Assistance | 205 | 143 | 150 |
| Infrastructure Security & Energy Restoration | 1,200 | 1,200 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **25,998** | **10,262** | **4,739** |
| **Total, Oak Ridge National Laboratory** | **25,998** | **10,262** | **4,739** |
| **Pacific Northwest National Laboratory** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 8,419 | 5,314 | 4,716 |
| Resilient Distribution Systems | 14,992 | 13,571 | 5,160 |
| Cybersecurity for Energy Delivery Systems | 13,071 | 4,900 | 0 |
| Energy Storage | 7,462 | 11,032 | 3,400 |
| Transformer Resilience and Advanced Components | 570 | 0 | 0 |
| Transmission Permitting and Technical Assistance | 472 | 323 | 250 |
| Infrastructure Security & Energy Restoration | 703 | 703 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **45,689** | **35,843** | **13,526** |
| **Total, Pacific Northwest National Laboratory** | **45,689** | **35,843** | **13,526** |
| **Richland Operations Office** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Infrastructure Security & Energy Restoration | 856 | 856 | 0 |
| **Total, Richland Operations Office** | **856** | **856** | **0** |
| **Sandia National Laboratories** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 1,574 | 2,400 | 1,469 |
| Resilient Distribution Systems | 2,073 | 2,288 | 500 |
| Cybersecurity for Energy Delivery Systems | 2,148 | 1,900 | 0 |
| Energy Storage | 9,486 | 13,770 | 4,000 |
| Transformer Resilience and Advanced Components | 90 | 0 | 500 |
| Transmission Permitting and Technical Assistance | 231 | 185 | 150 |
| Infrastructure Security & Energy Restoration | 349 | 349 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **15,951** | **20,892** | **6,619** |
| **Total, Sandia National Laboratories** | **15,951** | **20,892** | **6,619** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Electricity Delivery and Energy Reliability | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Savannah River Operations Office** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Resilient Distribution Systems | 24 | 0 | 0 |
| Transformer Resilience and Advanced Components | 50 | 0 | 250 |
| Infrastructure Security & Energy Restoration | 300 | 300 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **374** | **300** | **250** |
| **Total, Savannah River Operations Office** | **374** | **300** | **250** |
| **Stanford Site Office** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Resilient Distribution Systems | 3,015 | 0 | 0 |
| **Total, Stanford Site Office** | **3,015** | **0** | **0** |
| **Washington Headquarters** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Transmission Reliability | 3,948 | 7,392 | 0 |
| Resilient Distribution Systems | 3,779 | 6,701 | 480 |
| Cybersecurity for Energy Delivery Systems | 2,858 | 25,079 | 0 |
| Energy Storage | 5,596 | 3,558 | 0 |
| Transformer Resilience and Advanced Components | 269 | 1,114 | 2,000 |
| Transmission Permitting and Technical Assistance | 917 | 2,132 | 1,710 |
| Infrastructure Security & Energy Restoration | 3,856 | 3,795 | 0 |
| Program Direction | 21,989 | 21,433 | 14,621 |
| **Total, Electricity Delivery and Energy Reliability** | **43,212** | **71,204** | **18,811** |
| **Total, Washington Headquarters** | **43,212** | **71,204** | **18,811** |
| **Western Area Power Administration** | | | |
| **Electricity Delivery and Energy Reliability** | | | |
| Infrastructure Security & Energy Restoration | 289 | 289 | 0 |
| Program Direction | 2 | 0 | 0 |
| **Total, Electricity Delivery and Energy Reliability** | **291** | **289** | **0** |
| **Total, Western Area Power Administration** | **291** | **289** | **0** |
| **Total, Electricity Delivery and Energy Reliability** | **230,000** | **228,438** | **61,309** |

# Cybersecurity, Energy Security, and Emergency Response

# Cybersecurity, Energy Security, and Emergency Response

## Cybersecurity, Energy Security, and Emergency Response
## Proposed Appropriation Language

*For Department of Energy expenses including the purchase, construction, and acquisition of plant and capital equipment, and other expenses necessary for energy sector cybersecurity, energy security, and emergency response activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, $95,800,000, to remain available until expended: Provided, That of such amount, $7,800,000 shall be available until September 30, 2020, for program direction.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Public Law Authorizations**

Public Law 95–91, "Department of Energy Organization Act", 1977

Public Law 109-58, "Energy Policy Act of 2005"

Public Law 110-140, "Energy Independence and Security Act, 2007"

Public Law 114-94, "Fixing America's Surface Transportation Act", 2015

### Explanation of Changes

The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery (OE) and Cybersecurity, Energy Security, and Emergency Response (CESER).

- OE includes the Transmission Reliability and Resilience, Resilient Distribution Systems, Energy Storage, Transformer Resilience and Advanced Components, and Transmission Permitting and Technical Assistance programs.
- CESER includes the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs.
- Program direction funding is allocated between the two appropriations, with administrative, senior management, budget, procurement, contractual management and human capital support activities funded within OE under a service center approach that will support both appropriations.

**Cybersecurity, Energy Security, and Emergency Response**
**($K)**

| FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR (Comparable)[a] | FY 2019 Request |
|---|---|---|---|---|
| 0 | 79,200 | 0 | 78,662 | 95,800 |

**Overview**

Cybersecurity, Energy Security, and Emergency Response (CESER) leads the Department's efforts to secure U.S. energy infrastructure against all hazards, reduce the risks of and impacts from cyber events and other disruptive events, and assist with restoration activities. CESER is a proposed new appropriation in FY 2019, established by transferring the Cybersecurity for Energy Delivery Systems (CEDS) and Infrastructure Security and Energy Restoration (ISER) programs, along with a portion of program direction funding, from the Electricity Delivery and Energy Reliability appropriation. Other programs from Electricity Delivery and Energy Reliability, which is renamed to Electricity Delivery (OE), remain there.

Due to the critical role the electric grid plays across Federal, State, and local jurisdictions, CESER programs work in an integrated manner in partnership with industry and other stakeholders as well as other DOE offices, to enhance the resilience (the ability to withstand and quickly recover from disruptions and maintain critical function) and security (the ability to protect system assets and critical functions from unauthorized and undesirable actors) of the U.S. energy infrastructure. A reliable and resilient power grid is critical to U.S. economic competiveness and leadership.

Within the appropriation, CESER funds:

- Research and Development (R&D) to deliver game-changing tools and technologies that help utilities secure today's energy infrastructure from advanced cyber threats and design next-generation future systems that are built from the start to automatically detect, reject, and withstand cyber incidents, regardless of the threat.
- Cybersecurity Tools and Development to strengthen the energy sector's cybersecurity posture through public and private sector partnerships that leverage DOE-supported tools, guidelines, outreach, training, and technical assistance.
- Emergency Preparedness and Response to pursue enhancements to the reliability, survivability, and resiliency of energy infrastructure, and facilitating faster recovery from disruptions to energy supply, including management and oversight of the Office of Petroleum Reserves. Funding is requested under the Strategic Petroleum Reserve appropriation for the salaries and related requirements of the headquarters Federal workforce responsible for providing programmatic policy, planning, and oversight—including strategic project planning, budget formulation and financial management, operations, engineering, safety, security, and technical analysis of programmatic activity—of the Strategic Petroleum Reserves.

**Highlights and Major Changes in the FY 2019 Budget Request**

The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: CESER and OE. The OE Overview is provided separately.

- CESER includes the CEDS and ISER programs.
- Program direction funding is allocated between the two appropriations, with administrative, senior management, budget, procurement, contractual management and human capital support activities funded within OE under a service center approach that will support both appropriations.

**Cybersecurity for Energy Delivery Systems** ($70,000,000; +$8,000,000) seeks to reduce the risk of energy disruptions due to cyber events. CESER's mission to enhance the reliability and resilience of the Nation's energy infrastructure cannot be

[a] The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: CESER and OE. To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 and FY 2018 reflect amounts for the CEDS and ISER programs, and a portion of Program Direction funding, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017 and FY 2018.
[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

achieved without both near- and long-term activities to strengthen cyber security across the Nation. The request reflects the critical need to accelerate and expand efforts to strengthen the energy infrastructure against cyber threats and mitigate vulnerabilities, focusing on enhancing the speed and effectiveness of cyber threat and vulnerability sharing, establishing a national cyber supply chain assessment capability in partnership with industry, and accelerating game-changing R&D.

**Infrastructure Security and Energy Restoration** ($18,000,000; +$9,000,000) coordinates a national effort to secure U.S. energy infrastructure against all hazards, reduce impacts from disruptive events, and assist with restoration activities. The request supports on-going efforts and maintains capability to respond to energy sector emergencies through a regionalized volunteer delivery model and improves the Federal national energy infrastructure situational awareness and visualization capability provided by EAGLE-I. ISER will expand its efforts with state, local, tribal, and territorial (SLTT) partners to ensure their energy assurance plans integrate cyber information sharing mechanisms and are aligned with energy sector industry efforts. ISER will also establish an energy-sector-specific cyber incident response and hunt capability specializing in the intersection of cyber threats and energy sector industrial control systems.

**FY 2017 Key Accomplishments**

**New Cyber-Attack Energy Assurance Exercise**: DOE took an important step to strengthen the security and resilience of the Nation's energy infrastructure against cyber threats by co-sponsoring Liberty Eclipse, a new regional energy assurance exercise to promote state- and local-level preparedness and resilience for future energy emergencies stemming from a cyber incident. Approximately 100 participants and over 60 participating organizations, including Federal, State, and local governments; trade and state associations; national laboratories; oil and natural gas companies; electric utilities; and communications companies participated in the exercise.

**Improved Situational Awareness**: ISER significantly boosted the capabilities of, and expanded access to, the EAGLE-I situational awareness tool. EAGLE-I is an interactive geographic information system that provides capabilities for monitoring energy infrastructure assets, reporting energy outages, displaying potential threats to energy infrastructure, and coordinating emergency response and recovery. As of June 1, 2017 (the start of hurricane season), EAGLE-I incorporated visualization of customer impact forecasts and expanded access beyond Federal employees to include emergency operations centers and energy emergency assurance coordinators in all 50 states and Washington, D.C. This expanded access will help more local responders facilitate electric sector situational awareness in their regions and accelerate restoration.

**High Performance Computing Speeds Up Assessment of Grid Security**: With increasing uncertainties in modern power systems, having a computer-based tool that can quickly evaluate grid security in near real-time is essential to better understand the operational risks and make timely control decisions to ensure system reliability. Today's tools, however, are not fast enough to meet the needs of the power industry. Early-stage research funded by CEDS at the Pacific Northwest National Laboratory (PNNL) produced new algorithms using high performance parallel computing. The prototype tool, which has shown significant speed improvements, is now available to research facilities using the GridPack software suite.

**Cybersecurity, Energy Security, and Emergency Response**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR[b] (Comparable)[a] | Total FY 2019 Request | FY 2019 Request vs FY 2017 Enacted (Comparable)[a] |
|---|---|---|---|---|---|---|
| Cybersecurity for Energy Delivery Systems | … | 62,000 | … | 61,579 | 70,000 | +8,000 |
| Infrastructure Security and Energy Restoration | … | 9,000 | … | 8,939 | 18,000 | +9,000 |
| Program Direction | … | 8,200 | … | 8,144 | 7,800 | -400 |
| **Total, Cybersecurity, Energy Security, and Emergency Response** | **…** | **79,200** | **…** | **78,662** | **95,800** | **+16,600** |
| **Federal Full Time Equivalent Employees (FTEs)** | **…** | **20** | **…** | **20** | **20** | **…** |
| Additional FE FTEs at NETL supporting CESER[c] | … | 9 | … | 9 | 9 | … |
| Total CESER-funded FTEs | … | 29 | … | 29 | 29 | … |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $0; STTR: $0
- FY 2017 Enacted (comparable): SBIR: $1,312; STTR: $184
- FY 2019 Request: SBIR: $960; STTR: $135

[a] The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: CESER and OE. To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 and FY 2018 reflect amounts for the CEDS and ISER programs, and a portion of Program Direction funding, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017 and FY 2018.
[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).
[c] CESER funds FTEs at FE's National Energy Technology Laboratory who are FE employees, but support CESER activities. The FTEs are in FE's FTE totals and are not included in the CESER's FTE totals shown on the "Federal Full Time Equivalent Employees (FTEs)" line.

The tables below shows the funding allocation between the two offices under the prior and the proposed budget structures.

**FY 2017 Enacted Appropriation Comparability Matrix**
**($K)**

| New Structure / Old Structure | Cybersecurity, Energy Security, and Emergency Response | Electricity Delivery | **Total** |
|---|---|---|---|
| Transmission Reliability | … | 36,000 | **36,000** |
| Resilient Distribution Systems | … | 50,000 | **50,000** |
| Cybersecurity for Energy Delivery Systems | 62,000 | … | **62,000** |
| Energy Storage | … | 31,000 | **31,000** |
| Transformer Resilience and Advanced Components | … | 6,000 | **6,000** |
| Transmission Permitting and Technical Assistance | … | 7,500 | **7,500** |
| Infrastructure Security and Energy Restoration | 9,000 | … | **9,000** |
| Program Direction | 8,200 | 20,300 | **28,500** |
| **Total** | **79,200** | **150,800** | **230,000** |

**FY 2018 Annualized CR Comparability Matrix[a]**
**($K)**

| New Structure / Old Structure | Cybersecurity, Energy Security, and Emergency Response | Electricity Delivery | **Total** |
|---|---|---|---|
| Transmission Reliability | … | 35,756 | **35,756** |
| Resilient Distribution Systems | … | 49,660 | **49,660** |
| Cybersecurity for Energy Delivery Systems | 61,579 | … | **61,579** |
| Energy Storage | … | 30,790 | **30,790** |
| Transformer Resilience and Advanced Components | … | 5,959 | **5,959** |
| Transmission Permitting and Technical Assistance | … | 7,449 | **7,449** |
| Infrastructure Security and Energy Restoration | 8,939 | … | **8,939** |
| Program Direction | 8,144 | 20,162 | **28,306** |
| **Total** | **78,662** | **149,776** | **228,438** |

[a] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**FY 2019 Request to Congress Comparability Matrix**
**($K)**

| New Structure / Old Structure | Cybersecurity, Energy Security, and Emergency Response | Electricity Delivery | **Total** |
|---|---|---|---|
| Transmission Reliability | … | 13,000 | **13,000** |
| Resilient Distribution Systems | … | 10,000 | **10,000** |
| Cybersecurity for Energy Delivery Systems | 70,000 | … | **70,000** |
| Energy Storage | … | 8,000 | **8,000** |
| Transformer Resilience and Advanced Components | … | 5,000 | **5,000** |
| Transmission Permitting and Technical Assistance | … | 6,000 | **6,000** |
| Infrastructure Security and Energy Restoration | 18,000 | … | **18,000** |
| Program Direction | 7,800 | 19,309 | **27,109** |
| **Total** | **95,800** | **61,309** | **157,109** |

## Cybersecurity for Energy Delivery Systems

### Overview

The Nation's energy infrastructure is a major cyberattack target for malicious external actors. Over the past decade, the frequency and sophistication of cyber-attacks have increased as adversaries advanced their tactics from scanning to reconnaissance to full compromise of critical energy control systems. Given the Nation's growing dependence on electricity and fuels and increasing interdependencies with communication systems and other critical infrastructures, a major attack could cause wide-ranging national security and economic impacts. Cyber risks from operator error, software upgrades, and equipment failures have also grown as the Nation's electricity and fuel delivery systems have become more complex and interdependent. As a result, energy cybersecurity and resilience is among the Nation's most urgent security challenges.

The 2015 and 2016 cyber-attacks on the Ukraine electrical distribution system demonstrated the vulnerability of power grids to cyber events and the advanced capabilities of our cyber adversaries. The 2015 attack knocked out power to 225,000 customers for several hours. Attackers used spear phishing emails to gain initial access to utility IT networks. The hackers then went undetected for nine months as they stole credentials using keystroke loggers, identified hosts and devices, and hijacked the SCADA (supervisory control and data acquisition) data management system (DMS) to systematically open breakers and cause a power outage. The attackers' ability to perform long-term reconnaissance operations and execute a highly synchronized, multistate, multisite attack represents a step change in sophistication and intent. Subsequent cyber-attacks targeting U.S. energy systems have shared some traits with those seen during the Ukraine events.

Securing cyber systems and ensuring reliable energy delivery is a major challenge for the U.S. and our global partners. The dramatic increase in focused cyber probes, innovative social engineering, and malware exploits has strained the financial, technical, and human resources of energy companies as they adjust to a new risk paradigm. The rapid pace of technology and market changes is also transforming the energy business. Grid modernization is introducing new technologies to better manage increasingly complex transmission and distribution systems. Advanced information and communications technologies that improve reliability, increase situational awareness, enhance asset management, and speed recovery from unplanned outages are being widely deployed. While benefits of these new cyber-based systems have been clearly demonstrated, they also increase the cyber-attack surface and require innovative cyber security approaches and continuous monitoring to ensure appropriate levels of security. Simply put, the rapid pace of change in the cyber-physical control of energy systems, coupled with the advancing cyber exploit capabilities of our adversaries, have made it extremely challenging for the energy sector to stay ahead of the escalating cyber risks they face.

DOE has been collaborating with the energy sector for nearly two decades in a voluntary public-private partnership to identify and mitigate physical and cyber risks to energy systems. Through this partnership, DOE has earned the trust of energy companies and helped accelerate the mutual exchange of information and deployment of new technology, tools, and best practices to improve security and resilience. The Cybersecurity for Energy Delivery Systems (CEDS) program partnered with the energy sector and Federal agencies in 2006 and again in 2011 to develop the *Roadmap to Achieve Energy Delivery Systems Cybersecurity*, which guides public and private investments to achieve the common vision of resilient energy delivery control systems that are designed, installed, operated, and maintained to survive a cyber-incident while sustaining critical functions.[a]

To effectively integrate DOE's responsibilities for energy cybersecurity efforts, CEDS collaborated across the Department to develop the *DOE Multiyear Plan for Energy Sector Cybersecurity* (MYP), which aims to reduce cyber risks in the U.S. energy sector through coordinated, focused activities. The MYP builds upon priorities from the *Roadmap* and provides a common organizing framework that integrates DOE efforts in concert with energy sector owners and operators and key stakeholders. The MYP outlines a comprehensive program that guides investments focused on three goals:

- Strengthen energy sector cybersecurity preparedness
- Coordinate cyber incident response and recovery
- Accelerate game-changing R&D of resilient energy delivery systems

[a] https://energy.gov/sites/prod/files/Energy%20Delivery%20Systems%20Cybersecurity%20Roadmap_finalweb.pdf

The CEDS program aligns with the MYP goal to reduce the risk of energy disruptions due to cyber events. Enhancing the reliability and resilience of the Nation's energy infrastructure cannot be achieved without both near- and long-term activities to strengthen cyber security across the Nation.

The FY 2019 Budget Request for CEDS focuses on three key activities:

- Enhancing the speed and effectiveness of threat and vulnerability information sharing, including bi-directional machine-to-machine information sharing
- Developing an energy delivery system testing and analysis laboratory to better understand energy sector supply chain system and component threats and vulnerabilities
- Accelerating game-changing R&D to mitigate cyber incidents in today's systems and to develop next-generation resilient energy delivery systems

CEDS has successfully accelerated information sharing with the private sector. The Cybersecurity Risk Information Sharing Program (CRISP) develops situational awareness tools and facilitates the timely sharing of cyber threat information, providing a near-real-time capability for energy owners and operators to voluntarily share cyber threat data, analyze this data, and receive machine-to-machine mitigation measures. Industry support for CRISP, which focuses on IT threats, has prompted the expansion of CRISP capabilities to monitor, analyze, and share operational technology threat indicators affecting control systems.

CEDS supports a research and development (R&D) portfolio to address the energy sector's key technology challenges as described in the Roadmap. National laboratory participation in CEDS projects also ensures critical skill sets remain current and sustains core capabilities, ensuring they can provide support to the energy sector in case of a cyber-event. CEDS efforts engage energy sector stakeholders from the earliest stages and align with the Roadmap strategy to ensure that CEDS is working the right problems. This approach enables the continuous transition of long-term innovative early-stage research from the national laboratories and academia into capabilities that the energy sector can put into practice to reduce cyber risk. The dynamic cyber threat landscape, continuous advances in energy delivery system technologies, and the use of legacy devices in ways not previously envisioned underscore the importance of this continuous transition. In addition, CEDS provides strategic leadership on cybersecurity aspects of the energy sector's operational security, asset protection, baseline practices, risk management, situational awareness, incident management, and other issues needed to achieve the Roadmap vision.

**Highlights of the FY 2019 Budget Request**

The request reflects the critical need to accelerate and expand efforts to strengthen the energy infrastructure against cyber threats and mitigate vulnerabilities. Working closely with the energy sector and our government partners, the request focuses on the following key areas:

- **Strengthen Energy Sector Cybersecurity Preparedness**

  DOE strengthens the energy sector's cybersecurity posture through public and private sector partnerships that leverage DOE-supported tools, guidelines, outreach, training, and technical assistance.

  - ✓ **The Cybersecurity Risk Information Sharing Program** facilitates timely bi-directional sharing of cyber threat information and integrates situational awareness tools to help the energy sector to identify, prioritize, and coordinate the protection of its critical infrastructure. It is one of the most effective and advanced tools for sharing critical information on malicious cyber activities with utilities. The request will improve CRISP by integrating additional utility data from the Cyber Analytics Tools and Techniques (CATT) effort into the Intelligence Community Information Technology Environment (IC ITE), which provides a common platform for the Intelligence Community to easily and securely share analytic tools and technologies, information, and resources. CRISP will also leverage and integrate advanced operational technology (OT) tools and technologies developed under the Cybersecurity for the OT Environment (CYOTE) pilot.
  - ✓ **The Cyber Analytics Tools and Techniques** effort will continue in FY 2019 by expanding utility data migration to the IC ITE based on the results of the FY 2018 pilot effort to migrate the data from one utility. CATT will improve the speed, value, and cost of CRISP analysis, reports, and mitigations. The request will expand data migration with additional utilities to operationalize best practices, and will improve IT threat detection by adding/integrating new

analytic tools to the CRISP platform. This will enable a wider review of the CRISP information from the Intelligence Community to enhance the classified enrichment of information.

- ✓ **The Cybersecurity for the Operational Technology Environment Pilot** monitors utility data in the complex OT environment to identify malicious actions. The pilot with four utilities will be completed in FY 2018 and will transition to a production environment in FY 2019. The request expands the CYOTE approach to include additional utilities and apply the results and lessons learned from the OT pilot. While the current CRISP program monitors IT networks, CYOTE aims to design an industry-led approach for collecting and sharing OT data, which will be enhanced by special insights from the U.S. intelligence community and DOE national laboratories to deliver actionable information to utility operators. The CYOTE initiative will leverage information sharing techniques developed under CRISP for maximum effectiveness.
- ✓ **The Advanced Industrial Control System Analysis Center** and associated capabilities will fill a national security gap through capabilities that assess energy components for vulnerabilities. This national capability will span the DOE laboratory network and work in collaboration with private sector partners to use the analysis of energy sector cyber supply chain component and model impacts to address system threats and vulnerabilities through technical solutions, share information about findings, and develop mitigation and response solutions.

- **Accelerate game-changing R&D of Energy Delivery Systems Able to Survive a Cyber-Attack**

  CESER's portfolio of R&D aims to deliver game-changing tools and technologies that help utilities secure today's energy infrastructure from advanced cyber threats and design next-generation future systems that are built from the start to automatically detect, reject, and withstand cyber incidents, regardless of the threat. The Department will continue to develop continuous monitoring tools and secure control system communications.

  - ✓ The request supports a competitive solicitation for energy sector-led R&D that strengthens energy delivery control system cybersecurity, addressing legacy energy delivery control system infrastructure as well as the continuing introduction of new power system technologies. Research areas could include, but are not limited to, technologies or techniques that detect an action that is expected at times, but not in the immediate operational context, or support an automated response.
  - ✓ The request supports national laboratory early-stage R&D in energy delivery control system cybersecurity that will strengthen and maintain core capabilities for the energy sector. This approach advances the state of the art in today's systems, while recognizing that developing cybersecurity solutions to stay ahead of the latest threat is a reactionary cycle that must be broken. Innovative R&D to develop self-healing systems can disrupt this cycle and change the game for energy delivery system cybersecurity, even as the threat advances and the attack surface increases. Today is the time to design cybersecurity into future grid scenarios. Grid operations are rapidly evolving to integrate millions of new smart grid devices and distributed energy resources, and legacy devices are often being used in ways never previously envisioned. As operation of the grid becomes increasingly complex and distributed, new energy delivery system designs with built-in cyber resilience will be essential. CEDS R&D helps secure our Nation's energy infrastructure from cyber-attack, which is critical to national security, but for which an individual energy sector organization would likely be unable to support a business case.
  - ✓ The R&D focus areas include early-stage technologies such as those that:
    - o Focus on data and physics to redesign the architecture presently being used that exposes the energy grid to cyber threats. For instance, develop near-term actionable strategies for mitigation of physical consequences that might result from cyber-attack by using technology, design modifications, or operational considerations to protect national critical infrastructure, such as the transmission system and energy delivery operational communications platforms.
    - o Prevent a cyber-incident by decreasing the cyber-attack surface of energy delivery systems and components, blocking attempted misuse of the energy delivery system at every level, or decreasing the risk posed by malicious functionality.
    - o Detect a cyber-incident by providing for real-time continuous cybersecurity situational awareness at all energy delivery system levels that recognizes attempts to execute unwanted functionality that the energy delivery system was not designed to support or attempts to misuse an energy delivery system functionality that should never be executed under the immediate circumstances.

- Mitigate a cyber-incident by distinguishing a disruption of energy delivery resulting from a cyber incident, from a disruption resulting from a different cause, characterizing the extent and consequences of a cyber incident to support response actions and providing for automated response.
- Advance cyber resilience by designing cybersecurity into emerging power system device for future grid scenarios from the start or designing power systems and components to automatically recognize, and reject, attempted misuse.

**Cybersecurity for Energy Delivery Systems Funding[a]**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[b] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Cybersecurity for Energy Delivery Systems** | **62,000** | **61,579** | **70,000** | **+8,000** |

SBIR/STTR:

- FY 2017 Enacted: SBIR: $1,312; STTR $185
- FY 2019 Request: SBIR: $960; STTR $135

**Cybersecurity for Energy Delivery Systems Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| | **+8,000** |

- A $15,000 increase supports an Advanced Industrial Control System Analysis Center and associated capabilities to create a national capability that spans the DOE laboratory network, in collaboration with private sector partners, to model and analyze energy sector cyber supply chain component and address system threats and vulnerabilities through technical solutions
- A $14,000 increase in cybersecurity tools supports redesign of information data-sharing architecture and data analytics platforms and utilize new sensors to enable greater participation, as well as reflecting the completed development of existing work on the Cybersecurity Maturity Model
- A $2,000 reduction in cybersecurity R&D completes the early stage of building a National lab-led research partnership to develop technologies that help detect energy infrastructure operational data compromised by an adversary
- A $5,000 reduction is for the Virtual Energy Sector Advanced Digital Forensics Analysis Platform, which completes implementation and begins transitioning to the private sector in FY 2017; no further funding is needed in FY 2019
- The industry-scale electric grid test bed funded at $9,000 in FY 2017; no funding is requested in FY 2019
- The FY 2017 appropriation also included $5,000 to develop cyber and cyber-physical solutions for advanced control concepts for distribution and municipal utility companies; no further funding is requested in FY 2019

[a] FY 2017 enacted appropriations and FY 2018 funding through the continuing resolution are provided in the Electricity Delivery and Energy Reliability appropriation account. FY 2019 funding is requested in the CESER appropriation account, due to the reorganization proposed in FY 2019.

[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Activities and Explanation of Changes**[a]

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Cybersecurity for Energy Delivery Systems**<br>**$62,000,000** | **$70,000,000** | **+$8,000,000** |
| • Issue a competitive research call for National Laboratory high-risk/high-payoff energy delivery control system cybersecurity research, and mid-term R&D that will also strengthen and maintain core capabilities for the energy sector<br>• Expand the utility volunteers to demonstrate C2M2 data analytics and benchmarking methodologies, building on existing benchmarking work and laying the foundation for the C2M2 web portal<br>• Establish a CRISP Operational Pilot focused on improving the enrichment of the participant's data with U.S. Government information and increase the speed of real-time sharing<br>• Begin the development of innovative solutions to use for reconstitution after a large-scale cyber event<br>• Complete funding for the Virtual Energy Sector Advanced Digital Forensics Analysis Platform for conducting real-time advanced digital forensics analysis for the energy sector to detect and mitigate malicious activity<br>• Continue development of the industry-scale electric grid test bed | • Advance game-changing R&D by focusing on two key activities:<br>✓ Support strategic partnerships with national laboratories to sustain core capabilities<br>✓ Industry-led partnership competitive Funding Opportunity Announcement (FOA)<br>• Improve the efficiency and effectiveness of CRISP by integrating with Intelligence Community IT Enterprise<br>• Continue the CATT effort and initiate migration of additional Utilities to broaden the base to operationalize lessons learned<br>• Expand the CYOTE approach to other utilities and apply the results of the OT pilot completed during FY 2018 | • The FY 2017 appropriation supported activities such as building a research partnership to develop a tool or technology for next-generation energy delivery systems to recognize malicious compromise of data or algorithms, while the FY 2019 request will complete prototypes of such tools or technologies<br>• The FY 2017 appropriation supported the initiation of the CYOTE Pilot, while the FY 2019 request advances the information sharing platform and partnership model to dramatically improve speed, reduce cost, and increase industry participation<br>• The FY 2019 request establishes an Advanced Industrial Control System Analysis Center and associated capabilities related to energy sector cyber supply chain threats and vulnerabilities |

[a] FY 2017 enacted appropriations are provided in the Electricity Delivery and Energy Reliability appropriation account. FY 2019 funding is requested in the CESER appropriation account, due to the reorganization proposed in FY 2019.

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • Continue development cyber and cyber-physical solutions for advanced control concepts for distribution and municipal utility companies | • Fully operationalize an initial national supply chain assessment capability using national laboratory infrastructure to provide the flexibility to analyze a fraction of exploits, malware, and cyber vulnerabilities in OT systems in safe research environments to enhance visibility into supply chain vulnerabilities in the energy operational technology environment<br>✓ This funding will support development of easily reconfigurable test-beds and dissection of energy components supplied by industry to analyze and track hardware and software vulnerabilities inherent across components at the distribution and transmission-scale | |

**Cybersecurity for Energy Delivery Systems**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Cybersecurity—Develop new protective measures to reduce risks from cyber incidents.** | | |
| Target | • Complete preliminary design of an early-stage technology that establishes a tailored trustworthy space for one substation control system component. | • Complete preliminary design of an early-stage technology for prevention, detection, mitigation, or resilience against cyber incidents in energy delivery systems. | • Complete prototype of an early-stage technology for prevention, detection, mitigation, or resilience against cyber incidents in energy delivery systems. |
| Result | Met | TBD | TBD |
| Endpoint Target | Continuously advance the vision of reliable and resilient energy delivery systems throughout our Nation that are designed, installed, operated, and maintained to survive a cyber incident while sustaining critical functions. | | |
| Comment | This performance measure was associated with the Electricity Delivery and Energy Reliability appropriation prior to FY 2019. | | |

## Infrastructure Security and Energy Restoration

### Overview

The Infrastructure Security and Energy Restoration (ISER) program coordinates a national effort to secure U.S. energy infrastructure against all hazards, reduce impacts from disruptive events, and assist industry with restoration activities. ISER works closely with the electricity and oil and natural gas industries, other Federal agencies, and State, Local, Tribal, and Territorial (SLTT) communities to advance national energy security and prepare for, respond to, and recover from evolving threats and events.

ISER is responsible for executing DOE's Energy Sector Specific Agency (SSA) and Emergency Support Function-12 (ESF-12) (Energy) roles and providing DOE's support to the Infrastructure Systems Recovery Support Function.[a] ISER also serves as the point of entry to DOE and the Federal Government for all energy infrastructure security and resilience stakeholders, including those from the private sector.

To meet its mission and support its stakeholders, ISER delivers critical capabilities including energy sector emergency response and recovery (including cyber incident response coordination); near-real-time situational awareness and information sharing about the status of the electric grid; training and exercises, which strengthen Federal, regional, state, tribal, and territorial abilities to work together to prepare for and mitigate the effects of an energy sector emergency; and analysis of evolving threats and hazards to energy systems including cyber, electromagnetic pulses, and space weather.

### Highlights of the FY 2019 Budget Request

The budget request reflects ISER's commitment to significantly expand Energy Sector security and resilience through full coordination with our government and industry partners in the delivery of emergency response coordination, energy sector situational awareness, and cyber preparedness and incident coordination as stipulated in the 2015 Fixing America's Surface Transportation (FAST) Act, as well as by seeding public private partnerships at National Laboratories.

**Maintain Emergency Support Function 12 Capacity:** Subsequent to completing implementation of the regionalized approach to providing energy sector emergency response (in cooperation with the Department of Homeland Security [DHS] Office of Infrastructure Protection and the Federal Emergency Management Agency [FEMA]) in FY 2018, ISER will focus in FY 2019 on consolidating lessons learned from major hurricanes, including Harvey, Irma, and Maria, into its response procedures, will develop web-based training modules, and will refresh training for all responders. ISER will engage the ESF-12 support agencies (including the U.S. Army Corps of Engineers and the Department of Interior) to ensure the Federal Government is fully coordinated in advance of catastrophic events to best support energy sector efforts during response to restoration. Long-term restoration activities from all hazards will be supported as necessary.

**Improve Energy Sector Situational Awareness Capabilities:** ISER is home to EAGLE-I, the Federal Government's situational awareness tool for national power outages. In FY 2017, a much-needed complete refresh of the underlying systems was completed. In FY 2018, EAGLE-I capabilities were expanded to incorporate new sources of data including satellite imagery and EAGLE-I was redesigned to address user feedback. In FY 2019, ISER will focus on continuing expansion of data sources into EAGLE-I (such as natural gas supply information) and further developing and incorporating predictive modeling capabilities at DOE laboratories and other Federal agencies (such as the National Oceanic and Atmospheric Administration's SLOSH [sea, lake, and overland surges from hurricanes] models and earthquake and hurricane impact models) to further expand EAGLE-I usefulness as a collaborative platform for historic and real time data collection, assimilation, integration, and curation across the public and private sectors. It will continue to be the Federal focal point for collecting and sharing energy infrastructure interdependencies and analyses, linked with other Federal efforts. Additionally, ISER will build out EAGLE-I capability to support State and Regional Energy Sector exercises.

**Ensure Cybersecurity Incident Coordination and Preparedness:** In FY 2019, ISER will build out its effective, timely, and coordinated cyber incident management capability as part of its all-hazards approach to incident response for the energy sector. In collaboration with DHS, the Federal Energy Regulatory Commission (FERC), the Electricity Information Sharing and Analysis Center (E-ISAC), industry, and international stakeholders, and in concert with work performed under the CEDS program, ISER will continue to develop and formalize incident management processes and procedures (such as

[a] The Infrastructure Systems Recovery Support Function is described at https://www.fema.gov/pdf/recoveryframework/infrastructure_system_rsf.pdf.

communications and coordination of activities, roles, and responsibilities) that align with the National Incident Management System and National Response Framework (NRF). ISER's FY 2019 focus will be to develop "pre-cooked" tools and agreements with industry to enable more rapid response to cyber incidents. Additional work will focus on redundant communications, dedicated transmission, and increased security at defense critical electric infrastructure using best practices in sensing and modeling.

**Establish an Energy Sector Operational Technology Cyber Incident Response and Hunt Capability** to provide subject matter experts specializing in the intersection of cyber threats and energy sector industrial control systems. Recent cyber incidents affecting the energy sector have illuminated both the need for the specific technical skill set. OE envisions starting with a team of 6 cyber energy responders to support, either remotely or in person, incidents affecting the electricity, oil, and natural gas subsectors. These will complement efforts by the Department of Homeland Security, Federal Bureau of Investigation, and other agencies deploying assets to assist with cyber incidents. This capability will support DOE engagement via remote and on-site assistance to affected private sector energy entities as well as to DOE's Power Marketing Administrations, and will supplement and tie into industry cyber mutual assistance activities. When not involved in incident response, these experts will link Federal intelligence with industry owned information to enhance response coordination; support state energy assurance planning by engaging with state, local, tribal, and territorial partners to ensure that their energy assurance plans integrate cyber threats mitigation strategies and sharing mechanisms; and support DOE's annual cyber competition and exercise programs.

**Enhance engagement with SLTT Entities.** In FY 2019, the SLTT Energy Assurance program will support proactive engagement on planning with states and territories to promote greater preparedness for hurricanes, fuel emergencies, and cyber incidents. ISER will pilot application of its National Risk and Hazard Matrix to a few individual states or regions, and expand the threats/hazards addressed. The SLTT program will increase focus on island/remote area emergency response, and cybersecurity incident coordination with State and territorial partners to improve understanding of impacts for energy sector. The SLTT program will continue to build partnerships between industry and states with an emphasis on regional energy security planning to emphasize best practices and improve access to data sources to better anticipate supply chain disruptions. Additionally, ISER will develop and implement a plan specifically designed to inform State regulators about the threats and hazards, including cyber, electromagnetic pulse (EMP), and geomagnetic disturbance (GMD) threats, affecting the energy sector entities under their purview.

**Build National Laboratory–Industry Partnerships**. In its role as the SSA, ISER works with the Electricity Sector Coordinating Council (ESCC) and the Oil and Natural Gas Sector Coordinating Council (ONGCC) to identify gaps in their ability to address cyber, physical and supply chain vulnerabilities that require the capabilities of DOE's national laboratories. ISER will expand implementation of this public-private partnership approach beyond situational awareness (EAGLE-I) and operational technology (OT) cyber supply chain vulnerabilities to address other concerns of national importance (such as EMP).

**Infrastructure Security and Energy Restoration Funding[a]**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[b] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Infrastructure Security and Energy Restoration** | **9,000** | **8,939** | **18,000** | **+9,000** |

**Infrastructure Security and Energy Restoration Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| The FY 2019 ISER budget proposal significantly enhances the U.S. Government's ability to work with industry and Federal, State, and local partners to prepare for and respond to all threats and hazards that might affect the energy sector. | **+9,000** |

In addition to supporting on-going efforts, funding requested in FY 2019 will enable ISER to:

- fully address all lessons learned from 2017 hurricanes in incident response; greatly improve situational awareness capabilities (EAGLE-I) by incorporating new sources of electricity data, natural gas supply information, enhanced predictive modeling capability and a platform to support State and regional exercises;
- develop "pre-cooked" tools and agreements with industry to enable more rapid response to cyber incidents;
- establish an Energy Sector Operational Technology Cyber Incident Response and Hunt Capability providing subject matter experts specializing in the intersection of cyber threats and energy sector industrial control systems to support all incidents affecting the electricity, oil, and natural gas subsectors;
- strengthen engagement with states, territories, and regulators to promote greater energy sector preparedness for hurricanes, fuel emergencies, and cyber incidents; and
- focus on building national laboratory–industry partnerships to address concerns of national importance, such as EMP.

[a] FY 2017 enacted appropriations and FY 2018 funding through the continuing resolution are provided in the Electricity Delivery and Energy Reliability appropriation account. FY 2019 funding is requested in the Cybersecurity, Energy Security, and Energy Restoration appropriation account, due to the reorganization proposed in FY 2019.

[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

## Infrastructure Security and Energy Restoration

**Activities and Explanation of Changes**[a]

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Infrastructure Security and Energy Restoration**<br>**$9,000,000** | **$18,000,000** | **+$9,000,000** |
| • *ESF 12 Responsibilities*: Establish enhanced annual training on regional energy infrastructure for volunteer energy responders and significantly increase the number of available responders without increasing budgetary outlay. | • Expand implementation of the regionalized approach to provide volunteer emergency responders, which proved very successful in improving response and cooperation with the DHS Office of Infrastructure Protection and FEMA.<br>• Develop an annex to emergency response procedures focused on how to provide support to remote locations—islands, Alaska, etc. | • ISER will develop web-based emergency response training modules and refresh training for all 100+ volunteer energy responders.<br>• Using lessons learned from major hurricanes, including Harvey, Irma, and Maria in 2017, ISER will engage the ESF-12 support agencies to ensure that the Federal Government is fully coordinated in advance of catastrophic events to best support energy sector efforts during response and restoration. |
| • *SSA Responsibilities*: Continue implementation of National Preparedness and Critical Infrastructure Security and Resilience mandates and the coordination of other national energy preparedness policies. Maintain and strengthen relationships with the Energy Sector by chairing the ESCC and ONGSCC. Work across the Federal Government to facilitate the energy sector's access to needed support for preparedness, response, and recovery. | • Continue work with the ESCC and ONGSCC to identify gaps in their ability to address cyber, physical and supply chain vulnerabilities that require the capabilities of DOE national laboratories. Clarify a public-private partnership approach to establishing these capabilities. | • Expand the national laboratory–industry partnership beyond EAGLE-I and OT cyber supply chain vulnerabilities to other concerns of national importance, such as EMP. |
| • *Exercises*: ISER will establish an exercise program in order to meet the requirements established in the NRF and to validate and evaluate the ability of DOE's capabilities to respond to energy emergencies and facilitate the restoration of energy system with industry, Federal, and SLTT partners. | • Conduct Clear Path VII and continue to engage SLTT entities and enhance their access to situational awareness information through EAGLE-I. Conduct at least one cyber exercise. | • Maintain proactive engagement on planning with states and territories to promote greater preparedness for hurricanes, fuel emergencies, and cyber incidents. |

[a] FY 2017 enacted appropriations are provided in the Electricity Delivery and Energy Reliability appropriation account. FY 2019 funding is requested in the Cybersecurity, Energy Security, and Energy Restoration appropriation account, due to the reorganization proposed in FY 2019.

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • *Situational Awareness and Emergency Response Tools*: Building on EAGLE-I, the Federal Government's situational awareness tool for national power outages, develop national energy infrastructure situational awareness visualization capability. | • Maintain EAGLE-I as the Federal source for near-real-time situational awareness of energy infrastructure. Build out additional capability to address industry interest in damage assessments and for SLTT coordinated situational awareness and to support State and Regional Energy Sector exercises. | • In FY 2019, develop and link new predictive modeling capabilities (such as SLOSH, earthquake, and hurricane impact models) at DOE laboratories and Federal agencies to further expand EAGLE-I usefulness. |
| • *Cyber Incident Response*: Build cyber protections into DOE's all-hazard incident response plan and incorporate applicable national policies and directives. | • Build out the effective, timely, and coordinated cyber incident management capability with a focus on developing "pre-cooked" tools and agreements with industry to enable more rapid response to cyber incidents and on redundant communications, dedicated transmission, and increased security for defense critical electric infrastructure | • Additional focus on redundant communications, dedicated transmission, and increased security for defense critical electric infrastructure. |
| | • Establish an Energy Sector Operational Technology Cyber Incident Response and Hunt Capability providing subject matter experts specializing in the intersection of cyber threats and energy sector industrial control systems to support all incidents affecting the electricity, oil, and natural gas subsectors | • Establish an Energy Sector Operational Technology Cyber Incident Response and Hunt Capability to respond to cyber threats to and incidents affecting energy sector industrial control systems |
| • *New and Emerging Threats*: Continue identifying strategies and conducting analysis on methods to improve the resilience of critical energy infrastructure components, such as identifying critical companies from an incident-response standpoint. | • Expand work on evolving threats and hazards including EMP, space weather, cyber, physical, and supply chain vulnerabilities. | • No major changes. |

**Infrastructure Security and Energy Reliability**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **ISER—Informational Awareness—Improve information sharing among energy sector stakeholders as measured by the number of active accounts in the EAGLE-I platform; both the total number and the diversity of participation from mission partners, e.g., State Emergency Operations Centers.** | | |
| Target | • 500 active accounts with more than 5% from state and local partners | • Achieve 1,000 active accounts with more than 10% from state, local, and private sector partners. | N/A |
| Result | Met | TBD | N/A |
| Endpoint Target | By the end of FY 2018, EAGLE-I will be the predominant source for energy situational awareness for mission partners during an emergency as measured by having more than 1,000 active accounts from all types of stakeholders | | |
| Comment | This performance measure is not continued into FY 2019. This performance measure was associated with the Electricity Delivery and Energy Reliability appropriation prior to FY 2019. | | |
| Performance Goal (Measure) | **ISER—Situational Awareness—Improve awareness of near real-time monitoring situational awareness tool, across the Federal Government ensuring that this tool is available to interagency partners for use in their operations centers and other appropriate situations.** | | |
| Target | • 80% situational awareness capability availability | N/A | N/A |
| Result | Met | N/A | N/A |
| Endpoint Target | By the end of FY 2023, EAGLE-I will be the predominant source for energy sector situational awareness for mission partners for emergency response and preparedness by maintaining an active user base that includes all Federal, State, local, and private sector mission partners; and direct sharing or integration with other Federal situational awareness platforms. | | |
| Comment | This measure is not continued into FY 2018. This performance measure was associated with the Electricity Delivery and Energy Reliability appropriation prior to FY 2019. | | |

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **ISER Situational Awareness Capability—Improve information sharing among energy sector emergency response stakeholders and mission partners by expanding EAGLE-I situational awareness capabilities.** | | |
| Target | N/A | N/A | • Implement an information sharing capability (e.g., web services) with state emergency operations centers. |
| Result | N/A | N/A | TBD |
| Endpoint Target | By the end of FY 2023, all federal, state, local, and private sector mission partners will have access to EAGLE-I capabilities for energy sector situational awareness, emergency response, and emergency preparedness. EAGLE-I will provide sharing or integration capabilities with other Federal situational awareness mission partners. | | |

## Program Direction

### Overview

Program Direction provides for the costs associated with the Federal workforce, including salaries, benefits, travel, training, and other related expenses. It also provides for the costs associated with contractor services that, under the direction of the Federal workforce, support the Cybersecurity, Energy Security, and Emergency Response (CESER) mission.

**Salaries and Benefits** support Federal employees who provide executive management, programmatic oversight, and analysis for the effective implementation of the CESER program. This includes staff at Headquarters and at the National Energy Technology Laboratory (NETL). While CESER funds NETL staff within its budget, the NETL Federal employees are included within the full-time equivalent (FTE) total for the Fossil Energy Research and Development account.

ISER provides FTEs to support Federal Emergency Management Agency (FEMA) Emergency Support Function 12 (ESF-12) mission events and all required ESF 12 training activities. During FEMA mission events, CESER FTE base pay is funded by Program Direction funding, while CESER is reimbursed by FEMA for overtime and travel expenses. CESER also provides FTE support for international energy issues at the request of the Department of State, which reimburses CESER for all salary and benefit expenses associated with the work.

**Travel** includes transportation, subsistence, and incidental expenses that allow CESER to effectively manage research and development programs and projects in the field; to assist the Department of Homeland Security, the Department of State and local governments, and the private sector to help protect against and recover from disruptions in the energy infrastructure by providing ESF-12 and readiness training for DOE emergency responders, who are coordinated through ISER. The Department of State and the private sector reimburse ISER for all travel related to their tasks.

**Support Services** includes contractor support directed by the Federal staff to perform administrative tasks and provide analysis to management and may also include support for post-doctoral fellows (such as American Association for the Advancement of Science [AAAS] fellows) and Intergovernmental Personnel Act (IPA) assignments.

**Other Related Expenses** includes equipment upgrades and replacements, office furniture, commercial credit card purchases using the simplified acquisition procedures to the maximum extent possible, and other needs.

### Highlights of the FY 2019 Budget Request

The FY 2019 Budget Request to Congress proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: CESER and Electricity Delivery (OE). Program direction for OE is provided separately.

- CESER includes the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs.
- Program direction funding is allocated between the two appropriations as described below:
  - Salaries and benefits for administrative, senior management, budget, procurement, contractual management and human capital support activities are funded in OE Program Direction under a service center approach that will support both appropriations. Salaries and benefits for employees reporting directly to ISER or CEDS are included in CESER Program Direction.
  - Support service funding for ISER and CEDS, due to contractual obligations, is primarily funded through OE Program Direction, including all support service administrative functions.
  - All corporate IT support (DOE's Energy Information Technology Services [EITS] desktop services) and working capital fund (WCF) expenses, such as rent, supplies, copying, graphics, mail, printing, telephones and security clearance expenses for ISER and CEDS are funded in the OE Program Direction request.

## Program Direction Funding ($K)

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR[b] (Comparable)[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted (Comp) |
|---|---|---|---|---|---|---|
| **Program Direction Summary** | | | | | | |
| **Washington Headquarters** | | | | | | |
| Salaries and Benefits | 0 | 3,539 | – | – | 3,601 | +62 |
| Travel | 0 | 289 | – | – | 183 | -106 |
| Support Services | 0 | 129 | – | – | 101 | -28 |
| Other Related Expenses | 0 | 775 | – | – | 1,021 | +246 |
| **Total, Washington Headquarters** | **0** | **4,732** | **–** | **–** | **4,906** | **+174** |
| **National Energy Technology Laboratory** | | | | | | |
| Salaries and Benefits | 0 | 2,840 | – | – | 2,239 | -601 |
| Travel | 0 | 117 | – | – | 120 | +3 |
| Support Services | 0 | 418 | – | – | 438 | +20 |
| Other Related Expenses | 0 | 93 | – | – | 97 | +4 |
| **Total, National Energy Technology Laboratory** | **0** | **3,468** | **–** | **–** | **2,894** | **-574** |
| **Total Program Direction** | | | | | | |
| Salaries and Benefits | 0 | 6,379 | – | – | 5,840 | -539 |
| Travel | 0 | 406 | – | – | 303 | -103 |
| Support Services | 0 | 547 | – | – | 539 | -8 |
| Other Related Expenses | 0 | 868 | – | – | 1,118 | +250 |
| **Total, Program Direction** | **0** | **8,200** | **0** | **8,144** | **7,800** | **-400** |

[a] The FY 2019 Budget Request proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: CESER and OE. To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 and FY 2018 reflect a portion of Program Direction funding, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017 and FY 2018.

[b] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[a] | FY 2018 Annualized CR[b] | FY 2018 Annualized CR[b] (Comparable)[a] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted (Comp) |
|---|---|---|---|---|---|---|
| **Program Direction Summary** | | | | | | |
| **Federal FTEs** | **0** | **20** | **0** | **20** | **20** | **0** |
| Additional FE FTEs at NETL supporting CESER[a] | 0 | 9 | 0 | 9 | 9 | 0 |
| Total CESER-funded FTEs | 0 | 29 | 0 | 29 | 29 | 0 |
| | | | | | | |
| **Support Services and Other Related Expenses** | | | | | | |
| **Support Services** | | | | | | |
| Technical Support | 0 | 219 | – | – | 187 | -32 |
| Management Support | 0 | 328 | – | – | 352 | +24 |
| **Total, Support Services** | **0** | **547** | **–** | **–** | **539** | **-8** |
| | | | | | | |
| **Other Related Expenses** | | | | | | |
| Other Services | 0 | 167 | – | – | 97 | -70 |
| EITS Desktop Services | 0 | 132 | – | – | 223 | +91 |
| WCF | 0 | 569 | – | – | 798 | +229 |
| **Total, Other Related Expenses** | **0** | **868** | **–** | **–** | **1,118** | **+250** |

[a] CESER funds 9 FTEs at FE's National Energy Technology Laboratory who support CESER activities. The 9 FTEs are in FE's FTE totals and are not included in the CESER FTE totals shown on the "Federal FTEs" line.

## Program Direction

**Activities and Explanation of Changes**[a]

| FY 2017 Enacted (Comparable) | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted (Comp) |
|---|---|---|
| **Program Direction $8,200,000** | **$7,800,000** | **-$400,000** |
| **Salaries and Benefits $6,379,000**<br>• Salaries and benefits support 29 FTEs at HQ and NETL that provide executive management, programmatic oversight, and analysis for the effective implementation of the CESER program | **$5,840,000**<br>• Salaries and benefits support 29 FTEs at HQ and NETL that provide executive management, programmatic oversight, and analysis for the effective implementation of the CESER program[b] | **-$539,000**<br>• Reductions are due to changes in workforce composition |
| **Travel $406,000**<br>• Travel includes transportation, subsistence, and incidental expenses that allow CESER to effectively facilitate its mission | **$303,000**<br>• Travel includes transportation, subsistence, and incidental expenses that allow CESER to effectively facilitate its mission | **-$103,000**<br>• Reductions are attributed to the increased use of web-based meetings and better travel management and oversight by Federal managers |
| **Support Services $547,000**<br>• Support Services includes contractor support directed by the federal staff to provide analysis to management. Support Services may include support for post-doctoral fellows and Intergovernmental Personnel Act (IPA) assignments | **$539,000**<br>• Support Services includes contractor support directed by the federal staff to provide analysis to management. Support Services may include support for post-doctoral fellows and Intergovernmental Personnel Act (IPA) assignments[c] | **-$8,000**<br>• Reductions are driven by decreasing administrative work by contractors and better management by Federal contract managers |

[a] The FY 2019 Budget Request proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: CESER and OE. To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 reflect a portion of Program Direction funding, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017.

[b] Salaries and benefits for administrative, senior management, budget, procurement, contractual management and human capital support activities are funded within Electricity Delivery under a service center approach that will support both appropriations.

[c] Support service funding for ISER and CEDS, due to contractual obligations, is primarily funded through Electricity Delivery Program Direction, with all support services for ISER and CEDS administrative functions funded through Electricity Delivery Program Direction.

| FY 2017 Enacted (Comparable) | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted (Comp) |
|---|---|---|
| **Other Related Expenses $868,000**<br>• Other Related Expenses includes equipment upgrades and replacements, office furniture, minor construction, commercial credit card purchases using the simplified acquisition procedures to the maximum extent possible, and other needs | **$1,118,000**<br>• Other Related Expenses includes equipment upgrades and replacements, office furniture, minor construction, commercial credit card purchases using the simplified acquisition procedures to the maximum extent possible, and other needs[a] | **+$250,000**<br>• Increases are driven by estimated Working Capital Fund and EITS costs |

[a] All corporate IT support (DOE's Energy Information Technology Services [EITS] desktop services) and working capital fund (WCF) expenses, such as rent, supplies, copying, graphics, mail, printing, telephones and security clearance expenses for ISER and CEDS are funded in the Electricity Delivery Program Direction request.

**Research and Development ($K)[a]**

| | FY 2017 Enacted | FY 2017 Enacted (Comparable)[b] | FY 2018 Annualized CR[c] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|---|
| Basic | 0 | 3,484 | – | 3,266 | -218 |
| Applied | 0 | 37,668 | – | 26,127 | -11,541 |
| Development | 0 | 3,484 | – | 3,266 | -218 |
| Total, R&D | 0 | 44,636 | – | 32,659 | -11,977 |

**Small Business Innovative Research/Small Business Technology Transfer (SBIR/STTR) ($K)**

| | FY 2017 Transfer | FY 2017 Transfer (Comparable)[b] | FY 2019 Request Projected Transfer | FY 2019 Request vs FY 2017 Transfer |
|---|---|---|---|---|
| Cybersecurity for Energy Delivery Systems | | | | |
| SBIR | 0 | 1,312 | 960 | -352 |
| STTR | 0 | 184 | 135 | -49 |

[a] R&D reporting includes a proportional share of program direction funding in addition to direct R&D funding. Program direction funding was not included in the R&D reporting in the FY 2016 and prior year budget justifications.

[b] The FY 2019 Budget Request proposes to split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow an apples-to-apples comparison with the FY 2019 request, the comparable amounts for FY 2017 reflect amounts for the Cybersecurity for Energy Delivery Systems program, equivalent to what would have been in CESER, had the proposed structure been in place in FY 2017.

[c] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Cybersecurity, Energy Security, and Emergency Resp | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Argonne National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 1,000 |
| CEDS | 0 | 0 | 654 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **1,654** |
| **Total, Argonne National Laboratory** | **0** | **0** | **1,654** |
| **Brookhaven National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| CEDS | 0 | 0 | 200 |
| **Total, Brookhaven National Laboratory** | **0** | **0** | **200** |
| **Idaho National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 1,000 |
| CEDS | 0 | 0 | 19,900 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **20,900** |
| **Total, Idaho National Laboratory** | **0** | **0** | **20,900** |
| **Lawrence Berkeley National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 100 |
| CEDS | 0 | 0 | 1,050 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **1,150** |
| **Total, Lawrence Berkeley National Laboratory** | **0** | **0** | **1,150** |
| **Lawrence Livermore National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 500 |
| CEDS | 0 | 0 | 1,900 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **2,400** |
| **Total, Lawrence Livermore National Laboratory** | **0** | **0** | **2,400** |
| **Los Alamos National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| CEDS | 0 | 0 | 200 |
| **Total, Los Alamos National Laboratory** | **0** | **0** | **200** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Cybersecurity, Energy Security, and Emergency Resp | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **National Energy Technology Lab** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 1,000 |
| CEDS | 0 | 0 | 25,709 |
| Program Direction | 0 | 0 | 2,894 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **29,603** |
| **Total, National Energy Technology Lab** | **0** | **0** | **29,603** |
| **National Renewable Energy Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| CEDS | 0 | 0 | 1,050 |
| **Total, National Renewable Energy Laboratory** | **0** | **0** | **1,050** |
| **Oak Ridge National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 4,000 |
| CEDS | 0 | 0 | 3,250 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **7,250** |
| **Total, Oak Ridge National Laboratory** | **0** | **0** | **7,250** |
| **Pacific Northwest National Laboratory** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 2,000 |
| CEDS | 0 | 0 | 6,687 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **8,687** |
| **Total, Pacific Northwest National Laboratory** | **0** | **0** | **8,687** |
| **Richland Operations Office** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 850 |
| **Total, Richland Operations Office** | **0** | **0** | **850** |
| **Sandia National Laboratories** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 1,000 |
| CEDS | 0 | 0 | 3,900 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **4,900** |
| **Total, Sandia National Laboratories** | **0** | **0** | **4,900** |
| **Savannah River Operations Office** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 500 |
| **Total, Savannah River Operations Office** | **0** | **0** | **500** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Cybersecurity, Energy Security, and Emergency Resp | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Washington Headquarters** | | | |
| **Cybersecurity, Energy Security, and Emergency Resp** | | | |
| Infrastructure Security and Energy Restoration (ISER) | 0 | 0 | 6,050 |
| CEDS | 0 | 0 | 5,500 |
| Program Direction | 0 | 0 | 4,906 |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **16,456** |
| **Total, Washington Headquarters** | **0** | **0** | **16,456** |
| **Total, Cybersecurity, Energy Security, and Emergency Resp** | **0** | **0** | **95,800** |

# Naval Petroleum and Oil Shale Reserves

# Naval Petroleum and Oil Shale Reserves

**Naval Petroleum and Oil Shale Reserves**
**Proposed Appropriation Language**

*For Department of Energy expenses necessary to carry out naval petroleum and oil shale reserve activities, $10,000,000 to remain available until expended: Provided, that, notwithstanding any other provision of law, unobligated funds remaining from prior years shall be available for all naval petroleum and oil shale reserve activities.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

New FY 2019 budget authority of $10.0 million will fund continued environmental assessment and remediation activity at the Naval Petroleum Reserve No. 1 (NPR-1) site.

**Public Law Authorizations**

- P.L. 94-258, U.S. Naval Petroleum Reserves Production Act of 1977
- P.L. 95-91, U.S. Department of Energy Organization Act of 1977
- P.L. 104-106, The National Defense Authorization Act For Fiscal Year 1996
- P.L. 105-261, The Strom Thurmond National Defense Act for Fiscal Year 1999
- P.L. 109-58, Energy Policy Act of 2005

**Naval Petroleum and Oil Shale Reserves**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 12,005[1] | 14,848 | 10,000 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).
FY 2018 Annualized CR assumes the use of $5,250,000 in prior year balances to offset requirements.

**Overview**
The Naval Petroleum and Oil Shale Reserves (NPOSR) program manages five legal agreements that were executed as part of the 1998 sale of Naval Petroleum Reserve 1 (NPR-1) in Elk Hills, California. The legal agreements direct post-sale work, including environmental restoration and remediation, contract closeout, and records disposition. Legal agreements also include payment for post-employment medical and dental benefits to former Management & Operating (M&O) contractor employees. The NPR-1 program continues to work towards closing out the remaining environmental findings at the site, as required by the 2008 agreement between the Department of Energy (DOE) and the California Department of Toxic Substances Control (DTSC).

DOE also operated Naval Petroleum Reserve 3 (NPR-3) and the Rocky Mountain Oilfield Testing Center (RMOTC), co-located near Casper, Wyoming until its sale in January 2015. DOE retains responsibility for Industrial Landfill number 2 (IND-2) located at NPR-3 until a closure permit is issued by the Wyoming Department of Environmental Quality (WDEQ). Landfill remediation activities were completed in FY 2017 and ground water sampling began in compliance with WDEQ requirements. The period of sampling will be specified by WDEQ but is expected to continue for four to seven years. No new FY 2019 Budget Authority is being requested for NPR-3 as prior-year balances are sufficient to fund ongoing monitoring activities through NPR-3 closeout.

**Highlights and Major Changes in the FY 2019 Budget Request**
NPR-1 will continue to work with the California DTSC and other stakeholders on the environmental remediation and cultural resource activities in accordance with the 2008 DTSC Corrective Action Consent Agreement to obtain a status of No Further Action (NFA) required for 131 Areas of Concern (AOC). Also included is the payment to former M&O contractor employees for post-employment medical and dental benefits.

NPR-3 will continue groundwater sampling activities for the landfill closure with oversight by the Washington Headquarters office.

[1] Program received a direct appropriation of $14,950,000 in FY 2017; $2,944,987 in prior-year balances were rescinded, per Section 307 of the Consolidated Appropriations Act, 2017.

**Naval Petroleum and Oil Shale Reserves**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Naval Petroleum and Oil Shale Reserves** | | | | |
| Production Operations | 12,630 | --- | 18,550 | +5,920 |
| Management | 2,320 | --- | 2,000 | -320 |
| Use of Prior Year Balances | 0 | --- | -10,550 | -10,550 |
| **Subtotal, Naval Petroleum and Oil Shale Reserves** | **14,950** | **14,848** | **10,000** | **-4,950** |
| Section 307 Rescission of Prior Year Balances | -2,945 | --- | 0 | **+**2,945 |
| **Total, Naval Petroleum and Oil Shale Reserves** | **12,005** | **14,848** | **10,000** | **+2,945** |
| **Federal FTEs** | **4** | **4** | **4** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

FY 2018 Annualized CR assumes the use of $5,250,000 in prior year balances to offset requirements.

## Naval Petroleum and Oil Shale Reserves
## Production Operations

**Overview**

The NPR-1 program continues to work towards closing out the remaining environmental restoration and remediation activities for 131 AOCs, as required by the 2008 agreement between DOE and California's DTSC. DOE will continue the monitoring and oversight of environmental remediation of the Elk Hills site and the work on records disposition.

The NPR-3 program will continue post-sale activities for the closure of the landfill using prior-year balances. No new FY 2019 Budget Authority is requested for NPR-3.

**Highlights of the FY 2019 Budget Request**

The program will continue the ongoing activities to attain release from the remaining environmental findings related to the sale of NPR-1. As of the end of FY 2017, all AOCs have undergone an initial investigation and the program has made recommendations to California's DTSC for either NFA status, additional investigation, or remedial action.

The FY 2019 request includes funding for the implementation and reporting of three remedial action work plans for three AOCs. The FY 2019 request also includes funding to remediate one AOC leading to NFA status for that AOC.

Of the 131 AOCs for which DOE is responsible for environmental cleanup, as of September 30, 2017, 68 AOCs have received NFA certification from California's DTSC, 23 AOCs are under DTSC review for NFA certification, and 40 AOCs have undergone an initial field work investigation that require remediation activities and/or the need for additional field work to be performed.

**Production Operations Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| NPR-1 Closeout | 12,580 | --- | 18,550 | +5,970 |
| NPR-3 Disposition | 50 | --- | 0 | -50 |
| Use of Prior Year Carryover | 0 | --- | -10,550 | -10,550 |
| **Subtotal, Production Operations** | **12,630** | **---** | **8,000** | **-4,630** |
| Section 307 Rescission of Prior Year Balances | -2,945 | --- | 0 | +2,945 |
| **Total, Production Operations** | **9,685** | **---** | **8,000** | **-1,685** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Production Operations**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **NPR-1 Closeout** Uses $10,050,000 in prior-year balances to supplement new FY 2019 budget authority to finance continued environmental assessment and remediation activity, in accordance with NPR-1 post-sale legal agreements. | **-1,635** |
| **NPR-3 Disposition:** Uses $500,000 in prior-year balances for continued groundwater sampling and landfill monitoring activities. | **-50** |
| **Total, Production Operations** | **-1,685** |

## Production Operations

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Production and Operations $9,685,000** | **$7,000,000** | **-$1,685,000** |
| **NPR-1 Closeout $9,635,000** | **$7,000,000** | **-$1,635,000** |
| Program continued ongoing activities to attain release from the remaining environmental findings related to the sale of NPR-1. | Planned activity level of $17,050,000 is financed by $10,050,000 in prior year balances and $7,000,000 new budget authority. Funds implementation/reporting of three remediation action work plans and remediation of one AOC leading to No Further Action status. | Prior year balances will be used to supplement new budget authority. |
| **NPR-3 Disposition $50,000** | **Planned Activity Level: $0** | **-$50,000** |
| Completion of Phase III of the NPR-3 Disposition. | Disposition completed; post-sale remediation monitoring activities for the landfill will use $500,000 in prior year balances. | Prior-year balances will be used for landfill closure and monitoring activities. |

## Naval Petroleum and Oil Shale Reserves
## Management

**Overview**

Management provides the Federal staffing resources and associated costs required to provide overall direction and execution of the NPOSR. There are a variety of inherently governmental functions, such as program management, contract administration, and budget formulation and execution that require a dedicated Federal workforce. NPOSR uses contractor support services and other related expenses to support the field environmental assessment, remediation and management of the program.

**Highlights of the FY 2019 Budget Request**

The NPR-1 funding supports Federal staff that provide oversight and monitor environmental clean-up and records disposition activities. The sales agreement also includes payments to former M&O contractor employees for post-medical and dental benefits.

NPR-3/RMOTC final office closeout was completed December 30, 2015; however, administrative oversight of the landfill closure will continue to be conducted by the Department of Energy Headquarters office. No new FY 2019 Budget Authority is requested for NPR-3.

**Management Funding**

**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Washington Headquarters** | | | | |
| Salaries and Benefits | 525 | --- | 525 | 0 |
| Travel | 50 | --- | 50 | 0 |
| Support Services | 450 | --- | 425 | -25 |
| Other Related Expenses | 1,045 | --- | 1,000 | -45 |
| **Total, Washington Headquarters** | **2,070** | **---** | **2,000** | **-70** |
| | | | | |
| **NPR – Wyoming** | | | | |
| Salaries and Benefits | 0 | --- | 0 | 0 |
| Travel | 10 | --- | 0 | -10 |
| Support Services | 75 | --- | 0 | -75 |
| Other Related Expenses | 165 | --- | 0 | -165 |
| **Total, NPR – Wyoming** | **250** | **---** | **0** | **-250** |
| | | | | |
| **Total Management** | | | | |
| Salaries and Benefits | 525 | --- | 525 | 0 |
| Travel | 60 | --- | 50 | -10 |
| Support Services | 525 | --- | 425 | -100 |
| Other Related Expenses | 1,210 | --- | 1,000 | -210 |
| **Total, Management** | **2,320** | **---** | **2,000** | **-320** |
| **Federal FTEs** | **4** | **---** | **4** | **0** |
| | | | | |
| **Support Services** | | | | |
| Technical Support | | | | |
| Environmental, Safety, Security & Health | 0 | --- | 0 | -0 |
| Technical Services | 450 | --- | 400 | -50 |
| Total, Technical Support | **450** | **---** | **400** | **-50** |
| | | | | |
| Management Support | | | | |
| Business Administration | 75 | --- | 0 | -75 |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| IT Support | 0 | --- | 25 | +25 |
| Total Management Support | **75** | **---** | **25** | **-50** |
| **Total, Support Services** | **525** | **---** | **425** | **-100** |
| | | | | |
| **Other Related Expenses** | | | | |
| Rent to Others | 0 | --- | 0 | 0 |
| Communications, Utilities & Misc. | 0 | --- | 0 | 0 |
| Other Services | 1,210 | --- | 1,000 | -210 |
| Operation and Maintenance of Equipment | 0 | --- | 0 | 0 |
| Supplies and Materials | 0 | --- | 0 | 0 |
| **Total, Other Related Expenses** | **1,210** | **---** | **1,000** | **-210** |

* A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

## Management

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Management $2,320,000** | **$2,000,000** | **-$320,000** |
| **Salaries and Benefits $525,000** | **$525,000** | **0** |
| Continued monitoring (cultural resources mitigation, environmental clean-up, oversight and audit) activities at NPR 1 and NPR 3. | Continue monitoring (cultural resources mitigation, environmental clean-up, oversight and audit) activities at NPR-1. No new FY 2019 Budget Authority is requested for NPR-3. | No change. |
| **Travel $60,000** | **$50,000** | **-$10,000** |
| Federal travel remained at prior reduced levels and was available to accomplish disposition process and environmental cleanup. | Federal travel will be required for environmental cleanup at NPR-1. No new FY 2019 Budget Authority is requested for NPR-3. | Reduction of travel activities reflects closure of NPR-3. |
| **Support Services $525,000** | **$425,000** | **-$100,000** |
| Support services provided for ESS&H, IT, Finance, and Technical Services supported disposition of the site at NPR-3 and environmental clean-up of NPR-1. | Support Services for environmental clean-up of NPR-1. No new FY 2019 Budget Authority is requested for NPR-3. | Reduction of services reflects closure of NPR-3. |
| **Other Related Expenses $1,210,000** | **$1,000,000** | **-$210,000** |
| Funding provided for communication services, materials and supplies, services; lease of Casper office and NPR Headquarters other expenses. Office lease expired December 2015. | As in prior years, funding provides for post-employment medical and dental benefits for former M&O contractor employees at NPR 1. No new FY 2019 Budget Authority is requested for NPR-3. | Reduction of expenses reflects closure of NPR-3. |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Naval Petroleum and Oil Shale Reserves | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Naval Petroleum Reserve No 1** | | | |
| **Naval Petroleum and Oil Shale Reserves** | | | |
| Productions Operations | 12,580 | 14,848 | 18,550 |
| Management | 1,000 | 1,000 | 1,000 |
| **Total, Naval Petroleum and Oil Shale Reserves** | **13,580** | **15,848** | **19,550** |
| **Total, Naval Petroleum Reserve No 1** | **13,580** | **15,848** | **19,550** |
| **Naval Petroleum Reserve No 3** | | | |
| **Naval Petroleum and Oil Shale Reserves** | | | |
| Productions Operations | 50 | 50 | 0 |
| Management | 250 | 250 | 0 |
| **Total, Naval Petroleum and Oil Shale Reserves** | **300** | **300** | **0** |
| **Total, Naval Petroleum Reserve No 3** | **300** | **300** | **0** |
| **Washington Headquarters** | | | |
| **Naval Petroleum and Oil Shale Reserves** | | | |
| Management | 1,070 | 1,070 | 1,000 |
| **Total, Washington Headquarters** | **1,070** | **1,070** | **1,000** |
| **Total, Naval Petroleum and Oil Shale Reserves** | **14,950** | **17,218** | **20,550** |

# Strategic Petroleum Reserve

# Strategic Petroleum Reserve

## Strategic Petroleum Reserve
## Proposed Appropriation Language

*For Department of Energy expenses necessary for Strategic Petroleum Reserve facility development and operations and program management activities pursuant to the Energy Policy and Conservation Act (42 U.S.C. 6201 et seq.), [$222,605,000] $175,105,000, to remain available until expended.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

### Explanation of Changes

Decrease reflects reductions to the Physical Security Program, Cavern Integrity Program, Major Maintenance Program, preventive/corrective maintenance activities, replacement of communication equipment, network storage, and data systems activities.

**Public Law Authorizations**
Public Law 109-58, "Energy Policy Act of 2005"

**Strategic Petroleum Reserve**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 222,605[1] | 221,485 | 175,105 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

The Strategic Petroleum Reserve (SPR) protects the U.S. economy from disruptions in critical petroleum supplies and meets the U.S. obligations under the International Energy Program (Energy Policy and Conservation Act, P.L. 94-163, as amended, Section 151). The SPR benefits the United States by providing an insurance policy against potential interruptions in U.S. petroleum supplies, whether originating from domestic or international supply disruptions, natural disasters, sabotage, or acts of terrorism.

FY 2019 funds support the program's operational readiness and drawdown capabilities. The SPR will continue conducting multiple non-emergency crude oil sales as directed by sections 403 and 404 of the Bipartisan Budget Act of 2015 (P.L. 114-74) and Section 5010 of the 21st Century Cures Act (P.L. 114-255). In accordance with the Bipartisan Budget Act of 2015, Section 403 directs the Secretary of Energy to sell 5 million barrels of SPR crude oil in FY 2019, while Section 404 authorizes DOE, subject to appropriation, to sell SPR crude oil up to the authorized revenue ceiling to fund the SPR Modernization Program, to include up to $300 million in FY 2019. Under Section 5010 of the 21st Century Cures Act, the Secretary of Energy is directed to draw down and sell 6 million barrels of SPR crude oil in FY 2019.

**Highlights and Major Changes in the FY 2019 Budget Request.**

**This FY 2019 request will support the SPR's operational readiness and drawdown capability of 4.13 million barrels per day.** The SPR Program will pursue the following major activities in FY 2019:

- Complete the degasification of crude oil inventory at the West Hackberry site, and conduct cavern wellbore activities.
- Support the program's ability to meet performance goals and milestones/targets. Under the Performance Goal of sustained (90 day) drawdown rate – enable ready distribution of SPR crude oil by achieving maximum sustained (90 day) drawdown rate of 4.4 million barrels per day, the target drawdown rate has been revised to 4.13 million barrels per day. This was done due to the non-availability of one above ground storage tank at the SPR Bryan Mound site, the projected availability of caverns for use in drawdown operations, as derived from the Five Year Integrated Workover Schedule, and projected site outrages for planned maintenance activities.
- Major changes from FY 2017 include the elimination of one cavern wellbore workover rig and crew, with a corresponding reduction of five wellbore remediations and eight wellbore diagnostic workovers (compared to FY 2017); a reduction in the physical security and preventive/corrective equipment maintenance programs; and increased level of multi-year crude oil sales that were initiated in FY 2017.

[1] Program received a direct appropriation of $223,000,000 in FY 2017; $395,000 in prior-year balances were rescinded, per Section 307 of the Consolidated Appropriations Act, 2017.

**Cybersecurity:** DOE is engaged in three categories of cyber-related activities: protecting the DOE enterprise from a range of cyber threats that can adversely impact mission capabilities; bolstering the U.S. Government's capabilities to address cyber threats; and, improving cybersecurity in the electric power subsector and the oil and natural gas subsector. The cybersecurity crosscut supports central coordination of the strategic and operational aspects of cybersecurity and facilitates cooperative efforts such as the Joint Cybersecurity Coordination Center for incident response and the implementation of Department-wide Identity Credential and Access Management.

| | Cyber-security | Total |
|---|---|---|
| Facilities Development and Operations | 3,175 | 3,175 |

**Strategic Petroleum Reserve**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Strategic Petroleum Reserve** | | | | |
| Facilities Development and Operations | 195,345 | --- | 149,131 | -46,214 |
| Management | 27,260 | --- | 25,974 | -1,286 |
| **Total, Strategic Petroleum Reserve** | **222,605** | **221,485** | **175,105** | **-47,500** |
| **Federal FTEs** | **126** | **126** | **126** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

## Strategic Petroleum Reserve

### Overview

The Strategic Petroleum Reserve (SPR) protects the U.S. economy from disruptions in critical petroleum supplies and meets the U.S. obligations under the International Energy Program (Energy Policy and Conservation Act, P.L. 94-163, as amended, Section 151). The SPR benefits the United States by providing an insurance policy against potential interruptions in U.S. petroleum supplies whether originating from domestic and international supply disruptions, natural disasters, sabotage, and acts of terrorism.

The SPR has 668.3 million barrels of crude oil inventory (as of January 3, 2018) stored in underground cavern storage, provides the U.S. with multiple geostrategic benefits, and anchors the world's collective energy security system. A release of petroleum from the SPR can mitigate the potential economic damage of an actual disruption in international or domestic petroleum supplies and the accompanying price increases. The SPR avails the United States of international emergency assistance through its participation in the International Energy Agency (IEA) energy supply security initiatives. IEA members are required to maintain 90 days' worth of net petroleum import protection in government-owned and/or commercial stocks, and have a commitment to participate with other stockholding nations in a coordinated release of stocks in the event of a major supply disruption. The 679.2 million barrels of SPR inventory (as of June 30, 2017) provided 149 days of net petroleum import protection, while the U.S. percentage share of an IEA collective action release was 43.2% (as of the 12-month period ending June 30, 2017).

To accomplish its mission and address the challenges outlined above, the SPR program is organized into two subprograms: Facilities Development and Operations, and Management. The Facilities Development and Operations subprogram funds all requirements associated with developing and maintaining facilities for the storage of petroleum, operations activities associated with placing petroleum into storage, and operational readiness initiatives associated with drawing down and distributing the inventory within 13 days' notice in the event of an emergency. The Management subprogram funds personnel and administrative expenses related to maintaining the Project Management Office (New Orleans, LA) and the Program Office (Washington, DC), as well as contract services required to support management and technical analysis of program initiatives and issues.

### Highlights of the FY 2019 Budget Request

SPR's surface and subsurface infrastructure require continued maintenance to ensure operational readiness capability. Likewise, the continued degasification of SPR stocks is required for the crude oil to be available for emergency use and to prevent the off-gassing of Volatile Organic Compounds (VOCs) and hydrogen sulfide above permitted levels during oil movements through commercial distribution points. Ongoing oil sale activities increase equipment usage and run times and will require consistent preventive, predictive and corrective maintenance to prevent or address equipment failures.

Cavern Integrity: The Casing Inspection and Cavern Remediation Program was developed in 2010 to remediate the anomalies in wellbore casings. This is necessary to maintain the required level of operational and drawdown capability. Cavern remediation and diagnostic workovers anticipate and remediate cavern wellbore failures that cause caverns to be removed from service, and in preventing potential environmental releases.

Crude Oil Degas Program: Degas of crude oil at West Hackberry site is scheduled for completion in December 2018.

Major changes from FY 2017 include the elimination of one cavern wellbore workover rig and crew, with a corresponding reduction of five wellbore remediations and eight wellbore diagnostic workovers (compared to FY 2017); a reduction in the physical security and preventive/corrective equipment maintenance programs; and increased level of multi-year crude oil sales that were initiated in FY 2017.

**Strategic Petroleum Reserve Funding**

**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Strategic Petroleum Reserve** | | | | |
| Facilities Development and Operations | 195,345 | --- | 149,131 | -46,214 |
| Management | 27,260 | --- | 25,974 | -1,286 |
| **Total, Strategic Petroleum Reserve** | **222,605** | **221,485** | **175,105** | **-47,500** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Strategic Petroleum Reserve**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Facilities Development and Operations:** The request reflects a reduced Cavern Integrity Program (-$13,796); reductions to the Major Maintenance Program (-$7,690); preventive/corrective/predictive maintenance program (-$10,572); reduction to the Physical Security Program (-$1,124); and decreases for IT support systems projects and contractor support (-$13,032). | **-46,214** |
| **Management:** The request reflects a decrease for hurricane planning activities and offsetting increases to Headquarters rent and IT system support. | **-1,286** |
| **Total, Strategic Petroleum Reserve** | **-47,500** |

## Strategic Petroleum Reserve
## Facilities Development and Operations

**Description**

The Facilities Development and Operations subprogram funds activities to maintain the SPR's operational readiness capability for successful drawdowns and operate the sites in a safe, secure, and environmentally acceptable manner. U.S. reliance on petroleum, combined with significant global reserves in regions of the world subject to political unrest, have made the United States economy vulnerable to supply disruptions. The SPR's stockpile of petroleum products diminishes this vulnerability to the effects of disruptions in supplies.

The SPR's underground storage caverns require maintenance to assure their storage capability and integrity. Surface and sub-surface infrastructure and systems that must be maintained to meet operational readiness requirements have been identified, and are funded in this subprogram.

### Facilities Development and Operations

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Facilities Development and Operations** | | |
| **$195,345,000** | **$149,131,000** | **-46,214,000** |
| *Casing Inspections and Remediations*<br>• Provides casing services in support of workover schedule using 2 leased rigs and crews to perform 5 cavern wellbore remediations and 9 wellbore workovers. | *Casing Inspections and Remediations*<br>• Funding level supports 1 cavern workover rig and leased crew to execute 1 cavern wellbore diagnostic workover and the required overhaul/maintenance of DOE Rig scheduled every five years. | *Casing Inspections and Remediations (-$13,796)*<br>• Reduction from 2 to 1 leased rig and crew for cavern integrity operations, with 1 planned wellbore diagnostic workover and no planned cavern wellbore remediations. Funding level supports DOE Rig for routine five year maintenance /overhaul. |
| *Major Maintenance*<br>• Continue approach to repair, replace, or upgrade equipment including Security, Environmental, Safety & Health (ESH), Drawdown and Non-Drawdown critical systems, including a custody transfer flow metering skid at the Big Hill site. | *Major Maintenance*<br>• Continue approach to repair, replace, or upgrade equipment including Security, Environmental, Safety & Health (ESH), Drawdown and Non-Drawdown critical systems. | *Major Maintenance (-$7,690)*<br>• Reduced funding level from FY 2017 will leave a core sustainable program of construction projects that support operational readiness, given multi-year oil sales. |
| *Maintenance*<br>• Provides maintenance of the SPR equipment and facilities to support drawdown readiness in a safe and environmentally compliant manner. | *Maintenance*<br>• Provides reduced level of preventive/corrective/predictive maintenance of the SPR equipment and facilities to support drawdown readiness in a safe and environmentally | *Maintenance (-$10,572)*<br>• Reduction to preventive/corrective/predictive maintenance of drawdown critical equipment, and a reduction to spare inventory supplies (pumps, valves, actuators and motors) for |

| | | |
|---|---|---|
| | compliant manner. | drawdown critical equipment. Reduction to the Piping Assurance Underground Inspections. |
| *Physical Security*<br>• Protect and defend personnel, property and resources against assault, sabotage, vandalism, theft, trespass and compromise of sensitive as well as classified information. | *Physical Security*<br>• A reduced Physical Security Program with marginally capable effectiveness in providing a deterrence and response posture to adversarial threats (as defined and required by the latest threat assessments). | *Physical Security (-$1,124)*<br>• Decrease reflects reductions in program areas to include contractor staffing, vulnerability assessments, force-on-force exercises, basic officer training courses, and coordinated activities with local law enforcement agencies. |
| *Data Systems & Support*<br>• Data Systems to support the mission of drawdown readiness, processing, sale and receipt of goods (oil), communications, reporting, providing protection from malware and computer viruses, and all other activity associated with the use of data and information systems. | *Data Systems & Support*<br>• Data Systems to support the mission of drawdown readiness, processing, sale and receipt of goods (oil), communications, reporting, providing protection from malware and computer viruses, and all other activity associated with the use of data and information systems. Compliance requirements for Fire Protection, DOT 5-year Navigable Waterway Inspection, RMAIP (Cyber Security), Multi-Factor Authentication and Piping Assurance Program. | *Data Systems & Support (-$13,032)*<br>• Decrease reflects reduction in hardware and software support as well as the one time replacement of radios and network storage in FY 2017. |

**Strategic Petroleum Reserve Capital Summary[2] ($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Capital Operating Expenses Summary (including MIE)** | | | | |
| Capital Equipment > $500K (including MIE) | 15,845 | --- | 7,360 | -8,485 |
| Plant Projects (GPP >$10M) | 0 | --- | 0 | +0 |
| **Total, Capital Operating Expenses** | **15,845** | **---** | **7,360** | **-8,485** |
| **Capital Equipment > $500K (including MIE)** | | | | |
| Total Non-MIE Capital Equipment (>$500K) | 10,699 | --- | 7,360 | -3,339 |
| Replace 24' Brine disposal Pipeline GFE (WH-826) | 5,146 | --- | 0 | -5,146 |
| **Total, Capital Equipment (including MIE)** | **15,845** | **---** | **7,360** | **-8,485** |
| **Plant Projects (GPP - Total Estimated Cost >$10M)** | | | | |
| **Total, Plant Projects (GPP – Total Estimated Cost** | **0** | **---** | **0** | **0** |
| | | --- | | |
| **Total, Capital Summary** | **15,845** | **---** | **7,360** | **-8,485** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

[2] This list of projects is illustrative and can be adjusted based on operational requirements, priorities, and/or funding.

## Strategic Petroleum Reserve
## Management

**Overview**

Management provides funding for the salaries and related requirements of the Headquarters federal workforce responsible for providing programmatic policy, planning and oversight, to include strategic project planning, budget formulation and financial management, operations, engineering, safety, security, and technical analysis of programmatic activity of the SPR. The additional Federal workforce of the SPR Project Management Office directs program execution and establishes technical performance standards as well as scope, cost, and schedule milestones for the Management and Operations contractor.

**Highlights of the FY 2019 Budget Request**

The Federal staff remains at 126 FTEs with additional technical support contractors. Travel is for operational field support and oversight, including site and vendor visits. Other related expenses include field building leases and telecommunications activities**.**

## Management Funding

($K)

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Program Direction Summary** | | | | |
| **Washington Headquarters** | | | | |
| Salaries and Benefits | 5,476 | --- | 5,476 | +0 |
| Travel | 150 | --- | 130 | -20 |
| Support Services | 2,745 | --- | 2,140 | -605 |
| Other Related Expenses | 548 | --- | 1,254 | +706 |
| **Total, Washington Headquarters** | **8,919** | **---** | **9,000** | **+81** |
| | | | | |
| **Strategic Petroleum Reserve Project Management Office** | | | | |
| Salaries and Benefits | 14,664 | --- | 14,664 | +0 |
| Travel | 481 | --- | 443 | -38 |
| Support Services | 477 | --- | 525 | +48 |
| Other Related Expenses | 2,719 | --- | 1,342 | -1,377 |
| **Total, SPR Project Management Office** | **18,341** | **---** | **16,974** | **-1,367** |
| | | | | |
| **Total Management** | | | | |
| Salaries and Benefits | 20,140 | --- | 20,140 | +0 |
| Travel | 631 | --- | 573 | -58 |
| Support Services | 3,222 | --- | 2,665 | -557 |
| Other Related Expenses | 3,267 | --- | 2,596 | -671 |
| **Total, Management** | **27,260** | **---** | **25,974** | **-1,286** |
| **Federal FTEs** | **126** | **---** | **126** | **0** |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Support Services** | | | | |
| Technical Support | | | | |
| Economic & Environmental Analysis | 560 | --- | 570 | +10 |
| Total, Technical Support | 560 | --- | 570 | +10 |
| | | | | |
| Management Support | | | | |
| Training and OPM Recruitment | 213 | --- | 157 | -56 |
| Technical Support | 2,449 | --- | 1,938 | -511 |
| Total Management Support | 2,662 | --- | 2,095 | -567 |
| **Total, Support Services** | **3,222** | --- | **2,665** | **-557** |
| | | | | |
| **Other Related Expenses** | | | | |
| Rent to Others | 591 | --- | 653 | +62 |
| Communications, Utilities, Misc. | 96 | --- | 100 | +4 |
| Other Services | 2,165 | --- | 1,418 | -747 |
| Supplies and Materials | 40 | --- | 50 | +10 |
| Equipment | 375 | --- | 375 | +0 |
| **Total, Other Related Expenses** | **3,267** | --- | **2,596** | **-671** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown

## Management

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Management $27,260,000** | **$25,974,000** | **-$1,286,000** |
| **Salaries and Benefits $20,140,000** | **$20,140,000** | **+$0** |
| • The funding supports salaries and benefits for 126 FTEs and associated costs required to provide overall direction and execution of the SPR. The SPR mission is carried out by a workforce composed largely of M&O contractors, although there are a variety of functions that are inherently governmental (i.e., program management, contract administration, budget formulation, and interagency/international coordination) that require a dedicated Federal workforce. | • The funding supports salaries and benefits for 126 FTEs and associated costs required to provide overall direction and execution of the SPR. The SPR mission is carried out by a workforce composed largely of M&O contractors, although there are a variety of functions that are inherently governmental (i.e., program management, contract administration, budget formulation, and interagency/international coordination) that require a dedicated Federal workforce. | • No change. |
| **Travel $631,000** | **$573,000** | **-$58,000** |
| • Provides travel to assure capability to achieve Level 1 Performance criteria for drawdown and distribution of the Reserve. | • Provides travel to assure capability to achieve Level 1 Performance criteria for drawdown and distribution of the Reserve. | • No significant change. |
| **Support Services $3,222,000** | **$2,665,000** | **-$557,000** |
| • Activities support project-planning efforts to maintain technical, mission essential support capabilities. | • Activities support project-planning efforts to maintain technical, mission essential support capabilities. | • Decrease in level of project-planning efforts for technical analyses which support programmatic operational readiness and capability requirements. |
| **Other Related Expenses $3,267,000** | **$2,596,000** | **-$671,000** |
| • Provides teleconferencing capabilities between sites; field site building leases; and contingency for DOE field employee evacuation expenses in the event of a hurricane. | • Provides teleconferencing capabilities between sites; field site building leases; and contingency for DOE field employee evacuation expenses in the event of a hurricane. | • Decrease is for hurricane preparedness requirements requested in FY17 that are not included in current request funding level and also includes offsetting increases to Headquarters rent and IT system support. |

**Strategic Petroleum Reserve**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Drawdown Readiness - Ensure the operational readiness of the SPR through the achievement of equal to or greater than 95% of the annual average of monthly maintenance performance and reliability goals.** | | |
| Target | 95 % of monthly maintenance and accessibility goals achieved | 95 % of monthly maintenance achieved | 95 % of monthly maintenance achieved |
| Result | Met - 98.36 | TBD | TBD |
| Endpoint Target | Achieve 95% of monthly maintenance and accessibility goals in all years. | | |
| Performance Goal (Measure) | **SPR Operating Cost - Ensure the cost efficiency of SPR operations through the achievement of an operating cost per barrel of crude oil storage capacity of no more than $0.30 per barrel** | | |
| Target | 0.3 $ operating cost per barrel | 0.3 $ operating cost per barrel | 0.3 $ operating cost per barrel |
| Result | Met - 0.248 | TBD | TBD |
| Endpoint Target | Achieve $ 0.30 operating cost per barrel. | | |
| Performance Goal (Measure) | **Sustained (90 day) Drawdown Rate - Maintain the capability to drawdown the SPR at the design drawdown rate of 4.415 million barrels per day.** | | |
| Target | 4.2 MMB/Day drawdown readiness rate | 4.13 MMB/Day drawdown readiness rate | 4.13 MMB/Day drawdown readiness rate |
| Result | Not Met - 4.17 | TBD | TBD |
| Endpoint Target | Achieve a 90-day drawdown rate of 4.415 million barrels per day by 2022 (end of Life Extension 2). | | |

## Strategic Petroleum Reserve
## Facilities Maintenance and Repair

The SPR Program's Facilities Maintenance and Repair activities are tied to its programmatic missions, goals, and objectives. The Facilities Maintenance and Repair activities funded by this budget and displayed below are intended to halt asset condition degradation.

**Costs for Direct-Funded Maintenance and Repair (including Deferred Maintenance Reduction)**
**($K)**

| | FY 2017 Actual Cost | FY 2017 Planned Cost | FY 2018 Planned Cost | FY 2019 Planned Cost |
|---|---|---|---|---|
| Strategic Petroleum Reserve | 48,925 | 47,324 | 30,602 | 32,552 |
| **Total, Direct-Funded Maintenance and Repair** | **48,925** | **47,324** | **30,602** | **32,552** |

**Report on FY 2017 Expenditures for Maintenance and Repair**
**($K)**

This report responds to legislative language set forth in Conference Report (H.R. 108-10) accompanying the Consolidated Appropriations Resolution, 2003 (Public Law 108-7) (pages 886-887), which requests the Department of Energy provide an annual year-end report on maintenance expenditures to the Committees on Appropriations. This report compares the actual maintenance expenditures in FY 2017 to the amount planned for FY 2017, including congressionally directed changes.

**Total Costs for Maintenance and Repair**
**($K)**

| | FY 2017 Actual Cost | FY 2017 Planned Cost |
|---|---|---|
| Strategic Petroleum Reserve | 48,925 | 47,324 |
| **Total, Direct-Funded Maintenance and Repair** | **48,925** | **47,324** |

**Strategic Petroleum Reserve**
**Safeguards and Security**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[1] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Protective Forces | 23,191 | --- | 18,354 | -4,837 |
| Physical Security Systems | 1,016 | --- | 1,067 | +51 |
| Information Security | 242 | --- | 232 | -10 |
| Cyber Security | 2,047 | --- | 3,175 | +1,128 |
| Personnel Security | 602 | --- | 598 | -4 |
| Material Control and Accountability | 0 | --- | 0 | 0 |
| Research and Development | 6 | --- | 0 | -6 |
| Program Management | 1,074 | --- | 1,464 | +390 |
| Security Investigations | 0 | --- | 0 | 0 |
| Transportation Security | 0 | --- | 0 | 0 |
| Construction | 150 | --- | 0 | -150 |
| **Total, Safeguards and Security** | **28,328** | **23,087** | **24,890** | **-3,438** |

[1] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**18-E-001, Strategic Petroleum Reserve (SPR) Modernization**
**Various Locations**
**Project Data Sheet is for Design and Construction**

**1. Summary, Significant Changes, and Schedule and Cost History**

**Summary**

There are two subprograms in SPR Modernization: Life Extension Phase II (LE2) and Marine Terminal Distribution Capability Enhancements (MTE). The LE2 subprogram will modernize aging SPR infrastructure through systems upgrades and associated equipment replacement to ensure continued ability to meet mission requirements for the next 25 years. LE2 activities will occur at the Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw storage sites. The MTE subprogram will address the strategic energy requirement to meet the SPR's distribution capability gap. Major components of MTE activities include distribution infrastructure modernization of crude oil pipelines, crude oil tank farm storage and dedicated marine loading and unloading facilities at the Seaway Distribution System and the Texoma Distribution System.

The Energy Security and Infrastructure Modernization (ESIM) Fund was established as the funding source for SPR modernization. The fund contains offsetting collections from the sale of SPR crude up to the authorized annual revenue ceiling. These sales are limited to the period of fiscal years 2017 through 2020.

The most recent DOE O 413.3B approved Critical Decision (CD) for LE2 is CD-1 that was approved 22 December 2016 with a total project cost range of $750 million to $1.4 billion and a CD-4 completion date range of September 2022 to September 2024. A Federal Project Director (FPD) has been assigned to this project and has approved this Construction Project Data Sheet (CPDS).

The most recent DOE O 413.3B Critical Decision (CD) for MTE is CD-0 that was approved by the Deputy Secretary of Energy on August 12, 2016, with a preliminary cost range of $0.5 billion to $1.5 billion and a CD-4 range of FY 2024 to 2025. A Federal Project Director has not been assigned to the MTE project.

**Significant Changes**

LE2 Project:
This Construction Project Data Sheet (CPDS) is an update from Fiscal Year 2018 and does not include a new start for the budget year. The Administration's FY 2018 Budget Request included a provision proposing changes that would reduce funding for SPR modernization to $1 billion. The St. James Terminal site has been deleted from the Life Extension 2 scope due to the Adminstration's lack of support for DOE reassuming operational control of the terminal. However, additional linear feet of piping have been identified for replacement at the remaining four sites from the ongoing oil sales leaving the point estimate roughly the same. Therefore, the project range has not been adjusted from the original CD-1 submission.

MTE Project:
The Marine Terminal Distribution Capability Enhancements project scope did not receive Congressional funding authority in fiscal year 2018 and will be re-evaluated pending development of finalized policy guidance within the Administration.

**Life Extension Phase II:**

**Critical Milestone History**

| | CD-0 | Conceptual Design Complete | CD-1 | CD-2 | Final Design Complete | CD-3 | CD-4 |
|---|---|---|---|---|---|---|---|
| FY 2018* | 10/30/15 | 09/01/16 | 12/22/16 | 3rd Qtr 2019 | 3rd Qtr 2019 | 3rd Qtr 2019 | 4th Qtr 2024 |
| FY 2019* | 10/30/15 | 09/01/16 | 12/22/16 | 3rd Qtr 2019 | 3rd Qtr 2019 | 3rd Qtr 2019 | 4th Qtr 2024 |

**CD-0** – Approved Mission Need for a construction project with a conceptual scope and cost range
**Conceptual Design Complete** – Actual date the conceptual design was completed (if applicable)
**CD-1** – Approve Alternative Selection and Cost Range

**CD-2** – Approve Performance Baseline
**Final Design Complete** – Estimated/Actual date the project design will be/was complete(d)
**CD-3** – Approve Start of Construction
**D&D Complete** –Completion of D&D work
**CD-4** – Approve Start of Operations or Project Completion
**PB** – Indicates the Performance Baseline

***Project does not have CD-2 approval and has not been baselined.**
**The costs are only estimates and consistent with the high end of the cost ranges.**

**Project Cost History**

| | TEC, Design ($000) | TEC, Construction ($000) | TEC, Total ($000) | OPC Except D&D ($000) | OPC, D&D ($000) | OPC, Total ($000) | TPC ($000) |
|---|---|---|---|---|---|---|---|
| FY 2018 | $100,628 | $1,299,372 | $1,400,000 | $6,711 | $0 | $6,711 | $1,406,711 |
| FY 2019 | $199,749* | $800,251 | $1,000,000** | $5,250 | $0 | $5,250 | $1,005,250 |

**The costs are only estimates and consistent with the high end of the cost ranges. No construction funds, except for approved long lead procurement, will be used until the project performance baseline for each subproject has been validated and CD-3 has been approved.**

***The increase in design cost is due to: 1) competing the design contract instead of using a reach-back contract to the M&O contractor partner; 2) adding fee to competed contract; 3) adding escalation to schedule delay caused by competing design contract; and 4) adding engineering cost associated with additional scope (deleted scope was represented completely in construction cost).**
**** The project cost of $1.4B was approved at CD-1; however, a new project cost will be established at CD-2 to align with the Administration's proposed $1B funding limitation.**

**2. Project Scope and Justification**

**Scope**
The Strategic Petroleum Reserve-Life Extension 2 (SPR-LE2) project involves work at four storage sites: Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw. The SPR-LE2 project will be managed as four projects based on site location for baseline development, field execution, and project completion. Completion of the SPR-LE2 project will extend SPR key equipment and infrastructure capabilities for an additional 25 years and assure the required drawdown of 4.2 million barrels per day. The scope at each of the four SPR storage facilities includes modernization of aging SPR infrastructure through systems upgrades and associated equipment replacement including repair or replace crude oil transfer systems, raw water systems, brine disposal systems, power distribution and lighting systems, and physical security systems. It also includes building and installing a new degasification plant at the Bayou Choctaw site.

**Justification**
In August 2016, the Department of Energy published a Long-Term Strategic Review (LTSR) of SPR capabilities and infrastructure. The LSTR compared current operational capability to Level 1 Technical and Performance Criteria and identified gaps within the storage site infrastructure and distribution system necessary to provide the design delivery rate of 4.2 million barrels per day, now and for the next 25 years. The results indicated that a significant investment in infrastructure and process equipment is critical to ensure the SPR can maintain readiness, meets mission requirements, and operates in an environmentally responsible manner. The SPR-LE2 Project addresses these requirements. Current surface assets and systems are more than halfway through their original design life of 25 years, and early analysis suggests the required Life Extension Program (LEP) could take up to six years to complete. Revitalization of many, but not all, of those assets and systems last occurred from 1995 to 2000 under the first LEP. As these assets continue to age, modernization will be required – either through additional maintenance and/or repair, or outright replacement.

The project is being conducted in accordance with the project management requirements in DOE O 413.3B, Program and Project Management for the Acquisition of Capital Assets.

**Preliminary Key Performance Parameters (KPPs)**

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance. The preliminary KPPs will be finalized when project is baselined at CD-2.

| Preliminary Performance Measure | Threshold | Objective |
|---|---|---|
| Raw Water Withdrawal Rate | TBD | 4.3 MMBD* |
| Peak Sustained Drawdown Rate | TBD | 4.2 MMBD* |
| Site Fill Rate | TBD | 605 MBD** |

***MMBD is Million Barrels per day.**

****MBD is Thousand Barrels per day.**

**3. Project Cost and Schedule**

**Financial Schedule**

(dollars in thousands)

| | Appropriations | Obligations | Costs |
|---|---|---|---|
| Total Estimated Cost (TEC) | | | |
| Design | | | |
| FY 2015 | N/A | $0 | $0 |
| FY 2016 | N/A | $0 | $0 |
| FY 2017 | N/A | $137,215 | $4,159 |
| FY 2018 | N/A | $26,612 | $40,567 |
| FY 2019 | N/A | $9,021 | $68,148 |
| FY 2020 | N/A | $16,213 | $38,579 |
| FY 2021 | N/A | $9,234 | $31,162 |
| FY 2022 | N/A | $1,454 | $17,134 |
| FY 2023 | N/A | $0 | $0 |
| FY 2024 | N/A | $0 | $0 |
| Total, Design **a** | N/A | $199,749 | $199,749 |
| Construction | | | |
| FY 2015 | N/A | $0 | $0 |
| FY 2016 | N/A | $0 | $0 |
| FY 2017 | N/A | $27,400 | $0 |
| FY 2018 **b** | N/A | $280,439 | $101,485 |
| FY 2019 | N/A | $492,412 | $128,060 |
| FY 2020 | N/A | $0 | $238,854 |
| FY 2021 | N/A | $0 | $230,348 |
| FY 2022 | N/A | $0 | $101,504 |
| FY 2023 | N/A | $0 | $0 |
| FY 2024 | N/A | $0 | $0 |
| Total, Construction | N/A | $800,251 | $800,251 |
| TEC | | | |
| FY 2015 | N/A | $0 | $0 |
| FY 2016 | N/A | $0 | $0 |
| FY 2017 | N/A | $164,615 | $4,159 |
| FY 2018 | N/A | $307,051 | $142,052 |
| FY 2019 | N/A | $501,433 | $196,208 |
| FY 2020 | N/A | $16,213 | $277,433 |
| FY 2021 | N/A | $9,234 | $261,510 |
| FY 2022 | N/A | $1,454 | $118,638 |
| FY 2023 | N/A | $0 | $0 |
| FY 2024 | N/A | $0 | $0 |
| Total, TEC | N/A | $1,000,000 | $1,000,000 |

| | (dollars in thousands) | | |
|---|---|---|---|
| | Appropriations | Obligations | Costs |
| Other Project Cost (OPC) | | | |
| FY 2015 **c,d** | $88 | $88 | $88 |
| FY 2016 **c,d** | $4,190 | $4,190 | $4,190 |
| FY 2017 **d** | $972 | $972 | $699 |
| FY 2018 **d** | $0 | $0 | $273 |
| FY 2019 | $0 | $0 | $0 |
| FY 2020 | 0 | $0 | $0 |
| FY 2021 | 0 | $0 | $0 |
| FY 2022 | 0 | $0 | $0 |
| FY 2023 | 0 | $0 | $0 |
| FY 2024 | 0 | $0 | $0 |
| Total, OPC | $5,250 | $5,250 | $5,250 |
| Total Project Cost (TPC) | | | |
| FY 2015 | $88 | $88 | $88 |
| FY 2016 | $4,190 | $4,190 | $4,190 |
| FY 2017 **e** | $340,972 | $165,587 | $4,858 |
| FY 2018 | $350,000 | $307,051 | $142,325 |
| FY 2019 **f** | $300,000 | $501,433 | $196,208 |
| FY 2020 | $10,000 | $16,213 | $277,433 |
| FY 2021 | $0 | $9,234 | $261,510 |
| FY 2022 | $0 | $1,454 | $118,638 |
| FY 2023 | $0 | $0 | $0 |
| FY 2024 | $0 | $0 | $0 |
| Total, TPC **d,g** | $1,005,250 | $1,005,250 | $1,005,250 |

**a**: DOE and DOE support labor; M&O project support
**b:** Bayou Choctaw CD-3A Degas Plant
**c**: Includes costs for Office of Project Management
**d:** Funding requirements are included in the Facilities Appropriation 089X0218.
**e**: FY2017 Omnibus authorized oil sales target of $340,000,000 (Appropriation). Actual proceeds were $323,196,000.
**f**: Includes costs for Office of Project Management EIR which will be funded from the DOE Contingency within LE 2 funds
**g**: The Total Project Cost (TPC) of $1.4B was approved at CD-1; however, a new TPC will be established at CD-2 to align with the Administration's proposed $1B funding limitation. The TPC for obligations and costs is the total of funds from Facilities Appropriation and funding received through the sale of SPR crude oil.

**Note**: Project is being funded through the sale of SPR crude oil and not through the normal congressional appropriations process.

**Details of Project Cost Estimate at High Range at CD-1**

(dollars in thousands)

| | Current Total Estimate | Previous Total Estimate | Original Validated Baseline |
|---|---|---|---|
| Total Estimated Cost (TEC) | | | |
| Design (PED) | | | |
| Design | $235,388 | $92,916 | N/A |
| Contingency | $21,306 | $7,712 | N/A |
| Total,PED | $256,694 | $100,628 | N/A |
| Land Acquisition | | | |
| Construction | | | |
| Site Facilities Construction | $295,636 | $335,992 | N/A |
| Off-Site Facilities | $150,994 | $171,605 | N/A |
| Drilling/Wellhead/Casings | $51,337 | $58,344 | N/A |
| Pipeline Construction | $119,388 | $135,685 | N/A |
| Construction Management | $95,690 | $108,752 | N/A |
| Project Support | $153,605 | $174,573 | N/A |
| Contingency | $276,656 | $314,421 | N/A |
| Total, Construction | $1,143,306 | $1,299,372 | N/A |
| Total, TEC | $1,400,000 | $1,400,000 | N/A |
| Contingency, TEC | $297,962 | $322,133 | N/A |
| Other Project Cost (OPC) | | | |
| OPC except D&D | | | |
| Conceptual Design | $1,366 | $2,781 | N/A |
| Other OPC Costs | $3,884 | $3,930 | N/A |
| Start-up | $0 | $0 | N/A |
| Contingency | $0 | $0 | N/A |
| Total, OPC except D&D | $5,250 | $6,711 | N/A |
| D&D | | | |
| D&D | | | N/A |
| Contingency | | | N/A |
| Total, D&D | $0 | $0 | N/A |
| Total, OPC | $5,250 | $6,711 | N/A |
| Contingency, OPC | $0 | $0 | N/A |
| Total, TPC | $1,405,250 | $1,406,711 | N/A |
| Total, Contingency | $297,962 | $322,133 | N/A |

**Note**: Project is being funded through the sale of SPR crude oil and not through the normal congressional appropriations process.

**Schedule of Appropriations Requests**

Section 404 of the Bipartisan Budget Act authorizes drawdown and sale of SPR crude oil over four fiscal years (FY2017 - FY2020) to finance SPR modernization. This CPDS reflects the high end of the cost ranges. A total project cost (TPC) of $1.4B was approved at CD-1; however, a new TPC will be established at CD-2 to align with the Administration's proposed $1B funding limitation. The intent is to execute SPR modernization within the authorized revenue ceiling proposed in the FY 2019 budget request shown below.

($000)

| Request | | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 | FY 2021 | FY 2022 | FY 2023 | FY 2024 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FY 2018 | TEC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| | OPC | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A | |
| | TPC | $ - | $ - | $375,400 | $350,000 | $174,600 | $100,000 | $ - | $ - | $ - | $ - | $1,000,000 |
| FY 2019 | TEC | $ - | $ - | $ 340,000 * | $ 350,000 | $ 300,000 | $ 10,000 | $ - | $ - | $ - | $ - | $1,000,000 |
| | OPC | $ 88 | $ 4,190 | $ 972 | $ - | $ - | $ - | $ - | $ - | $ - | $ - | $5,250 |
| | TPC | $ 88 | $ 4,190 | $ 340,972 | $ 350,000 | $ 300,000 | $ 10,000 | $ - | $ - | $ - | $ - | $1,005,250 |

***** FY2017 Omnibus authorized oil sales target of $340,000,000 (Appropriation). Actual proceeds were $323,196,000.

**4. Related Operations and Maintenance Funding Requirements**

**Not applicable for PED.**

| | |
|---|---|
| Start of Operation or Beneficial Occupancy (fiscal quarter or date) | Establish at CD-2 |
| Expected Useful Life (number of years) | 25 |
| Expected Future Start of D&D of this capital asset (fiscal quarter) | N/A |

**(Related Funding requirements)**

(dollars in thousands)

| | Annual Costs | | Life Cycle Costs | |
|---|---|---|---|---|
| | Current Total Estimate | Previous Total Estimate | Current Total Estimate | Previous Total Estimate |
| Operations | | N/A | | N/A |
| Maintenance & Repair | | N/A | | N/A |
| Total * | | N/A | | N/A |

*** Funding requirements are included in the Facilities Appropriation 089X0218.**

**5. D&D Information**

This project does not require D&D funding.

**6. Acquisition Approach**

The existing Strategic Petroleum Reserve Management and Operating Contractor did procure the Architect-Engineer contractor and will procure all Government Furnished Property and firm fixed priced construction contracts.

**Strategic Petroleum Reserve – Petroleum Account**
**Proposed Appropriation Language**

*For Department of Energy expenses necessary for the acquisition, transportation, and injection of petroleum products, and for other necessary expenses pursuant to the Energy Policy and Conservation Act of 1975, as amended (42 U.S.C. 6241, 6239 note), and Section 5010 of the 21st Century Cures Act (Public Law 114-255); $8,400,000 to remain available until expended.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

Program does not anticipate having prior-year balances to fund drawdown operations in FY 2019. As such, program requests the inclusion of language in the General Provisions authorizing the Secretary of Energy to drawdown and sell up to 1 million barrels of crude oil from the Strategic Petroleum Reserve to provide funding for drawdown operations. Proceeds shall be deposited into the SPR Petroleum Account during FY 2019 and shall remain available until expended. The current drawdown cost estimate for FY 2019 is approximately $10 million. Balances from the sale of up to 1 million barrels in excess of FY 2019 drawdown costs will be apportioned and allotted to future fiscal years.

**Public Law Authorizations**
Public Law 94-163, as amended.
Public Law 114-74
Public law 114-255

**Strategic Petroleum Reserve – Petroleum Account**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 0 | 0 | 0 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

The SPR Petroleum Account funds the following activities: 1) the incremental costs of withdrawing oil from the storage caverns and transporting it to the sales point where purchasers take title; 2) petroleum inventory acquisitions and associated transportation costs; 3) U.S. Customs duties; and 4) terminal throughput charges and other related miscellaneous costs. The SPR Petroleum Account also serves as the source of funding for the Northeast Gasoline Supply Reserve (NGSR).

Consistent with the FY 2018 budget request, the Administration is proposing to disestablish the NGSR in this FY 2019 budget request. The NGSR was administratively established in 2014 as part of the Strategic Petroleum Reserve (SPR) to ease regional shortages resulting from sudden/unexpected supply interruptions (i.e., Superstorm Sandy). NGSR consists of 1 million barrels of gasoline blendstock stored in leased commercial storage terminals located at South Portland, Maine; Revere, Massachusetts; Carteret, New Jersey; and Raritan Bay, New Jersey. The NGSR is not cost efficient or operationally effective. An Annual Coordinating Meeting of Entity Stockholders (ACOMES) benchmarking study of other oil stockpiling countries indicates that NGSR operating costs are twice as much as the next highest-cost country's gasoline reserve, and four times as costly as the third highest-cost country's gasoline reserve. Additionally, as a component of the SPR, the NGSR must follow the statutory release authorities of the SPR, which require national impact thresholds, making it operationally ineffective as a regional-type product reserve.

**Highlights and Major Changes in the FY 2019 Budget Request**

Sections 403 and 404 of the Bipartisan Budget Act of 2015 (P.L. 114-74) and Section 5010 of the 21st Century Cures Act (P.L. 114-255) direct non-emergency multi-year oil sales. Program requests that language authorizing the sale of one million barrels of SPR crude oil be included in the General Provisions. The proceeds from the requested sale of SPR crude oil will fund the costs of drawdown operations, including drawdown costs associated with mandatory oil sales. The NGSR leased commercial storage is currently financed through December 2018.

**SPR Petroleum Account**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted** | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **SPR Petroleum Account** | | | | |
| Petroleum Acquisition, Transportation and Drawdown | 7,364 | --- | 9,912 | +2,548 |
| Use of Crude Oil Sale Proceeds | 0 | --- | -9,912 | -9,912 |
| Northeast Gasoline Supply Reserve | 0 | --- | 3,000 | +3,000 |
| Use of Prior Year Balances | -7,364 | --- | -3,000 | +4,364 |
| **Total, SPR Petroleum Account** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

** $4,900,000 in unobligated balances was utilized to fund the drawdown operations for FY 2017 non-emergency oil sales directed by Section 404 of the Bipartisan Budget Act of 2015 and Section 5010 of the 21st Century Cures Act. Another $2,500,000 in unobligated balances was utilized for Hurricane Harvey Exchanges.

## Strategic Petroleum Reserve – Petroleum Account

**Overview**

The SPR Petroleum Account funds two subprograms: SPR Petroleum Acquisition/Transportation/Drawdown and the Northeast Gasoline Supply Reserve (NGSR). The Petroleum Acquisition subprogram funds all crude oil acquisition, transportation, drawdown and distribution of the inventory in the SPR within 13 days' notice in the event of an emergency. The NGSR subprogram funds all aspects of the refined petroleum product reserve of gasoline blendstock, acquired and owned by the U.S. government and stored at leased commercial storage terminals in the Northeast to help mitigate the impacts of sudden and unexpected supply interruptions.

*SPR Oil Acquisition/Transportation/Drawdown*

In 2014, the program conducted a Test Sale of the SPR to evaluate the drawdown and sales procedure capabilities of the Reserve in the TEXOMA distribution system. A portion of the 2014 SPR Test Sale receipts were used to acquire 4.2 million barrels of crude oil per Section 161(g) of the Energy Policy and Conservation Act of 1975, increasing the crude oil inventory to 695.1 million barrels. Currently, the Department is undergoing a series of non-emergency, multi-year oil sales pursuant to the Bipartisan Budget Act (BBA) of 2015 (Public Law 114–74), the 21st Century Cures Act (Public Law 114-255), and the Fixing America's Surface Transportation (FAST) Act (Public Law 114-94) and the Reconciliation pursuant to Titles II and V of the concurrent resolution on the budget for fiscal year 2018 (Public Law 115-466). Drawdown and sales are scheduled as follows:

- From FY 2018 through FY 2025 (eight consecutive years) – sell 58 million barrels of crude oil, with 5 million barrels to be sold in FY 2018. Proceeds will be deposited into the General Fund of the Treasury (BBA, Section 403).
- From FY 2017 through FY 2020 (four consecutive years) – sell the required volumes of SPR inventory to raise up to the authorized revenue ceiling to be deposited into the Energy Security and Infrastructure Modernization Fund (BBA, Section 404). In FY 2017, 6.3 million barrels were sold, with revenues totaling approximately $320 million.
- From FY 2017 through FY 2019 (three consecutive years) – sell 10 million barrels of crude oil in FY 2017, 9 million barrels in FY 2018, and 6 million barrels in FY 2019, for a total of 25 million barrels. Proceeds will be deposited in the General Fund of the Treasury (21st Century Cures Act, Section 5010).
- From FY 2023 through FY 2025 (three consecutive years) – sell 16 million barrels of crude oil in FY 2023, 25 million barrels in FY 2024, and 25 million barrels in FY 2025, for a total of 66 million barrels. Proceeds will be deposited in the General Fund of the Treasury (Fixing America's Surface Transportation Act, Section 32204).
- From FY 2026 through FY 2027, sell 7 million barrels of crude oil. Proceeds shall be deposited in the General Fund of the Treasury during the fiscal year in which the sale occurs (Public Law 115-466; Reconciliation pursuant to Titles II and V of the concurrent resolution on the budget for fiscal year 2018)

Drawdown costs for the FY 2017 oil sales were solely financed with $7,400,000 of prior year Test Sale balances. This FY 2019 budget request assumes inclusion of language in the General Provisions enabling the program to sell up to 1 million barrels of SPR crude oil to fund the cost of drawdown operations. The current drawdown cost estimate for FY 2019 is approximately $10 million. Balances from the sale of up to 1 million barrels in excess of FY 2019 drawdown costs will be apportioned and allotted to future fiscal years.

*Northeast Gasoline Supply Reserve*

Consistent with the FY 2018 budget request, the Administration is proposing to disestablish the NGSR in this FY 2019 budget request. The NGSR has not been utilized and has cost efficiency and operational functionality issues, as previously outlined.

**SPR Petroleum Account Funding**
**($K)**

| | FY 2017 Enacted** | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **SPR Petroleum Account** | | | | |
| Petroleum Acquisition, Transportation and Drawdown | 7,364 | --- | 9,912 | +2,548 |
| Use of Crude Oil Sale Proceeds | 0 | --- | -9,912 | -9,912 |
| Northeast Gasoline Supply Reserve | 0 | --- | 3,000 | +3,000 |
| Use of Prior Year Balances | -7,364 | --- | -3,000 | +4,364 |
| **Total, SPR Petroleum Account** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

** $4,900,000 in unobligated balances was utilized to fund the drawdown operations for FY 2017 non-emergency oil sales directed by Section 404 of the Bipartisan Budget Act of 2015 and Section 5010 of the 21st Century Cures Act. Another $2,500,000 in unobligated balances was utilized for Hurricane Harvey Exchanges.

**Strategic Petroleum Reserve – Petroleum Account**
**Explanation of Major Changes**
**($K)**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **SPR Petroleum Account** | | |
| **Petroleum Acquisition, Transportation and Drawdown $0** | **$0** | **+$0** |
| *Non-Emergency Drawdown*<br>• Drawdown costs for Hurricane Harvey Exchange as well as non-emergency, multi-year oil sales directed by Sections 403 and 404 of the Bipartisan Budget Act of 2015 (P.L. 114-74) and Section 5010 of the 21st Century Cures Act (P.L. 114-255) used prior year balances.. | • Program requests authorization to sell one million barrels of SPR crude oil to fund the cost of drawdown operations. | • No change. |
| **NGSR $0** | **$0** | **+$0** |
| • Continue commercial storage leases and oversight/administration activities financed for 4.5 years with 2014 Test Sale proceeds. | • Commercial storage contracts expire on December 31, 2018, therefore, the Department maintains the proposal made in the FY 2018 request to disestablish and liquidate the NGSR using prior year balances. | • No change. |

**Strategic Petroleum Reserve – Petroleum Account**

**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Multi-Year Oil Sales - Ensure cost efficiency of drawdown operations while meeting mandates of all legislatively-directed oil sales.** | | |
| Target | N/A | N/A | • Annual drawdown costs < 1.5% of revenue earned |
| Result | N/A | N/A | TBD |
| Endpoint Target | Achieve annual drawdown costs of <1.5% of revenue earned. | | |

**Energy Security and Infrastructure Modernization Fund**
**Proposed Appropriation Language**

*As authorized by section 404 of the Bipartisan Budget Act of 2015 (Public Law 114–74; 42 U.S.C. 6239 note), the Secretary of Energy shall drawdown and sell not to exceed [$350,000,000] $300,000,000 of crude oil from the Strategic Petroleum Reserve in fiscal year 2019: Provided, That the proceeds from such drawdown and sale shall be deposited in the Energy Security and Infrastructure Modernization account during fiscal year 2019: Provided further, That such amounts shall remain available until expended for necessary expenses to carry out modernization activities for the Strategic Petroleum Reserve.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

Reflects the financing structure of multi-year (FY 2017 – FY 2020) oil sales that will support SPR Modernization Program activities.

**Public Law Authorizations**
Public Law 114-74, "Bipartisan Budget Act of 2015"

**Energy Security and Infrastructure Modernization Fund**
**($K)**

| FY 2017 Enacted** | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 340,000 | --- | 300,000[1] |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**FY2017 Omnibus authorized oil sales target of $340,000,000. Actual proceeds were $323,196,000.

**Overview**

Section 404 of the Bipartisan Budget Act of 2015 directed the Secretary to establish an SPR Modernization Program to protect the United States economy from the impacts of emergency supply disruptions. The Energy Security and Infrastructure Modernization (ESIM) Fund was established in 2016 for the purpose of providing for the construction, maintenance, repair, and replacement of SPR facilities. In establishing the ESIM Fund, Congress made the following findings: 1. The SPR is one of the nation's most valuable energy security assets; 2. The age and condition of the SPR have diminished its value as a federal energy security asset; 3. Global oil markets and the location and amount of U.S. oil production and refining capacity have dramatically changed in the 40 years since the establishment of the SPR; and 4. Maximizing the energy security value of the SPR requires a modernized infrastructure that meets the drawdown and distribution needs of changed domestic and international oil and refining market conditions.

Section 404 also authorizes the drawdown and sale of crude oil from the Strategic Petroleum Reserve (SPR) up to $2 billion worth of SPR crude oil over four fiscal years (2017 through 2020) to finance an SPR Modernization Program. The Administration's FY 2018 Budget Request included a provision proposing changes that would reduce funding for SPR modernization from $2 billion to $1 billion. The SPR Modernization Program is currently composed of two distinct projects as outlined below. However, the Administration is currently re-evaluating the Marine Terminal Distribution Capability Enhancements project.

- The Life Extension Phase II project will modernize aging SPR infrastructure through systems upgrades and equipment replacement to ensure the SPR is able to meet mission requirements and maintain operational readiness for the next several decades.

- The Marine Terminal Distribution Capability Enhancements project will increase the SPR's effective distribution capability (the ability to add incremental barrels of crude oil to the market without displacing domestically produced oil and Canadian imports) during an oil supply disruption through the construction of new marine terminals, pipelines, and associated facilities. The project's scope will be re-evaluated pending development of finalized policy guidance with the Administration.

**Highlights and Major Changes in the FY 2019 Budget Request**

This FY 2019 funding level continues the financing structure for multi-year (FY 2017 – FY 2020) oil sales that support an effective SPR Modernization Program.

[1] Budget Request is offset by Crude Oil Sales revenue Offsetting Collections

**Energy Security and Infrastructure Modernization Fund**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted** | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Energy Security and Infrastructure Modernization Fund** | | | | |
| Oil Sale Revenue Targets | 340,000 | --- | 300,000 | -40,000 |
| Crude Oil Sales Revenue Offsetting Collections | -340,000 | --- | -300,000 | +40,000 |
| **Total, Energy Security and Infrastructure Modernization Fund** | **0** | **0** | **0** | **0** |
| **Federal FTEs** | **19** | **19** | **19** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).
**FY2017 Omnibus authorized oil sales target of $340,000,000. Actual proceeds were $323,196,000.

## Energy Security and Infrastructure Modernization Fund

**Overview**

Section 404 of the Bipartisan Budget Act of 2015 authorizes the drawdown and sale of crude oil from the Strategic Petroleum Reserve (SPR) up to the amount of the authorized revenue ceiling over four fiscal years (FY 2017 – FY 2020) to finance the modernization of the SPR. The Energy Security and Infrastructure Modernization Fund was established in FY 2016 to provide for the construction, maintenance, repair, and replacement of SPR facilities for the purpose of funding an SPR Modernization Program.

The Fund is organized into two subprograms: (1) Life Extension Phase II and (2) Marine Terminal Distribution Capability Enhancements. The Life Extension Phase II subprogram will modernize aging SPR infrastructure through systems upgrades and associated equipment replacement to ensure that the Reserve is able to meet its mission requirements and maintain operational readiness for the next several decades. The Marine Terminal Distribution Capability Enhancements subprogram will increase the effective distribution capacity of the SPR through the construction of new marine terminals, pipelines, and associated facilities. The Major Milestones (approved and estimated) for the two SPR Modernization Program projects, which have not yet been baselined, are as follows:

Life Extension Phase II Critical Decisions (CD):

- CD-0 Approve Mission Need – FY 2016 (Approved October 2015)
- CD-1 Approve Alternative Selection and Cost Range (Approved December 2016)
- CD-3A Approve Long Lead Time Equipment Procurement Items (Bryan Mound, Big Hill, West Hackberry) – FY 2017 (Approved July 2017)
- CD-3A Approve Long Lead Time Equipment Procurement Items (Bayou Choctaw) – FY 2018
- CD-2 Approve Performance Baseline– FY 2019
- CD-3 Approve Start of Construction– FY 2019
- CD-4 Approve Project Completion – FY 2022

Marine Terminal Distribution Capability Enhancements Critical Decisions (CD):

- CD-0 Approve Mission Need – FY 2016 (Approved August 2016)
- CD-1 through CD-4: To Be Determined

Life Extension**:** The Life Extension Phase II project will extend SPR equipment and infrastructure capabilities for an additional 25 years. The project involves work at the Bryan Mound, Big Hill, West Hackberry, and Bayou Choctaw storage sites. The major components of work activities at each site are:

- Bryan Mound and Big Hill: Process Piping, Pipelines, Process & Rotating Equipment
- West Hackberry: Brine System, Civil and Security Systems, Process Piping, and Process Equipment
- Bayou Choctaw: Brine Disposal System, Degas Plant, Roadways and Lighting, Security and Electrical Systems

Marine Terminal Enhancements: The SPR's Marine Terminal Enhancement (MTE) project will address the strategic energy requirement to meet the SPR's distribution capability gap. The project is currently being re-evaluated pending development of finalized policy guidance within the Administration.

**Energy Security and Infrastructure Modernization Fund Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Energy Security and Infrastructure Modernization Fund** | | | | |
| Oil Sale Revenue Targets | 340,000 | --- | 300,000 | -40,000 |
| Crude Oil Sales Revenue Offsetting Revenue Collections | -340,000 | --- | -300,000 | +40,000 |
| **Total, Energy Security and Infrastructure Modernization Fund** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Energy Security and Infrastruture Modernization Fund**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Oil Sale Revenue Targets:** The decrease reflects ESIM oil sale targets necessary toward funding the SPR Modernization Program. | |
| **Total, Energy Security and Infrastructure Modernization Fund** | **-40,000** |

**Energy Security and Infrastructure Modernization Fund**
**Life Extension Phase II**

**Description**
The Life Extension Phase II subprogram funds activities to modernize aging SPR infrastructure through systems upgrades and associated equipment replacement to ensure the ability to maintain operational and drawdown readiness capability. The scope of work includes system upgrades and associated equipment replacement for the following systems:

- Crude oil transfer systems
- Raw water systems
- Power distribution and electrical systems
- Physical security systems
- Firefighting systems
- Crude oil processing (degasification) plant
- Auxiliary systems and facilities

Revisions to the project's scope of work may occur between now and CD-2 approval. Once the project technical baseline for final scope of work, cost, and schedule is approved (anticipated in fourth quarter of FY 2019), start of construction activities will begin.

**FY 2019 – FY 2022 Key Milestones**
- Life Extension CD-2 Approve Performance Baseline – FY 2019.
- Life Extension CD-3 Approve Start of Construction Project Execution – FY 2019.
- Life Extension CD-4 Approve Project Completion – FY 2022

**Energy Security and Infrastructure Modernization Fund**
**Marine Terminal Distribution Capability Enhancements**

**Description**

The Marine Terminal Distribution Capability Enhancements subprogram funds activities to increase the effective distribution capability of the SPR (the ability to add incremental barrels of crude oil to the market without displacing domestically produced oil or Canadian imports) during an oil supply disruption through the construction of new marine terminals, pipelines, and associated facilities within the SPR's distribution system. The project is currently being re-evaluated pending development of finalized policy guidance within the Administration.

**FY 2019 – FY 2022 Key Milestones**

- To Be Determined

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **SPR Modernization** | | |
| **$340,000,000** | **$300,000,000** | **-40,000,000** |
| • Provided the first year of revenue targets from crude oil sales. The oil sales timeline established in the Bipartisan Budget Act of 2015 is limited to FY 2017 through FY 2020. Collection of oil sale receipts will be allocated towards the project's Total Estimated Cost in support of design; construction; construction management; and project management. | • Provides the third year of revenue targets from crude oil sales. Collection of oil sale receipts will be allocated towards the project's Total Estimated Cost in support of construction; construction management; and project management. | • Decrease in the level of oil sale proceeds required to meet the Life Extension 2 obligation schedule. |

## Management Funding
## ($K)

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **ESIM Program Direction** | | | | |
| Salaries and Benefits | 2,670 | --- | 2,860 | +190 |
| Travel | 36 | --- | 46 | +10 |
| Other Related Expenses | 100 | --- | 100 | 0 |
| **Total, Management** | **2,806** | **---** | **3,006** | **+200** |
| **Federal FTEs** | **19** | **---** | **19** | **0** |

**Energy Security and Infrastructure Modernization**
**Performance Measures**

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **SPR Modernization Project - Ensure project schedule and cost efficiency through achievement of satisfactory performance index scores that assess the magnitude of variation from the established schedule and cost baselines.** | | |
| Target | N/A | N/A | 0.85 on both the Cost and Schedule Performance Index |
| Result | N/A | N/A | TBD |
| Endpoint Target | Reach overall .90 Score on both the Cost and Schedule Performance Index at project closeout in 2022. | | |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Strategic Petroleum Reserve | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **National Energy Technology Lab** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 456 | 456 | 456 |
| **Total, National Energy Technology Lab** | **456** | **456** | **456** |
| **Oak Ridge National Laboratory** | | | |
| **SPR Econometric Modelling Support** | | | |
| Management | 489 | 560 | 570 |
| **Total, Oak Ridge National Laboratory** | **489** | **560** | **570** |
| **Sandia National Laboratories** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 3,490 | 2,670 | 3,220 |
| **Total, Sandia National Laboratories** | **3,490** | **2,670** | **3,220** |
| **Strategic Petroleum Reserve - Bayou Choctaw** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 14,339 | 13,017 | 11,419 |
| **Total, Strategic Petroleum Reserve - Bayou Choctaw** | **14,339** | **13,017** | **11,419** |
| **Strategic Petroleum Reserve - Big Hill** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 25,538 | 19,956 | 23,601 |
| **Total, Strategic Petroleum Reserve - Big Hill** | **25,538** | **19,956** | **23,601** |
| **Strategic Petroleum Reserve - Bryan Mound** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 19,057 | 16,923 | 19,298 |
| **Total, Strategic Petroleum Reserve - Bryan Mound** | **19,057** | **16,923** | **19,298** |
| **Strategic Petroleum Reserve - West Hackberry** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 32,520 | 20,679 | 19,888 |
| **Total, Strategic Petroleum Reserve - West Hackberry** | **32,520** | **20,679** | **19,888** |
| **Strategic Petroleum Reserve Project Office** | | | |
| **SPR Geotechnical Analytical Support** | | | |
| SPR - Facilities Development | 100,246 | 81,341 | 71,249 |
| **SPR Econometric Modelling Support** | | | |
| Management | 18,354 | 15,958 | 16,974 |
| **Total, Strategic Petroleum Reserve Project Office** | **118,600** | **97,299** | **88,223** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Strategic Petroleum Reserve | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Washington Headquarters** | | | |
| **SPR Econometric Modelling Support** | | | |
| Management | 8,511 | 8,440 | 8,430 |
| **Total, Washington Headquarters** | **8,511** | **8,440** | **8,430** |
| **Total, Strategic Petroleum Reserve** | **223,000** | **180,000** | **175,105** |

# Northeast Home Heating Oil Reserve

# Northeast Home Heating Oil Reserve

**Northeast Home Heating Oil Reserve**
**Proposed Appropriation Language**

*For necessary expenses for the Northeast Home Heating Oil Reserve storage, operation, and management activities pursuant to the Energy Policy and Conservation Act, [$6,500,000] $10,000,000 to remain available until expended.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

New budget authority of $10,000,000 is required in FY 2019 to maintain Northeast Home Heating Oil Reserve storage, operation, and management activities.

**Public Law Authorizations**

- P.L. 109-58, Energy Policy Act of 2005

**Northeast Home Heating Oil Reserve**

**($K)**

| FY 2017 Enacted[1] | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 6,497[2] | 6,456 | 10,000 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

FY 2018 Annualized CR assumes the use of $3,500 in prior year balances to offset requirements.

**Overview**

The Northeast Home Heating Oil Reserve (NEHHOR) provides a short-term supplement to the Northeast commercial system's supply of heating oil, in the event of a supply interruption. In FY 2012, NEHHOR converted from 2 million barrels of high sulfur heating oil to 1 million barrels of ultra-low-sulfur diesel (ULSD) to meet new Northeast states' emission standards. Leased commercial storage contracts went into effect on April 1, 2016, with the final option year extending through March 31, 2020. In FY 2019 the program will continue to operate the existing one million barrel reserve. The Department plans to reexamine the utility of continuing the reserve beyond the expiration of current storage contracts early 2020.

**Highlights and Major Changes in the FY 2019 Budget Request**

FY 2019 activities will focus on oversight, management and quality analysis of the Reserve, as well as ongoing information technology support for the Reserve's sales system.

[1] Does not include the use of prior-year funds.

[2] Program received a direct appropriation of $6,500,000 in FY 2017; $2,595.69 in FY 2015 balances were rescinded, per Section 307 of the Consolidated Appropriations Act, 2017.

**Northeast Home Heating Oil Reserve**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Northeast Home Heating Oil Reserve** | | | | |
| Northeast Home Heating Oil Reserve | 10,500 | --- | 10,000 | -500 |
| **Subtotal, Northeast Home Heating Oil Reserve** | **10,500** | **---** | **10,000** | **-500** |
| Use of Prior Year Balances | -4,000 | --- | 0 | +4000 |
| **Subtotal, Northeast Home Heating Oil Reserve** | **6,500** | **---** | **10,000** | **+3,500** |
| Section 307 Rescission of Prior Year Balances | -3 | --- | 0 | +3 |
| **Total, Northeast Home Heating Oil Reserve** | **6,497** | **---** | **10,000** | **+3,503** |
| **Federal FTEs** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

## Northeast Home Heating Oil Reserve

### Overview

Of all the households in the United States that use heating oil as fuel to heat their homes, the majority reside in the Northeast region of the country, making this area especially vulnerable to fuel oil disruptions. In 2000, the NEHHOR was created to provide protection from severe heating oil supply disruptions throughout the Northeast. The NEHHOR provides a short-term supplement to the Northeast system's commercial supply of heating oil in the event of a supply interruption. The NEHHOR is designed to augment, but not replace, commercial supplies during an emergency. It provides a buffer to assist the heating oil industry in mitigating short-term supply interruptions. The NEHHOR is a valuable component of U.S. energy security, separate from the Strategic Petroleum Reserve.

### Highlights of the FY 2019 Budget Request

The NEHHOR request will fund leased commercial storage contracts, oversight, management, information technology sales system support, and quality analysis by an independent quality assurance and inspection service. New FY 2019 budget authority of $10,000,000 will fund FY 2019 leased commercial storage contracts and associated oversight costs.

**Northeast Home Heating Oil Reserve Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Northeast Home Heating Oil Reserve** | | | | |
| Commercial Leases | 10,000 | --- | 9,200 | -800 |
| Information Technology Support | 400 | --- | 700 | +300 |
| Quality Control and Analysis | 100 | --- | 100 | 0 |
| **Subtotal, Northeast Home Heating Oil Reserve** | **10,500** | --- | **10,000** | **-500** |
| Use of Prior Year Balances | -4,000 | **---** | 0 | +4,000 |
| **Subtotal, Northeast Home Heating Oil Reserve** | **6,500** | --- | **10,000** | **+3,500** |
| Section 307 Rescission of Prior Year Balances | -3 | **---** | 0 | +3 |
| **Total, Northeast Home Heating Oil Reserve** | **6,497** | --- | **10,000** | **+3,503** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Northeast Home Heating Oil Reserve**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Northeast Home Heating Oil Reserve:** New budget authority of $10,000,000 is required to cover full program requirements in FY 2019, to include the full cost of leased commercial storage contracts, information technology support costs, and costs for product quality control and analysis. In FY 2017, prior-year balances supplemented new budget authority to fund Information Technology Support. | **+3,503** |
| **Total, Northeast Home Heating Oil Reserve** | **+3,503** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Northeast Home Heating Oil Reserve Account | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Undesignated Lab/Plant/Installation** | | | |
| **Northeast Home Heating Oil Reserve** | | | |
| Northeast Home Heating Oil Reserve | 9,114 | 9,076 | 9,038 |
| **Total, Undesignated Lab/Plant/Installation** | **9,114** | **9,076** | **9,038** |
| **Washington Headquarters** | | | |
| **Northeast Home Heating Oil Reserve** | | | |
| Northeast Home Heating Oil Reserve | 1,386 | 1,424 | 962 |
| **Total, Washington Headquarters** | **1,386** | **1,424** | **962** |
| **Total, Northeast Home Heating Oil Reserve Account** | **10,500** | **10,500** | **10,000** |

# Power Marketing Administrations

# Power Marketing Administrations

**Power Marketing Administrations**

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# Southeastern Power Administration

# Southeastern Power Administration

**Southeastern Power Administration**
**Proposed Appropriation Language**

*For necessary expenses of operation and maintenance of power transmission facilities and of marketing electric power and energy, including transmission wheeling and ancillary services, pursuant to section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), as applied to the Southeastern Power Administration (Southeastern or SEPA) marketing area, $6,500,000, including official reception and representation expenses in an amount not to exceed $1,500, to remain available until expended: Provided, That notwithstanding 31 U.S.C. 3302 and section 5 of the Flood Control Act of 1944, up to $6,500,000, collected by the Southeastern Power Administration from the sale of power and related services shall be credited to this account as discretionary offsetting collections, to remain available until expended for the sole purpose of funding the annual expenses of the Southeastern Power Administration: Provided further, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year 2019 appropriation estimated at not more than $0: Provided further, That, notwithstanding 31 U.S.C. 3302, up to $59,360,000 collected by the Southeastern Power Administration pursuant to the Flood Control Act of 1944 to recover purchase power and wheeling expenses shall be credited to this account as offsetting collections, to remain available until expended for the sole purpose of making purchase power and wheeling expenditures: Provided further, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred (excluding purchase power and wheeling expenses).*

Note.—A full-year 2018 appropriation was not enacted at the time the budget was prepared; therefore, the budget assumes operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

No changes.

**Public Law Authorizations:**
**Public Law 78-534, Flood Control Act of 1944**
**Public Law 95-91, DOE Organization Act of 1977, Section 302**
**Public Law 101-1-1, Title III, Continuing Fund (amended 1989)**
**Public Law 102-486, Energy Policy Act of 1992**

**Southeastern Power Administration**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|---|
| Gross | 84,929 | 84,352 | 79,684 |
| Offsets | -84,929 | -84,352 | -79,684 |
| **Net BA** | 0 | 0 | 0 |

*A full-year 2018 appropriation was not enacted at the time the budget was prepared; therefore, the budget assumes operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. These amounts are shown only at the Congressional control level and above, below that level, a dash (-) is shown.

**Overview**

Southeastern Power Administration (Southeastern or SEPA) exists to carry out the functions assigned by the Flood Control Act of 1944: to market the electric power and energy generated by the Federal reservoir projects to public bodies and cooperatives in the southeastern United States in a professional, innovative, customer-oriented manner, while continuing to meet the challenges of an ever-changing electric utility environment through continuous improvement. Southeastern provides 485 public power customers with 3,392 megawatts of hydroelectric capacity from 22 Federal multipurpose projects, operated by the U.S. Army Corps of Engineers (Corps) at cost based rates.

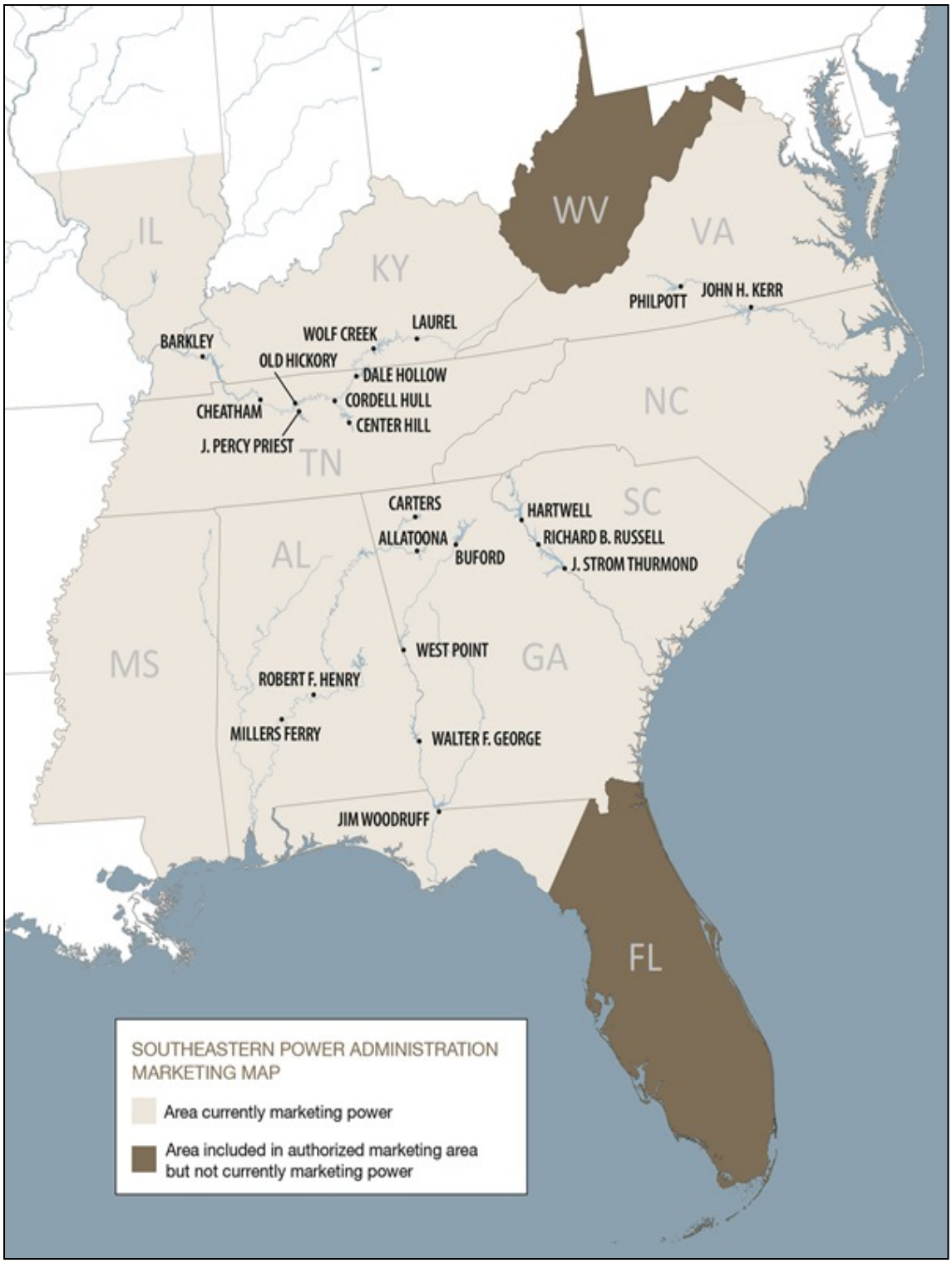
Annually, Southeastern produces an average of 7,613 gigawatt-hours of clean renewable hydroelectric energy. Southeastern maintains and upgrades its energy infrastructure to ensure reliable and efficient delivery of Federal power. Southeastern promotes energy efficiency, renewable energy, and sound management of the dispatch and distribution of Federal hydroelectric power resources in the southeastern United States while also meeting national utility performance standards and balancing the diverse interests of other water resource stakeholders. This budget submission enables Southeastern to promote the effective management of hydroelectric resources.

Program Direction supports day-to-day agency operation and Purchase Power and Wheeling supports acquisition of replacement and pumping power along with contractually-required transmission services. Consistent with the authority provided in the FY 2010 Energy and Water Appropriations, the FY 2019 Budget provides funding for annual expenses (Program Direction) through discretionary offsetting collections derived from power receipts collected to recover those expenses.

**Highlights and Major Changes in the FY 2019 Budget Request**

Southeastern's request for FY 2019 decreases Purchase Power and Wheeling (-$5.745 million), reflecting changes in transmission rates and rainfall estimates, and increases Program Direction (+$0.500 million) based on more accurate cost estimates. The FY 2019 budget request includes a proposal to change SEPA's statutory rate structure requirement from cost recovery to a market based structure.

## Service Area Map



**Southeastern Power Administration**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Southeastern Power Administration** | | | | |
| Purchase Power and Wheeling (PPW) | 78,929 | 78,393 | 73,184 | -5,745 |
| Program Direction (PD) | 6,000 | 5,959 | 6,500 | +500 |
| **Subtotal, Southeastern Power Administration** | **84,929** | **84,352** | **79,684** | -5,245 |
| Offsetting Collections, PPW | -60,760 | -50,654 | -59,360 | +1,400 |
| Alternative Financing, PPW | -18,169 | -27,739 | -13,824 | +4,345 |
| Offsetting Collections, Annual Expenses, PD | -1,000 | -993 | -6,500 | -5,500 |
| Use of Prior Year Balances, PD | -5,000 | -4,966 | 0 | +5,000 |
| **Total, Southeastern Power Administration** | **0** | **0** | **0** | **0** |
| **Federal FTEs** | **44** | | **44** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

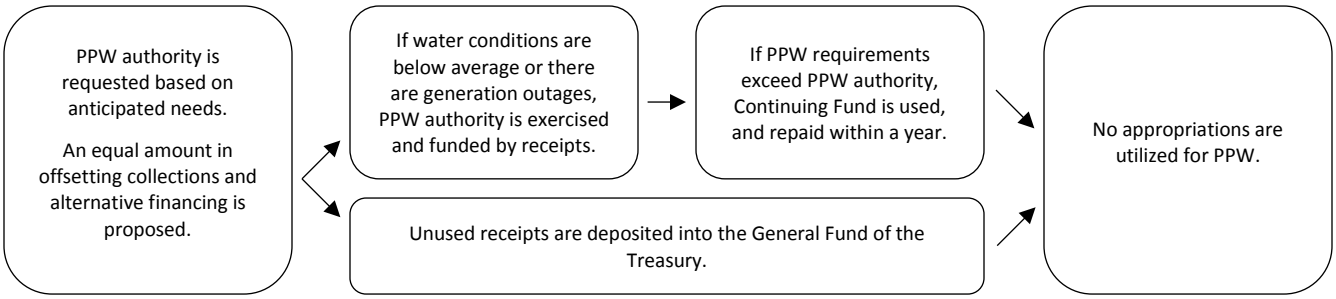
## Purchase Power and Wheeling

**Overview**

The mission of Purchase Power and Wheeling (PPW) is to provide funding for acquisition of transmission services, ancillary services for the system, pumping energy for the Richard B. Russell and Carters Pumped Storage units, and support of the Jim Woodruff Project. Southeastern must purchase power on the open market when its Federal generating assets cannot provide enough power to fulfill its contracts with its customers.

Additionally, because Southeastern does not own or operate any transmission infrastructure, transmission expenses are based on contracts with area transmission providers to deliver specified amounts of Federal power from the hydropower projects to Federal power customers. Southeastern has access to a continuing fund for emergency expenses necessary to ensure continuity of service. Southeastern has implemented a plan to repay any Purchase Power and Wheeling expenditures made through the Continuing Fund within one year.

The FY 2019 request uses customer receipts and net billing to pay for purchase power and wheeling expenses at no cost to the Federal Treasury. Some customers, acting independently or in partnerships, acquire replacement power and transmission services directly from suppliers. Southeastern will continue to assist its customers by arranging funding for these activities through alternative financing instruments, as needed.




**Highlights of the FY 2019 Budget Request**

The PPW subprogram supports Southeastern's mission to market and deliver reliable, cost-based hydroelectric power and related services. PPW enables Southeastern to wheel Federal power to preference customers, purchase replacement power, and acquire pumping energy to maximize the efficiency and benefits of Southeastern's hydropower resources. Power and services are marketed at rates designed to provide recovery of expenses and Federal investment, as established by law. The FY 2019 budget request includes a proposal to change SEPA's statutory rate structure requirement from cost recovery to a market based structure.

**Purchase Power & Wheeling Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Purchase Power** | | | | |
| Replacement Power | 5,876 | --- | 3,797 | -2,079 |
| Russell Project pumping power | 12,960 | --- | 12,944 | -16 |
| Carters Project pumping power | 12,457 | --- | 12,439 | -18 |
| Jim Woodruff Project support | 3,600 | --- | 2,600 | -1,000 |
| **Total, Purchase Power** | 34,893 | --- | 31,780 | -3,113 |
| **Wheeling** | | | | |
| Wheeling service charges | 39,272 | --- | 36,664 | -2,608 |
| Ancillary Services | 4,764 | --- | 4,740 | -24 |
| **Total, Wheeling** | 44,036 | --- | 41,404 | -2,632 |
| **Total, Purchase Power and Wheeling** | 78,929 | 78,393 | 73,184 | -5,745 |
| **Alternative Financing** | | | | |
| Net Billing | -18,169 | -27,739 | -13,824 | +4,345 |
| Subtotal, Purchase Power and Wheeling | 60,760 | 50,654 | 59,360 | -1,400 |
| Offsetting Collections Realized | -60,760 | -50,654 | -59,360 | +1,400 |
| **Total, Purchase Power and Wheeling Budget Authority** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Southeastern Power Administration**
**Purchase Power and Wheeling**
**($K)**

**Activities, Milestones, and Explanation of Changes**

| FY 2017 Request | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Purchase Power and Wheeling $78,929** | **$73,184** | **-$5,745** |
| **Purchase Power $34,893** | **$31,780** | **-$3,113** |
| • On-Peak Replacement Power, purchased to meet contract minimum service in drought conditions.<br>• Off-Peak Pumping Power, purchased to supplement stream flow energy demand.<br>• Jim Woodruff System Generating Support required for high river flows at low head plant. | • Continuing activities from prior year. | • The decrease in Purchase Power is due to expectation of improved rainfall and water condition factors used in calculating purchase power estimates. |
| **Wheeling $44,036** | **$41,404** | **-$2,632** |
| • Transmission expenses based on contracts with area transmission providers to deliver specified amounts of Federal power from the hydropower projects to Federal power customers. | • Continued funding supports ongoing activities. | • The decrease is due to variations in transmission rates. |

## Program Direction

### Overview

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Southeastern Power Administration. Provision is made for negotiation and administration of transmission and power contracts, collections of revenues, accounting and budget activities, development of wholesale power rates, amortization of the Federal power investment, energy efficiency and competitiveness programs, investigation and planning of proposed water resources projects, scheduling and dispatch of power generation, scheduling storage and release of water, administration of contractual operation requirements, and determination of methods of operating generating plants individually and in coordination with others to obtain maximum allowable utilization of resources.

### Highlights of the FY 2019 Budget Request

The FY 2019 Budget Request provides for the continuation of Southeastern's activities related to Program Direction at the level necessary to meet mission requirements.

## Program Direction Funding
## ($K)

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Program Direction Summary** | | | | |
| **Southeastern Power Administration** | | | | |
| Salaries and Benefits | 4,400 | --- | 4,800 | +400 |
| Travel | 120 | --- | 105 | -15 |
| Support Services | 50 | --- | 5 | -45 |
| Other Related Expenses | 1,430 | --- | 1,590 | +160 |
| **Total, Program Direction** | **6,000** | **5,959** | **6,500** | +500 |
| **Federal FTEs** | **44** | | **44** | **0** |
| **Support Services and Other Related Expenses** | | | | |
| Support Services | | | | |
| Management and Professional Support Services | 50 | --- | 5 | -45 |
| **Total, Support Services** | **50** | **---** | **5** | -45 |
| **Other Related Expenses** | | | | |
| Training | 10 | --- | 20 | +10 |
| Communications, Utilities, Misc. | 192 | --- | 177 | -15 |
| Equipment | 41 | --- | 81 | +40 |
| Maintenance Agreements | 74 | --- | 175 | +101 |
| Rent to GSA | 338 | --- | 352 | +14 |
| Rent to Others | 3 | --- | 0 | -3 |
| Tuition | 5 | --- | 10 | +5 |
| Contract Services | 404 | --- | 400 | -4 |
| Audit of Financial Statements | 254 | --- | 246 | -8 |
| Supplies and Materials | 69 | --- | 77 | +8 |
| Working Capital Fund | 37 | --- | 47 | +10 |
| Printing and Reproduction | 3 | --- | 5 | +2 |
| **Total, Other Related Expenses** | **1,430** | **---** | **1,590** | +160 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Program Direction**
**($K)**

**Activities, Milestones, and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $6,000** | **$6,500** | **+$500** |
| **Salaries and Benefits $4,400** | **$4,800** | **+$400** |
| • The funding supports Federal salaries and benefits for 44 FTEs who market Federal hydropower, promote energy efficiency and renewable energy, administrative support, and workloads in cyber-security and operational reliability. These estimates are derived from the current year budgeted salaries, plus cost-of-living adjustments, promotions, within-grade increases, overtime, DOE-cascading performance awards, and retirement payouts for unused leave. | • Continue funding support for Federal salaries and benefits for 44 FTEs. | • Increase for inflationary purposes |
| **Travel $120** | **$105** | **-$15** |
| • Funding supports transportation and per diem expenses incurred for preference customer meetings, relocation expenses for new FTEs, contract negotiations, rate forums, Congressional hearings, site visits, and operations meetings with industry organizations. | • Continued funding supports ongoing activities. | • Continue greater use of conference calls, webinar sessions, internet training, and video conferencing. |
| **Support Services $50** | **$5** | **-$45** |
| • Funding supports preference customers' efforts in support of the Energy Policy Act of 2005. | • Continue funding for co-sponsored training support for municipal and cooperative utilities. | • Decrease reflects reduced customer interest in program funding. |
| **Other Related Expenses $1,430** | **$1,590** | **+$160** |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • Funding provides administrative support for the office, rent, communications, maintenance, contract services, supplies, materials, and equipment and support for cyber and physical security, training expenses for power operator certification, support for installation of electronic hardware and software for the operations center and provides maintenance to integrate real-time data from the control area and provides the data to other transmission operators and NERC. | • Continue funding support for Southeastern Power Administration's headquarters office. | • Increase reflects equipment purchases/replacements and required hardware and software updates along with inflationary increases. |

**Southeastern Power Administration**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **SEPA Operating Cost - Annual Operating Cost Performance: Provide power at the lowest possible cost by keeping total operation and maintenance cost per kilowatt-hour generated at or below the National median for public power for 100+ customers.** | | |
| Target | N/A | N/A | 0.068 $/KWh |
| Result | N/A | N/A | TBD |
| Endpoint Target | Control annual Operations and Maintenance costs, thereby providing power at the lowest possible cost. | | |
| Comment | Due to the seasonal nature of hydropower generation throughout the fiscal year, a rolling 1-year total will be calculated for both Operating & Maintenance (O&M) expense information as well as Net Generation. O&M data is obtained through the financial management system, while generation data is compiled from the power operations reports of each contributing generating agency. The annual target for each performance reporting cycle is determined by referencing the latest annual report on financial and operating ratios as published by the American Public Power Association (APPA). Specifically, SEPA will refer to the "Median Values by Customer Size Class" table. The APPA compiles benchmark information from both a survey instrument and data residing with the Energy Information Administration. | | |
| Performance Goal (Measure) | **SEPA Repayment of Federal Power Investment - Repayment of Investment Performance - Ensure unpaid investment (UI) is equal to or less than the allowable unpaid investment (AUI) in accordance with DOE Order RA 6120.2 and Reclamation Law.** | | |
| Target | 2,212 million dollars AU | <=2,138 million dollars AUI | 2,135 million dollars AU |
| Result | Met - 1,586 | TBD | TBD |
| Endpoint Target | Continue to meet legislated cost recovery requirements for timely repayment of Federal investment in maintaining financial integrity of projects/program. | | |

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **SEPA System Reliability Performance - NERC - Attain average North American Electric Reliability Corporation (NERC) compliance ratings for NERC Control Performance Standard 1 (CPS1) of greater than or equal to 100 percent.** | | |
| Target | 100 CPS1 Rating | 100 CPS1 Rating | 100 CPS1 rating |
| Result | Met - 266.3 | TBD | TBD |
| Endpoint Target | Ensure the reliability of the electrical grid by attaining a NERC CPS1 rating of equal to or greater than 100 percent each year. | | |
| Comment | CPS1 measures generation/load balance on one-minute intervals. | | |

**Additional Tables**
**Revenue and Receipts**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|---|---|
| Gross Revenues | 301,816 | 292,676 | 293,856 | 297,638 | 299,873 | 308,642 | 310,186 |
| Net Billing (Credited as an Offsetting Receipt) | -12,848 | -15,071 | -13,824 | -14,001 | -14,187 | -14,383 | -14,588 |
| Total Cash Receipts | 288,968 | 277605 | 280,032 | 283,637 | 285,686 | 294,259 | 295,598 |
| Use of Offsetting Collections to fund PPW | -60,760 | -59,985 | -59,360 | -60,422 | -61,638 | -62,913 | -64,251 |
| Use of Offsetting Collections to fund Annual Expenses | -998 | -6,379 | -6,500 | -6,655 | -6,697 | -6,834 | -6,871 |
| Total Receipts, net use of Offsetting Collections | 227,210 | 211,241 | 214,172 | 216,560 | 217,351 | 244,177 | 244,044 |
| Cumberland Rehabilitation | -47,765 | -40,000 | -40,000 | -40,000 | -40,000 | -40,000 | -40,000 |
| GA-AL-SC Rehabilitation | -2,588 | -20,000 | -20,000 | -20,000 | -20,000 | -20,000 | -20,000 |
| Kerr-Philpott Rehabilitation | -17,401 | -5,000 | -5,000 | -5,000 | -5,000 | -5,000 | -5,000 |
| Jim Woodruff | -0 | -1,000 | -1,000 | -1,000 | -1,000 | -1,000 | -1,000 |
| Accts Rec Yearly Difference | +3 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Proprietary Receipts | 159,459 | 145,241 | 148,172 | 150,560 | 151,351 | 158,512 | 158,476 |
| Percent of Sales to Preference Customers | 99% | 99% | 99% | 99% | 99% | 99% | 99% |
| Energy Sales and Power Marketed (megawatt-hours) | 6,044,945 | 7,886,000 | 7,886,000 | 7,886,000 | 7,886,000 | 7,886,000 | 7,886,000 |

**Alternative Financing**

| 2017 | Transmission | Purchase Power | Offsetting Collections | Net Billing | Appropriated Funds |
|---|---|---|---|---|---|
| Jim Woodruff System | 361 | 2,023 | -1,941 | -443 | 0 |
| Kerr-Philpott System | 9,044 | 18,136 | -27,180 | 0 | 0 |
| GA-AL-SC System | 3,687 | 30,651 | -31,347 | -2,991 | 0 |
| Cumberland System | 9706 | 0 | -565 | -9,414 | 0 |
| | 22,437 | 51,171 | -60,760 | -12,848 | 0 |

| 2018 | Transmission | Purchase Power | Offsetting Collections | Net Billing | Appropriated Funds |
|---|---|---|---|---|---|
| Jim Woodruff System | 230 | 2,600 | -2,130 | -700 | 0 |
| Kerr-Philpott System | 5,657 | 0 | -5,657 | 0 | 0 |
| GA-AL-SC System | 24,582 | 30,437 | -51,860 | -3,159 | 0 |
| Cumberland System | 11,550 | 0 | -338 | -11,212 | 0 |
| | 42,019 | 33,037 | -59,985 | -15,071 | 0 |

| 2019 | Transmission | Purchase Power | Offsetting Collections | Net Billing | Appropriated Funds |
|---|---|---|---|---|---|
| Jim Woodruff System | 230 | 2,600 | -2,130 | -700 | 0 |
| Kerr-Philpott System | 5,649 | 0 | -5,649 | 0 | 0 |
| GA-AL-SC System | 25,866 | 29,180 | -51,498 | -3,548 | 0 |
| Cumberland System | 9,659 | 0 | -83 | -9,576 | 0 |
| | 41,404 | 31,780 | -59,360 | -13,824 | 0 |

**Power Marketed, Wheeled, or Exchanged by Project**

| Project | State | Plants | Installed Capacity (KW) | FY 2017 Estimated Power (GWH) | FY 2018 Estimated Power (GWH) | FY 2019 Estimated Power (GWH) |
|---|---|---|---|---|---|---|
| Kerr-Philpott System | | | | 293 | 293 | 293 |
| John H. Kerr | VA-NC | 1 | 291,000 | | | |
| Philpott | VA | 1 | 15,000 | | | |
| Georgia-Alabama-South Carolina System | | | | 2,508 | 2,508 | 2,508 |
| Allatoona | GA | 1 | 82,000 | | | |
| Buford | GA | 1 | 127,000 | | | |
| Carters | GA | 1 | 600,000 | | | |
| J. Strom Thurmond | GA-SC | 1 | 364,000 | | | |
| Walter F. George | GA-AL | 1 | 160,000 | | | |
| Hartwell | GA-SC | 1 | 424,000 | | | |
| R. F. Henry | AL | 1 | 82,000 | | | |
| Millers Ferry | AL | 1 | 90,000 | | | |
| West Point | GA-AL | 1 | 87,000 | | | |
| Richard B. Russell | GA-SC | 1 | 656,000 | | | |
| Jim Woodruff Project | FL-GA | 1 | 43,500 | 148 | 148 | 148 |
| Cumberland System | | | | 2,481 | 2,481 | 2,481 |
| Barkley | KY | 1 | 130,000 | | | |
| Center Hill | TN | 1 | 135,000 | | | |
| Cheatham | TN | 1 | 36,000 | | | |
| Cordell Hull | TN | 1 | 99,900 | | | |
| Dale Hollow | TN | 1 | 54,000 | | | |
| Old Hickory | TN | 1 | 103,752 | | | |
| J. Percy Priest | TN | 1 | 28,000 | | | |
| Wolf Creek | TN | 1 | 270,000 | | | |
| Laurel | TN | 1 | 61,000 | | | |
| Total Power Marketed | | 22 | 3,939,152 | 5,430 | 5,430 | 5,430 |

**System Statistics**

| | FY 2017 Actual | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|---|
| Generating Capacity: | | | |
| Nameplate Capacity (KW) | 3,939,152 | 3,939,152 | 3,939,152 |
| Peak Capacity (KW) [a] | 4,330,000 | 4,330,000 | 4,330,000 |
| Generating Stations | | | |
| Generating Projects (Number) | 22 | 22 | 22 |
| Available Energy | | | |
| Energy from Stream-flow (MWH) | 5,017,529 | 4,685,000 | 4,685,000 |
| Energy generated from Pumping (MWH) | 865,299 | 745,100 | 745,100 |
| Energy Purchased for Replacement (MWH) | 162,117 | 157,640 | 157,640 |
| Total, Energy available for marketing [b] (MWH) | 6,044,945 | 5,587,740 | 5,587,740 |

[a] Southeastern markets capacity based on nameplate plus an overload factor. NERC requires that Southeastern keep a portion of the capacity in reserve for emergency purposes and to cover losses.

[b] Gross amount. Transmission losses are deducted from this amount to estimate the amount of energy marketed.

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Southeastern Power Admin. - Operation & Maint. | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Southeastern Power Administration** | | | |
| **Purchase Power and Wheeling** | | | |
| | 6,000 | 5,959 | 6,500 |
| | **84,929** | **84,352** | **79,684** |
| Purchase Power and Wheeling | 78,929 | 78,393 | 73,184 |
| **Program Direction** | | | |
| Program Direction | | | |
| **Total, Southeastern Power Administration** | | | |
| **Total, Southeastern Power Admin. - Operation & Maint.** | **84,929** | **84,352** | **79,684** |

# Southwestern Power Administration

# Southwestern Power Administration

**Southwestern Power Administration**
**Proposed Appropriation Language**

*For necessary expenses of operation and maintenance of power transmission facilities and of marketing electric power and energy, for construction and acquisition of transmission lines, substations and appurtenant facilities, and for administrative expenses, including official reception and representation expenses in an amount not to exceed $1,500 in carrying out section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), as applied to the Southwestern Power Administration, $45,802,000 to remain available until expended: Provided, That notwithstanding 31 U.S.C. 3302 and section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), up to $35,402,000 collected by the Southwestern Power Administration from the sale of power and related services shall be credited to this account as discretionary offsetting collections, to remain available until expended, for the sole purpose of funding the annual expenses of the Southwestern Power Administration: Provided further, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year 2019 appropriation estimated at not more than $10,400,000: Provided further, That, notwithstanding 31 U.S.C. 3302, up to $83,000,000 collected by the Southwestern Power Administration pursuant to the Flood Control Act of 1944 to recover purchase power and wheeling expenses shall be credited to this account as offsetting collections, to remain available until expended for the sole purpose of making purchase power and wheeling expenditures: Provided further, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred (excluding purchase power and wheeling expenses).*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

No changes.

**Public Law Authorizations**

Southwestern Power Administration:

- P.L. 78-534, Section 5, Flood Control Act of 1944
- P.L. 95–91, Section 302, DOE Organization Act of 1977
- P.L. 100-71, Supplemental Appropriations Act, 1987
- P.L. 101–101, Title III, Continuing Fund (amended 1989)
- P.L. 102-486, Section 721, Energy Policy Act of 1992
- P.L. 108-447, Appropriations Act, FY 2005
- P.L. 111-85, Appropriations Act, FY 2010

**Southwestern Power Administration**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|---|
| Gross | 140,898 | 83,984 | 159,876 |
| Offsets | -129,841 | -73,002 | -149,476 |
| **Net BA** | 11,057 | 10,982 | 10,400 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

Southwestern Power Administration's (Southwestern) mission is to market and reliably deliver Federal hydroelectric power, with preference to public bodies and cooperatives. This is accomplished by maximizing the use of Federal assets to repay the Federal investment, participating with other water resource users in an effort to balance diverse interests with power needs within broad parameters set by the U.S. Army Corps of Engineers (Corps), and implementing public policy.

Southwestern markets and delivers power at wholesale rates to 78 municipal utilities, 21 rural electric cooperatives, and 3 government entities in the six states of Arkansas, Kansas, Louisiana, Missouri, Oklahoma, and Texas. In turn, these customers distribute that power to nearly nine million end users in the six-state area. To integrate the operation of the Federal hydroelectric generating plants and to transmit power from 24 multi-purpose Corps dams to customers, Southwestern operates and maintains 1,380 miles of high-voltage transmission lines, 26 substations/switchyards, and 51 microwave and very high frequency (VHF) radio sites. Southwestern is headquartered in Tulsa, Oklahoma. The agency operates a dispatch center in Springfield, Missouri as well as maintenance facilities in Jonesboro, Arkansas; Gore, Oklahoma; and Springfield, Missouri.

Southwestern participates in the Southwest Power Pool (SPP) Regional Transmission Organization (RTO), which reinforces Southwestern's role as part of the Nation's interconnected generation and transmission system. In participation with the SPP RTO, Southwestern works on regional and interregional transmission policy initiatives in response to the evolution of the electric utility industry. Furthermore, with the integration of a large investor owned electric utility into the Midcontinent Independent System Operator (MISO) RTO, Southwestern coordinates its varied utility activities in conjunction with a broader group of stakeholders. As the demand for the transmission of power increases across regional and interregional footprints, maintaining the Nation's energy infrastructure, and coordination with the RTOs in Southwestern's marketing area has become more critical than ever. Southwestern assures the efficient and reliable delivery of Federal hydropower, thus fulfilling energy security for the present as well as for future generations.

Southwestern's marketing services and delivery capability provide for recovery of all annual operating costs, including the Corps' hydropower related costs, and for repayment of taxpayer investment in all assets and facilities that support the Federal hydropower program. Hydroelectric power is a domestic energy source that helps reduce American dependence on foreign energy supplies and provides American jobs. Southwestern produces an average of 5,570 gigawatt-hours of clean renewable hydroelectric energy annually.

Southwestern will use the following strategies to fulfill its mission

- Market and deliver, at the lowest possible cost, all available Federal hydropower generated at the Corps multipurpose projects and work with the Corps, states, cooperatives, and municipalities to meet its statutory requirements while balancing the interests of other water users.
- Maintain infrastructure and modernize systems to increase the reliability, efficiency, and use of Federal assets. This will be accomplished using appropriations; Federal power receipts; and alternative financing arrangements, which include net billing, bill crediting, and/or reimbursable authority (customer advances).[1]
- Conduct annual power repayment studies to ensure power rates are sufficient to repay all annual operating costs and the Federal investment with interest.
- Meet Southwestern's limited 1200-hour peaking power contractual obligations with necessary purchase power and wheeling using Federal power receipts; alternative financing arrangements, which include net billing, bill crediting, and/or reimbursable authority (customer advances); and the Continuing Fund as necessary in periods of below-average hydropower generation.
- Operate the transmission system efficiently to support the Nation's integrated power grid and engage in transmission policy initiatives within the RTOs in Southwestern's marketing area to respond effectively to the evolution of the electric utility industry.
- Meet requirements for Southwestern's compliance with the latest North American Electric Reliability Corporation (NERC) standards.
- Bolster Southwestern's cyber and physical security postures using best-available technologies and in cooperation with DOE and industry partners to protect the Federal transmission system and the Nation's power grid.

External factors that present potential adverse impacts to the overall achievement of the programs' strategic goals include weather, natural disasters, NERC reliability standards, industry deregulation, physical and cybersecurity, changing electric industry organizational structure, interconnections, open access, the uncertainty of sustainable funding resources, competing uses' demand for the limited water resource, and other unforeseen requirements. More specifically:

- The bulk of Southwestern's transmission infrastructure is approximately 60 years old and requires ongoing maintenance and replacement while concurrently balancing changing and increasing demands for availability.
- Industry efforts to improve the reliability of the Nation's power grid are placing more requirements on Southwestern's workforce to implement mandatory reliability standards.
- Southwestern continues to emphasize security, both cyber and physical, as an agency priority. Ongoing assessments, realigning vacant positions, investments in the cyber and physical security programs, and infrastructure protection improvements enable Southwestern to continue to provide a safe and reliable product.
- Southwestern competes with the rest of the electric utility industry to attract and retain the quality workforce needed to provide a reliable power supply and transmission service as Southwestern's workforce retires.
- Southwestern is increasingly challenged by more complex transmission policy developments including intricate energy and capacity markets, transmission planning processes, and technical rate structures; the deployment of new technologies such as renewables and distributed generation; and heightening emissions and environmental restrictions.

**Highlights of the FY 2019 Budget Request**

Southwestern requests a net appropriation of $10.4 million for FY 2019. Southwestern's appropriation consists of four subprograms: Operations and Maintenance, Construction, Purchase Power and Wheeling, and Program Direction. Consistent with the authority provided in the 2010 Energy and Water Appropriations, the FY 2019 Budget provides funding for annual expenses (Operations and Maintenance and Program Direction) through discretionary offsetting collections derived from power receipts collected to recover those expenses. Priority is being placed on maintenance, physical and cybersecurity, compliance, and cost containment.

[1] Southwestern's authority to use net billing and bill crediting is inherent in the authority provided by the Flood Control Act of 1944 and has been affirmed by the Comptroller General. Honorable Secretary of the Interior B-125127 (February 14, 1956).

Consistent with the FY 2018 Budget Request, the FY 2019 Budget Request includes the proposal that the Federal government be authorized to sell the transmission assets of Southwestern. The FY 2019 budget request also includes a proposal to change Southwestern's statutory rate structure requirement from cost recovery to a market based structure.

**Southwestern Power Administration**
**Funding by Congressional Control**
**($K)**

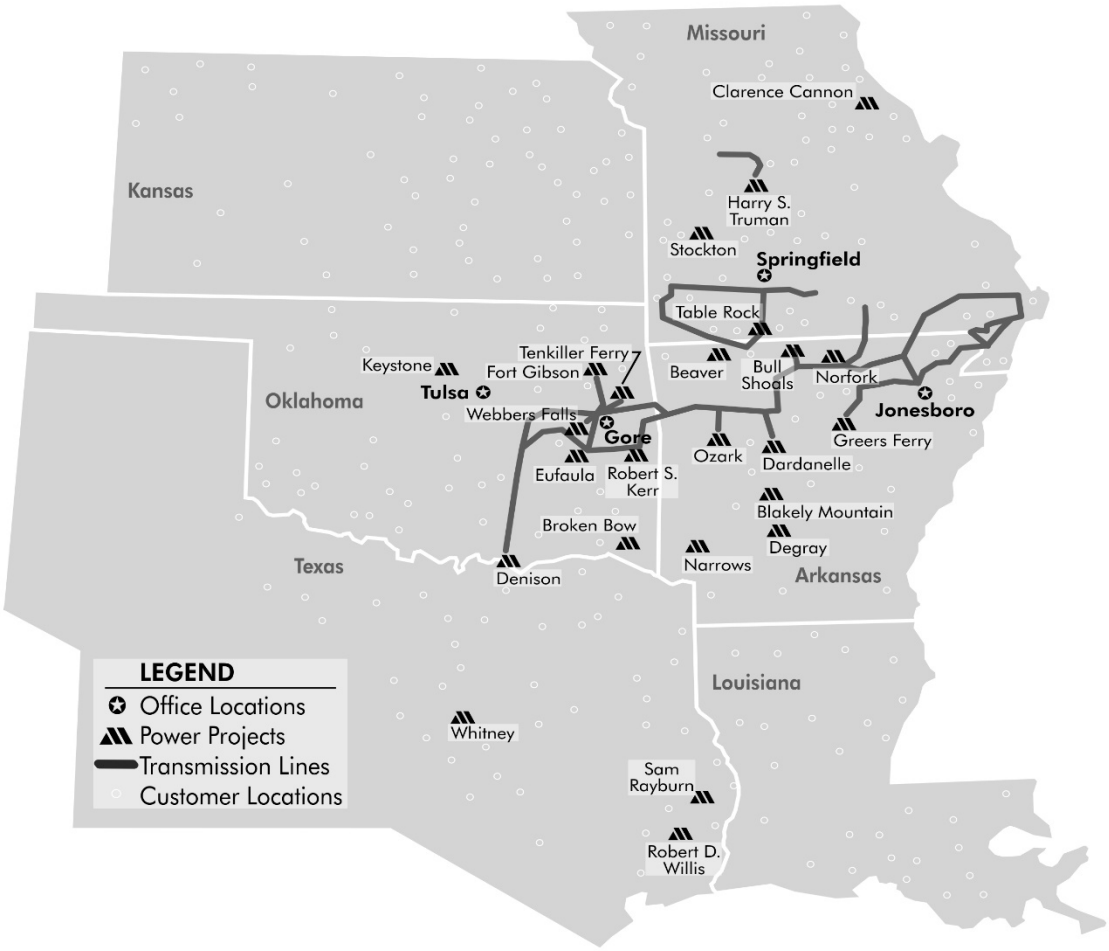
| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Operation and Maintenance** | | | | |
| Program Direction (PD) | 31,516 | 32,372 | 32,995 | +1,479 |
| Operations and Maintenance (O&M) | 13,896 | 16,680 | 17,006 | +3,110 |
| Construction (CN) | 12,486 | 14,932 | 16,875 | +4,389 |
| Purchase Power and Wheeling (PPW) | 83,000 | 20,000 | 93,000 | +10,000 |
| **Subtotal, Operation and Maintenance** | 140,898 | 83,984 | 159,876 | +18,978 |
| Offsetting Collections, PD (annual expenses) | -29,271 | -29,072 | -29,695 | -424 |
| Use of Prior Year Balances, PD (annual expenses) | 0 | 0 | 0 | 0 |
| Offsetting Collections, O&M (annual expenses) | -5,315 | -5,279 | -5,707 | -392 |
| Use of Prior Year Balances, O&M (annual expenses) | 0 | 0 | 0 | 0 |
| Offsetting Collections, PPW | -73,000 | -9,932 | -83,000 | -10,000 |
| Alternative Financing, O&M | -6,269 | -9,042 | -8,894 | -2,625 |
| Alternative Financing, CN | -5,986 | -9,609 | -12,180 | -6,194 |
| Alternative Financing, PPW | -10,000 | -10,068 | -10,000 | 0 |
| **Total, Operation and Maintenance** | 11,057 | 10,982 | 10,400 | -657 |
| | | | | |
| **Federal FTEs** | 194 | | 194 | 0 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Operation and Maintenance**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Operations and Maintenance:** The increase in the operations and maintenance subprogram reflects the acquisition or construction of a new facility, offset by a reduction in substation equipment purchases. | **+3,110** |
| **Construction:** The increase in the construction subprogram reflects rebuilding a total of 20.8 miles of transmission line. | **+4,389** |
| **Purchase Power and Wheeling:** The increase in system support reflects anticipated needs based on projected market prices. In recent years, Southwestern has relied upon its Purchase Power and Wheeling (PPW) receipt authority to fund its Purchased Power needs. Southwestern is only requesting the authority at the "worst case scenario" level; it has not and does not anticipate expending the full authority unless and until a severe water condition occurs in its six-state region. | **+10,000** |
| **Program Direction:** The increase in the program direction subprogram incorporates the on-boarding of hard to fill positions, back-filling retirees, anticipated costs for two replacement support service contracts that are due to be re-competed (including upfront costs), and the costs of the Human Resources Service Center. | **+1,479** |
| **Total, Southwestern, Operation and Maintenance** | **+18,978** |

## Service Area Map



**Southwestern Power Administration**
**Operations and Maintenance**

**Description**

The activities of the Operations and Maintenance (O&M) subprogram are critical components in maintaining the reliability of the Federal power system, which is part of the Nation's interconnected generation and transmission system. By marketing and delivering hydroelectric energy, Southwestern makes a meaningful contribution of clean, safe, reliable, affordable, and secure renewable hydroelectric energy to our Nation. The Energy Policy Act (EPACT), the National Energy Policy (NEP), and the Department of Energy (DOE) support Southwestern's important role in meeting electricity demand by supplying cost-based hydroelectric energy to its customers. These laws and policies emphasize the need to ensure safety, security, and reliability of the Nation's energy infrastructure.

Southwestern's planned O&M projects are subject to change due to unanticipated equipment failure, customer needs, and weather conditions. The realities of maintaining a complex interconnected electric power system periodically require unforeseen reprioritizations of planned projects. All projects share the commonality of maintaining, repairing, and improving the aging infrastructure to ensure the reliability of the Federal power system.

The budget request includes a proposal to authorize the Federal government to sell the transmission assets of Southwestern. Until such time as this proposal is approved, Southwestern will continue its plans for operating, maintaining, and replacing equipment.

Power Marketing

The Power Marketing activity funds technical and economic studies to support Southwestern's transmission planning, water resources management, and communication functions. Technical and economic studies provide data to analyze and evaluate the impacts of proposed operational changes and decision-making based on cost-benefit analysis. Funding is also required for Southwestern's coordination with the RTOs and to provide regional power restoration assistance to other non-hydropower generation sources during electric power grid emergencies. The National Electric Transmission Congestion Study identified constraints in the Nation's interconnected electrical grid which could impede power flows. Studies to identify any constraints on Southwestern's system will continue to be conducted. These studies show how the marketing and delivery of power is operationally impacted. In an effort to decrease annual expenses and the rate impacts to our customers, Southwestern plans to acquire or construct a new facility to house power schedulers, communications, cybersecurity, and administrative personnel. This request meets the Administration's goals of cutting costs, decreasing Federal spending, and reducing the overall Government footprint. The funding level for this activity is derived from Southwestern's engineering plan, negotiated architect/engineering contracts, and the number of studies required per year.

Operations

The Operations activity funds communication functions associated with the dispatch and delivery of power; environmental, safety, and health activities; and other transmission activity costs such as physical security, cybersecurity, and day-to-day power dispatch functions. The Operations activity includes three subactivities:

Communications

This subactivity funds telemetering improvements, technical support to protect cyber infrastructure, an e-tagging system that electronically schedules power for customers, load forecasting, digital test equipment, the radio frequency spectrum fee, and supplies and materials. The telemetering improvements include replacement of obsolete power and energy accounting equipment and modification of existing remote terminal units that improve the reliability of the power system, specifically in the areas of monitoring and control. Funding is required for upgrades that enable Southwestern to meet the goals of the EPACT, NEP, and NERC by replacing aging infrastructure while assuring reliability and continuing to coordinate with the RTOs in its marketing area. The funding level for communications maintenance is derived from maintenance history, the age of equipment, expected life span, annual diagnostic maintenance testing, and historical pricing information.

Environmental, Safety, and Health

This subactivity funds environmental activities including waste disposal and clean-up of oil and polychlorinated biphenyl contaminates from old circuit breakers and transformers, grounding and drainage, cultural resource reviews, and environmental assessments for threatened and endangered species. This subactivity also funds property transfers, wetland assessments, environmental library access, Toxic Substance Control Act and Resource Conservation Recovery Act compliance, contractor services, and requirements of the Environmental Protection Program as identified in DOE Order 450.1. The Safety and Health Program activities require funding for aviation safety, industrial hygiene, medical examinations, medical officer, wellness program, safety equipment, and first aid supplies.

Other Transmission

This subactivity funds physical security, field utility costs, and day-to-day power expenses of the dispatch center.

Maintenance

The Maintenance activity funds routine repair, maintenance, and improvement of Southwestern's substations/switchyards and high-voltage transmission lines and ensures delivery of reliable, efficient, and clean power to its customers. Southwestern's initial facilities, which were built approximately 60 years ago, are constantly evaluated. The funding level is based on analysis derived from age of equipment, risk of failure, life-cycle of equipment, and field crew evaluation. Internal and external factors include obsolescence of technology and unavailability of replacement parts. This budget request reflects Southwestern's assessment of the funding required to ensure continued reliability of the Federal power system and to fulfill the NERC operational criteria. The maintenance activity includes two subactivities:

Substation Maintenance

This subactivity funds power circuit breakers, disconnect switches, instrument transformers, protective relays and related equipment, computer aided drafting and design, revenue meters, vehicle maintenance, fuel, and other equipment to reliably perform general maintenance projects. Southwestern maintains the Federal power system in compliance with the regional electric reliability council and NERC requirements. The funding level for this subactivity is derived from an internal maintenance information system, which includes age and condition of the existing equipment.

Transmission Line Maintenance

This subactivity funds the purchase and maintenance of wood and steel structures, crossarms and braces, right-of-way (ROW) clearing, herbicide application, aerial patrol of the transmission system to identify maintenance needs, routine vehicle repair and maintenance, tractors, equipment, and fuel. The number of steel or wood poles and crossarms and high-voltage insulators replaced is derived from internal maintenance information system criteria. Emphasis has been placed on ROW clearing since NERC identified improper/insufficient ROW clearing as a major factor in potential blackouts. The funding level is appropriate for the number of structures and components to be replaced and the miles of ROW to be cleared as set forth by Southwestern's maintenance plan for meeting the goals of the EPACT, NEP, and NERC to maintain a reliable transmission system.

Capitalized Moveable Equipment

This activity funds the replacement of vehicles, tractor-trailers, and heavy equipment used for the maintenance and repair of the transmission system and facilities. These vehicles and equipment have exceeded their useful lives and require high levels of maintenance. The vehicle cost estimates are derived from General Services Administration (GSA) pricing schedules.

**Operations and Maintenance Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Operations and Maintenance (O&M)** | | | | |
| Power Marketing | 200 | --- | 4,200 | +4,000 |
| Operations | 5,756 | --- | 7,893 | +2,137 |
| Maintenance | 7,185 | --- | 3,088 | -4,097 |
| Capitalized Moveable Equipment | 755 | --- | 1,825 | +1,070 |
| **Subtotal, Operations and Maintenance** | **13,896** | **16,680** | **17,006** | **+3,110** |
| Offsetting Collections (annual expenses) | -5,315 | -5,279 | -5,707 | -392 |
| Use of Prior Year Balances, (annual expenses) | 0 | 0 | 0 | 0 |
| Alternative Financing | -6,269 | -9,042 | -7,894 | -1,625 |
| **Total, Operations and Maintenance** | **2,312** | **2,359** | **3,405** | **+1,093** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Operations and Maintenance $13,896,000** | **$17,006,000** | **+$3,110,000** |
| **Power Marketing $200,000** | **$4,200,000** | **+$4,000,000** |
| • The Power Marketing activity funds the technical and economic studies to support transmission planning. | • The Power Marketing activity funds the technical and economic studies to support transmission planning and the purchase or construction of a facility to reduce Southwestern's Federal real property footprint by 25%, reduce future costs by $21M over 30 years and eliminate unnecessary overhead expenses of approximately $1M annually, which equates to a 0.5 percent downward pressure on the power rates charged to customers. | • The increase reflects the acquisition of a new facility, any modifications needed and furniture purchases. |
| **Operations $5,756,000** | **$7,893,000** | **+$2,137,000** |
| *Communications ($4,404,000)*<br>• This subactivity funds telemetering improvements, technical support to protect cyber infrastructure, SCADA/EMS system maintenance, load forecasting, and digital testing equipment. | *Communications ($6,384,000)*<br>• Funding for this subactivity continues. | *Communications (+$1,980,000)*<br>• The increase reflects mobile radio system replacement, hardware and software in support of information technology. |
| *Environmental, Safety, and Health ($829,000)*<br>• The subactivity funds environmental, safety, and health services. | *Environmental, Safety, and Health ($798,000)*<br>• Funding for this subactivity continues. | *Environmental, Safety, and Health (-$31,000)*<br>• The decrease reflects a reduction in environmental updates and surveys required for FY 2019. |
| *Other Transmission ($523,000)*<br>• The subactivity funds physical security, field utility costs, and day to day expenses of the dispatch center. | *Other Transmission ($711,000)*<br>• Funding for this subactivity continues. | *Other Transmission (+$188,000)*<br>• The increase reflects an increase in security enhancements. |

| **Maintenance $7,185,000** | **$3,088,000** | **-$4,097,000** |
|---|---|---|
| *Substation ($4,190,000)*<br>• This subactivity funds all equipment, parts, and materials for the operation of high voltage substations. | Substation ($2,044,000)<br>• Funding for this subactivity continues. | *Substation (-$2,146,000)*<br>• The decrease reflects a reduction in the purchase of equipment. |
| *Transmission Line Maintenance ($2,995,000)*<br>• Funding for this subactivity continues with the addition of purchasing a Track Crane to access wetlands, croplands, and river bottoms. This will decrease outages, reduce equipment repairs, and provide a safer work site. | *Transmission Line Maintenance ($1,044,000)*<br>• Funding for this subactivity continues. | *Transmission Line Maintenance (-$1,951,000)*<br>• The decrease reflects completion of the river crossing replacement. |
| **Capitalized Moveable Equipment $755,000** | **$1,825,000** | **+$1,070,000** |
| • This activity funds the replacement of vehicles, tractor-trailers, and heavy equipment used for the maintenance and repair of the transmission system and facilities. | • This activity funds the replacement of vehicles, tractor-trailers, and heavy equipment used for the maintenance and repair of the transmission system and facilities. | • The increase reflects additional off-road heavy equipment utility trucks being replaced. |

**Southwestern Power Administration**
**Construction**

**Description**

The activities of the Construction subprogram enable Southwestern to market and deliver Federal hydropower in the most reliable, safe, efficient, and cost-effective manner to meet the operational criteria required by the North American Electric Reliability Corporation while avoiding transmission infrastructure deterioration. Southwestern's planned construction projects are subject to change based on unanticipated equipment failure, customer needs, and weather conditions. The realities of maintaining a complex interconnected power system include unforeseen priority projects which arise periodically, causing a reprioritization of planned projects. All projects share the commonality of replacing aging infrastructure necessary to maintain the reliability of the Federal power system.

The budget request includes a proposal to authorize the Federal government to sell the transmission assets of Southwestern. Until such time as this proposal is approved, Southwestern will continue current plans for construction, maintenance, and equipment upgrades.

Transmission System

This activity funds current construction projects that require expansion of, or additions to, existing facilities. Southwestern ensures system reliability by replacing aging equipment and removing constraints that limit power flows. The projects outlined below address Southwestern's efforts to reduce the risk of extended service outages, avoid more costly replacements in the future, and support the increased transmission system usage. The funding level for this activity is derived from internal and external management decisions and field crew observations. System age, risk of equipment failure, life-cycles, and obsolescence of technology and unavailability of spare parts, budget constraints, cost, and demand for more capacity are also considered in these budgeting decisions. These variables are assessed and incorporated into Southwestern's ten-year construction plan. The transmission activity includes three subactivities:

Substation Upgrades

This subactivity funds the construction and upgrade of the substations and the components necessary to provide improved system reliability and reduce future maintenance and equipment costs. Southwestern owns and operates 26 substation/switching stations. Many of these facilities were designed and constructed over 60 years ago. The equipment which will be replaced or upgraded includes power transformers, circuit breakers, and control equipment, as well as the structural components necessary to sustain reliable power delivery and support a stable, flexible interconnected power grid.

Communication Upgrades

This subactivity funds all communication equipment planned to provide improved system reliability and reduce future maintenance and equipment costs. This subactivity also provides funding for microwave radios and microwave tower additions, replacements, and modifications that will increase the reliability of communications with generating plants and substations. The communication system provides for the transfer of voice and data traffic to allow monitoring and control of power system generation and transmission assets.

Transmission Upgrades

This subactivity funds transmission system upgrades. Much of the conductor, optical ground wire (OPGW), and static wire on Southwestern's transmission lines has reached the end of its service life. With this assumed service life, approximately 20 to 30 miles of transmission line, including the conductor, OPGW, static wire, and structures, will need to be replaced each year. As Southwestern replaces the conductor, Southwestern will use the opportunity to increase line capacity where practical to accommodate increased loads in the region.

Spectrum Relocation

The Commercial Spectrum Enhancement Act of 2004 (CSEA, Title II of P.L. 108-494) created the Spectrum Relocation Fund (SRF) to streamline the relocation of Federal systems from existing spectrum bands and accommodate commercial use by facilitating reimbursement of relocation costs to affected agencies. Southwestern has received $42.8 million in spectrum relocation funds, as approved by the Office of Management and Budget, and as reported to the Congress. Southwestern has completed 94 percent of the tower installation project and anticipates completing construction and obtaining comparable capability by the spring of 2019. These mandatory funds will remain available until expended, and Southwestern will return any amounts received in excess of actual relocation costs to the SRF. Spectrum relocation activities were funded from spectrum auction proceeds; thus, no funding is requested in this subactivity.

**Construction Funding**

**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Construction** | | | | |
| Transmission System | | | | |
| Substation Upgrades | 1,520 | --- | 1,896 | +376 |
| Communication Upgrades | 4,466 | --- | 4,579 | +113 |
| Transmission Upgrades | 6,500 | --- | 10,400 | +3,900 |
| **Subtotal, Construction** | **12,486** | **14,932** | **16,875** | **+4,389** |
| Alternative Financing | -5,986 | -9,609 | -12,180 | -6,194 |
| **Total, Construction** | **6,500** | **5,323** | **4,695** | **-1,805** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Construction $12,486,000** | **$16,875,000** | **+$4,389,000** |
| **Transmission System $12,486,000** | **$16,875,000** | **+$4,389,000** |
| *Substation Upgrades ($1,520,000)*<br>• Springfield Transformer #1 replacement project consists of replacing an autotransformer that threatens system reliability due to exceeding its life expectancy of 35 years. Due to its age, this autotransformer is difficult to repair due to scarcity of parts and overloading issues. | *Substation Upgrades ($1,896,000)*<br>• Paragould Transformer #2 replacement project consists of replacing an autotransformer that threatens system reliability by exceeding its life expectancy of 35 years. Due to its age, this autotransformer is difficult to repair due to scarcity of parts and overloading issues. | *Substation Upgrades (+$376,000)*<br>• The increase reflects an increase in the projected cost of replacing the transformer based on size and ratings. |
| *Communication Upgrades ($4,466,000)*<br>• This subactivity funds all communication equipment, fiber optic, and microwave systems additions and replacements. | *Communication Upgrades ($4,579,000)*<br>• This subactivity funds all communication equipment, fiber optic, and microwave systems additions and replacements. | *Communication Upgrades (+$113,000)*<br>• The increase reflects a minor increase in the replacement of fiber optic and microwave systems. |
| Transmission Upgrades ($6,500,000)<br>• Rebuild Carthage-LaRussell, adding OPGW, 11 miles; adding OPGW to Carthage-Neosho, 22.9 miles. | *Transmission Upgrades ($10,400,000)*<br>• Rebuild Van Buren-Liberty, 12.2 miles and rebuild Akins-Liberty, 8.6 miles due to age, condition and electrical loading of the conductor. | *Transmission Upgrades (+$3,900,000)*<br>• The increase in the construction subprogram reflects rebuilding an additional a total of 20.8 miles of transmission line. |

**Southwestern Power Administration**
**Purchase Power and Wheeling**

**Description**

The Purchase Power and Wheeling (PPW) subprogram provides for the purchase of energy to meet peaking power contractual obligations and the delivery of Federal power. Southwestern's power sales contracts provide for 1200-hours of peaking power per year, representing only a portion of its customers' firm load requirements. The customers provide their own resources and/or purchases for the remainder of their firm loads. Southwestern must purchase power when the generating projects cannot produce enough to fulfill its 1200-hour contract obligations. Above average purchases are required in times of severe drought or instances of multiple project outages that limit power production. Purchases of power are generally made on the open spot market and with public entities. Delivery of purchase power to Southwestern's system is made via the Southwest Power Pool RTO or our own transmission system. All such power purchases are blended with the available Federal hydroelectric power to provide a more beneficial and reliable product while ensuring repayment of the Federal investment plus interest.

Southwestern's budget request for the PPW subprogram reflects anticipated needs to ensure adequate funding to fulfill its 1,200-hour peaking power contractual obligations based on volatile market prices, limited availability of energy banks, and all but the most severe hydrological conditions. Southwestern will continue to use Federal power receipts and alternative financing arrangements, which include net billing, bill crediting, and/or reimbursable authority (customer advances), to fund this subprogram. When hydropower generation falls significantly below normal due to severe drought conditions or major outages, Southwestern will utilize the Continuing Fund for emergency PPW expenses.

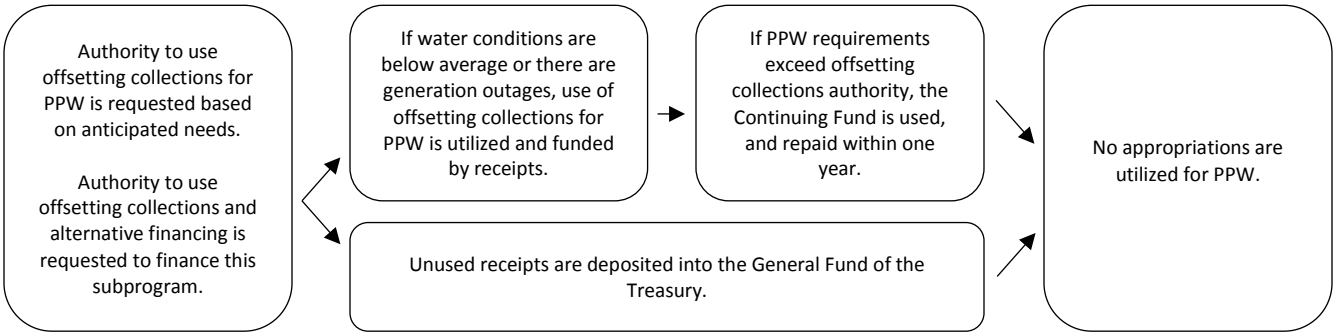
The activities of the PPW subprogram provide for the purchase of energy to fulfill limited peaking power contractual obligations to ensure the marketability of the Federal resource and repayment of the Federal investment. This subprogram also provides for wheeling services that deliver Federal power to optimize the operation of the hydroelectric facilities marketed by Southwestern. This subprogram enhances the reliability of the electrical transmission grid. PPW includes two activities:

<u>System Support</u>

This activity funds purchase power requirements of the hydroelectric power system needed to fulfill all 1200-hour contractual peaking power obligations with customers. System support requirements depend on the conditions of the hydroelectric power system which is affected by weather, volatile market prices, and limited availability of energy banks. In prior years, inadequate funding for PPW and hydrological fluctuations required multiple requests to access the Continuing Fund to ensure sufficient funding was available to fulfill Southwestern's 1200-hour peaking power contractual obligations. In FY 2008, Southwestern requested, and Congress approved, an increase in its authority to use Federal power receipts (offsetting collections). The use of this authority will be dependent upon the hydrological conditions realized during the fiscal year. Under average conditions, less than half of the authority requested will be used. Since the rates charged to its customers are based on full cost recovery, Southwestern has a built-in incentive to minimize expenditures for purchase power. This authority ensures greater flexibility in times of below average generation and volatile market prices, and will decrease dependence on the Continuing Fund under all but the most severe hydrological conditions.

Other Contractual Services

This activity funds other contractual services that provide for wheeling associated with the purchase of transmission service to meet limited peaking power obligations and for the integration of projects for the delivery of Federal power. The funding level is derived from contractual wheeling requirements. The FY 2019 funding request reflects the projected cost for wheeling services based on contractual pricing and delivery terms.



**Purchase Power and Wheeling Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Purchase Power and Wheeling** | | | | |
| System Support | 79,500 | --- | 89,500 | +10,000 |
| Other Contractual Services | 3,500 | --- | 3,500 | 0 |
| **Subtotal, Purchase Power and Wheeling** | **83,000** | **20,000** | **93,000** | **+10,000** |
| Offsetting Collections (PPW) | -73,000 | -9,932 | -83,000 | -10,000 |
| Alternative Financing | -10,000 | -10,068 | -10,000 | 0 |
| **Total, Purchase Power and Wheeling** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Purchase Power and Wheeling**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Purchase Power and Wheeling $83,000,000** | **$93,000,000** | **+$10,000,000** |
| **System Support $79,500,000** | **$89,500,000** | **+$10,000,000** |
| • This activity funds purchase power requirement needed to fulfill all 1200-hour contractual peaking power obligations with customers. | • This activity funds purchase power requirement needed to fulfill all 1200-hour contractual peaking power obligations with customers. | • The increase in system support reflects anticipated needs based on projected market prices. |
| **Other Contractual Services $3,500,000** | **$3,500,000** | **+$0** |
| • Contractual services for wheeling associated with the purchase of transmission service. | • Contractual services for wheeling associated with the purchase of transmission service. | • Funding remains the same. |

## Program Direction

### Overview

Southwestern's Program Direction subprogram ensures continued reliability of the Federal power system by utilizing Federal staffing resources and associated funds required to provide overall direction and execution of Southwestern's Operation and Maintenance Program.

The Program Direction subprogram supports DOE's and Southwestern's missions by providing compensation and all related expenses for its workforce, including those employees that operate and maintain Southwestern's high-voltage interconnected transmission system and associated facilities; those that plan, design, and supervise the construction of replacements, upgrades, and additions (capital investments) to the transmission facilities; those that market the power and energy produced to repay annual expenses and capital investment; and those that administratively support these functions.

Southwestern will use available programs, and develop new strategies to hire and train the next generation of engineers, power system dispatchers, high voltage electricians, and lineman. These initiatives will address the shortage of these valuable resources because of retirement trends, and the ever-expanding demands on the electric utility industry, such as compliance with NERC standards.

Southwestern trains all employees on a continuing basis in occupational safety and health regulations, policies, and procedures to keep the safety culture strong. Accidents are always reviewed to ensure lessons are learned and proper work protocol is in place.

### Highlights of the FY 2019 Budget Request

The FY 2019 Budget Request's funding level for salaries is derived from the current year budgeted salaries, promotions, and within-grade increases. The funding level for benefits is derived from a percentage of budgeted salaries.

## Program Direction Funding
## ($K)

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2018 Enacted |
|---|---|---|---|---|
| **Southwestern Power Administration** | | | | |
| Salaries and Benefits | 23,498 | --- | 23,311 | -187 |
| Travel | 1,203 | --- | 1,372 | +169 |
| Support Services | 3,105 | --- | 3,867 | +762 |
| Other Related Expenses | 3,710 | --- | 4,445 | +735 |
| **Subtotal, Southwestern Power Administration** | **31,516** | **32,372** | **32,995** | **+1,479** |
| Offsetting Collections (annual expenses) | -29,271 | -29,072 | -29,695 | -424 |
| Use of Prior Year Balances, PD (annual expenses) | 0 | 0 | 0 | 0 |
| **Total, Program Direction** | **2,245** | **3,300** | **3,300** | **+1,055** |
| **Federal FTEs** | 194 | | 194 | 0 |
| **Support Services** | | | | |
| Management Support | | | | |
| Reports and Analyses management and General Administrative Support | 3,105 | --- | 3,867 | +762 |
| Total Management Support | 3,105 | --- | 3,867 | +762 |
| **Total, Support Services** | **3,105** | **---** | **3,867** | **+762** |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Other Related Expenses** | | | | |
| Rent to Others | 850 | --- | 882 | +32 |
| Communication, Utilities, Misc. | 255 | --- | 390 | +135 |
| Printing and Reproduction | 110 | --- | 115 | +5 |
| Other Services | 660 | --- | 1085 | +425 |
| Training | 260 | --- | 285 | +25 |
| Power Marketing Liaison | 97 | --- | 178 | +81 |
| Financial Audit | 528 | --- | 545 | +17 |
| Supplies and Materials | 250 | --- | 250 | 0 |
| Equipment | 475 | --- | 465 | -10 |
| Working Capital Fund | 225 | --- | 250 | +25 |
| **Total, Other Related Expenses** | **3,710** | **---** | **4,445** | **735** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $31,516,000** | **$32,995,000** | **+$1,479,000** |
| **Salaries and Benefits $23,498,000** | **$23,311,000** | **-$187,000** |
| • The FY 2017 level supports 194 Federal employees: 54 percent of the employees are GS and subject to the Administration's proposed cost-of-living adjustment; salaries of the remaining 46 percent (craft workers and power system dispatchers) are determined through union negotiations and wage surveys. This activity also includes overtime, awards, relocation, workers' compensation, recruitment bonuses, retention pay, and advanced in-hire rates. By the end of FY 2017, approximately 13 percent of Southwestern's staff will be eligible for retirement. Southwestern will continue to invest in its employees, emphasizing strong development programs, completing skills gap analyses, and pursuing aggressive recruitment and retention efforts as identified in its Human Capital Management Workforce Plan. | • The FY 2019 level supports 194 Federal employees: 54 percent of the employees are GS; salaries of the remaining 46 percent (craft workers and power system dispatchers) are determined through union negotiations and wage surveys. This activity also includes overtime, awards, relocation, workers' compensation, recruitment bonuses, retention pay, and advanced in-hire rates. By the end of FY 2019, approximately 22 percent of Southwestern's staff will be eligible for optional retirement. Southwestern will continue to invest in its employees, emphasizing strong development programs, completing skills gap analyses, and pursuing aggressive recruitment and retention efforts. | • The decrease in Salaries and Benefits reflects cost savings from on-boarding of hard to fill positions and back-filling of retirees. |
| **Travel $1,203,000** | **$1,372,000** | **+$169,000** |
| • This activity funds all related travel and per diem expenses for mission-related travel to maintain the integrity and reliability of Southwestern's geographically dispersed power system. The funding level for this activity is primarily derived from the daily requirement of the field maintenance personnel to maintain 1,380 miles of transmission lines, 26 substations/switchyards, 51 microwave/radio sites, communication equipment, and the Supervisory Control and Data Acquisition network. Travel for the performance of general and administrative functions is also included. | • This activity funds all related travel and per diem expenses for mission-related travel to maintain the integrity and reliability of Southwestern's geographically dispersed power system. The funding level for this activity is primarily derived from the daily requirement of the field maintenance personnel to maintain 1,380 miles of transmission lines, 26 substations/switchyards, 51 microwave/radio sites, communication equipment, and the Supervisory Control and Data Acquisition network. Travel for the performance of general and administrative functions is also included. | • The increase in travel reflects transmission policy related efforts, water resource activities, and field maintenance crew travel. |

| FY 2017 Request | FY 2019 Request | Explanation of Changes<br>FY 2019 request vs FY 2017 Enacted |
|---|---|---|
| **Support Services $3,105,000** | **$3,867,000** | **+$762,000** |
| • This activity funds contracted management support services including information technology, E-Government, and administrative/records management support. The funding level for this activity is derived from the most recent negotiated contract for support services essential to achieve Southwestern's mission. | • This activity funds contracted management support services including information technology, E-Government, and administrative/records management support. The funding level for this activity is derived from the most recent negotiated contract for support services essential to achieve Southwestern's mission. | • Increase reflects anticipated costs for two replacement support service contracts that are due to be re-competed--including upfront costs. Also additional IT support is required to meet cyber security requirements. |
| **Other Related Expenses $3,710,000** | **$4,445,000** | **+$735,000** |
| • This activity funds rental space, facility security, the financial audit, services of the Power Marketing Liaison Office, the working capital fund, technology refresh in the areas of personal computers, hardware and software, printing and reproduction, and training and tuition fees in support of workforce planning and required training to meet the NERC emergency operations requirement. Rental space costs assume the GSA inflation factor. Other costs are based on the historical usage and actual cost of similar items. | • This activity funds rental space, facility security, the financial audit, services of the Power Marketing Liaison Office, the working capital fund, technology refresh in the areas of personal computers, hardware and software, printing and reproduction, and training and tuition fees in support of workforce planning and required training to meet the NERC emergency operations requirement. Rental space costs assume the GSA inflation factor. Other costs are based on the historical usage and actual cost of similar items. | • The increase reflects the costs of the Human Resources Service Center, the Working Capital Fund, training, the financial audit costs, and increases in other areas. |

**Southwestern Power Administration**

**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **SWPA - Operating Cost - Annual Operating Cost Performance: Provide power at the lowest possible cost by keeping total operation and maintenance cost per kilowatt-hour generated at or below the National median for public power for 100+ customers.** | | |
| Target | N/A | N/A | 0.068 /$ kWh |
| Result | N/A | N/A | TBD |
| Endpoint Target | Control annual Operations and Maintenance costs, thereby providing power at the lowest possible cost. | | |
| Comment | Due to the seasonal nature of hydropower generation throughout the fiscal year, a rolling 1-year total will be calculated for both Operating & Maintenance (O&M) expense information as well as Net Generation. O&M data is obtained through the financial management system, while generation data is compiled from the power operations reports of each contributing generating agency. The annual target for each performance reporting cycle is determined by referencing the latest annual report on financial and operating ratios as published by the American Public Power Association (APPA). Specifically, SWPA will refer to the "Median Values by Customer Size Class" table. The APPA compiles benchmark information from both a survey instrument and data residing with the Energy Information Administration. | | |
| Performance Goal (Measure) | **SWPA - System Reliability Performance - Outages - Effectively operate the transmission system to limit the number of accountable outages to no more than 3 annually.** | | |
| Target | 3 accountable outages | 3 accountable outages | N/A |
| Result | Met - 3 | TBD | N/A |
| Endpoint Target | Southwestern provides reliable service to customers each year, thereby maintaining power system reliability. | | |
| Comment | SWPA will be measuring this number of outages internally starting in FY 2019. As such, no target has been established for FY 2019. | | |
| Performance Goal (Measure) | **SWPA Annual Operating Cost Performance - Provide power at the lowest possible cost by keeping total operation and maintenance expense per kilowatt-hour generated below the national median for public power. ($/kilowatt hour, kWh)** | | |
| Target | < 0.065 $/kWh | N/A | N/A |
| Result | Met - 0.017 | N/A | N/A |
| Endpoint Target | Southwestern will continue to control annual Operations and Maintenance costs, thereby providing power at the lowest possible cost. | | |
| Comment | Prior information that was available is no longer supplied by utilities. As a result, this measure has been replaced by a new operating cost measure. | | |
| Performance Goal (Measure) | **SWPA Repayment of Investment Performance - Ensure unpaid investment (UI) is equal to or less than the allowable unpaid investment (AUI) in accordance with DOE Order RA 6120.2 and Reclamation Law.** | | |
| Target | 1,536 million in AU | 1,590 million in AU | 1, 89 million in AU |
| Result | Met - 551 | TBD | TBD |

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Endpoint Target | Continue to meet legislated cost recovery requirements for timely repayment of Federal investment in maintaining financial integrity of projects/program. | | |
| Performance Goal (Measure) | **SWPA System Reliability Performance - NERC - Attain average North American Electric Reliability Corporation (NERC) compliance ratings for NERC Control Performance Standard 1 (CPS1) of greater than or equal to 100 percent.** | | |
| Target | 100 CPS1 Rating | 100 CPS1 Rating | 100 CPS1 Rating |
| Result | Met - 195.44 | TBD | TBD |
| Endpoint Target | Ensure the reliability of the electrical grid by attaining a NERC CPS1 rating of equal to or greater than 100 percent each year. | | |
| Comment | CPS1 measures generation/load balance on one-minute intervals. | | |

**Southwestern Power Administration**
**Revenues and Receipts**

(Dollars in Thousands)

| | FY 2017 Actual | FY 2018 Estimate | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|---|---|
| Gross Revenues | | | | | | | |
| Sale and Transmission of Electric Energy | 194,280 | 268,300 | 268,300 | 268,300 | 268,300 | 268.300 | 268.300 |
| Total, Gross Revenues | 194,280 | 268,300 | 268,300 | 268,300 | 268,300 | 268,300 | 268,300 |
| Alternative Financing Credited as an Offsetting Receipt, Net Billing/Bill Crediting | -124,740 | -118,000 | -118,000 | -118,000 | -118,000 | -118,000 | -118,000 |
| Offsetting Collections, Southwestern Annual Expenses (Net Zero) | -34,586 | -33,088 | -35,402 | -35,059 | -35,479 | -36,413 | -36,890 |
| Adjustments not otherwise Classified | -2,069 | | | | | | |
| Offsetting Collections Realized, Purchase Power and Wheeling* | -17,000 | -83,000 | -83,000 | -83,000 | -83,000 | -83,000 | -83,000 |
| Total Proprietary Receipts | 15,885 | 34,212 | 31,898 | 32,241 | 31,821 | 30,887 | 30,410 |
| Percent of Sales to Preference Customers | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% | 100.0% |
| Energy Sales from Power Marketed (billions of kilowatt hours) | 5.0 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 | 5.4 |

* Offsetting Collections Realized, Purchase Power and Wheeling: Estimates assume the full requested use-of-receipts authority amount is utilized and expended. The actual amount will fluctuate dependent upon hydrologic conditions and subsequent replacement power purchases needed to fulfill contractual obligations.

**Southwestern Power Administration**
**System Statistics**

| | FY 2017 Actual | FY 2018 Estimate | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|---|---|
| Generating Capacity (kilowatts) | | | | | | | |
| Installed Capacity | 2,173,800 | 2,173,800 | 2,173,800 | 2,173,800 | 2,173,800 | 2,173,800 | 2,173,800 |
| Peak Capacity | 2,052,500 | 2,052,500 | 2,052,500 | 2,052,500 | 2,052,500 | 2,052,500 | 2,052,500 |
| Generating Stations | | | | | | | |
| Generating Projects (Number) | 24 | 24 | 24 | 24 | 24 | 24 | 24 |
| Substations/Switchyards (Number) | 26 | 26 | 26 | 26 | 26 | 26 | 26 |
| Substations/Switchyards (kVA Capacity) | 1,026,900 | 1,026,900 | 1,026,900 | 1,026,900 | 1,026,900 | 1,026,900 | 1,026,900 |
| Available Energy (Megawatt-hours) | | | | | | | |
| Energy Generated | 4,784,273 | 5,202,300 | 5,229,000 | 5,164,400 | 5,164,400 | 5,164,400 | 5,164,400 |
| Energy Received | 225,912 | 211,600 | 211,600 | 211,600 | 211,600 | 211,600 | 211,600 |
| Total, Energy Available for Marketing | 5,010,185 | 5,413,900 | 5,440,600 | 5,376,000 | 5,376,000 | 5,376,000 | 5,376,000 |
| Transmission Lines (Circuit-Miles) | | | | | | | |
| 161-KV | 1,117 | 1,117 | 1,117 | 1,117 | 1,117 | 1,117 | 1,117 |
| 138-KV | 164 | 164 | 164 | 164 | 164 | 164 | 164 |
| 69-KV | 99 | 99 | 99 | 99 | 99 | 99 | 99 |
| Total, Transmission Lines | 1,380 | 1,380 | 1,380 | 1,380 | 1,380 | 1,380 | 1,380 |

**Power Marketed, Wheeled, or Exchanged by Project**

| | State | Number of Plants | Installed Capacity (kW) | FY 2017 Actual Energy (GWh) | FY 2018 Estimated Energy (GWh) | FY 2019 Estimated Energy (GWh) | FY 2020 Estimated Energy (GWh) | FY 2021 Estimated Energy (GWh) | FY 2022 Estimated Energy (GWh) | FY 2023 Estimated Energy (GWh |
|---|---|---|---|---|---|---|---|---|---|---|
| Power Marketed | | | | | | | | | | |
| Interconnected | | | | | | | | | | |
| System | Missouri | 4 | 463,200 | 1,622 | 1,736 | 1,746 | 1,724 | 1,724 | 1,724 | 1,724 |
| | Arkansas | 9 | 1,037,100 | 902 | 966 | 971 | 959 | 959 | 959 | 959 |
| | Oklahoma | 7 | 514,100 | 1,040 | 1,113 | 1,119 | 1,105 | 1,105 | 1,105 | 1,105 |
| | Texas | 2 | 100,000 | 613 | 656 | 660 | 652 | 652 | 652 | 652 |
| | Louisiana | 0 | 0 | 363 | 389 | 391 | 386 | 386 | 386 | 386 |
| | Kansas | 0 | 0 | 374 | 401 | 403 | 398 | 398 | 398 | 398 |
| Subtotals | | 22 | 2,114,400 | 4,914 | 5,261 | 5,290 | 5,224 | 5,224 | 5,224 | 5,224 |
| Isolated: | | | | | | | | | | |
| Robert D. Willis Project | | | | | | | | | | |
| Sam Rayburn Project | | | | | | | | | | |
| 50% to Texas | | 2 | 59,400 | 48 | 76 | 76 | 76 | 76 | 76 | 76 |
| 50% to Louisiana | | 0 | 0 | 48 | 76 | 76 | 76 | 76 | 76 | 76 |
| Subtotals | | 2 | 59,400 | 96 | 152 | 152 | 152 | 152 | 152 | 152 |
| Total, Power Marketed | | 24 | 2,173,800 | 5,010 | 5,414 | 5,441 | 5,376 | 5,376 | 5,376 | 5,376 |
| | | | | | | | | | | |
| Power Wheeled/Exchanged | | | | | | | | | | |
| Wheeled (MW) | | | | 949 | 709 | 681 | 684 | 687 | 687 | 687 |
| Exchanged (GWh) | | | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Southwestern Power Admin. - Operation & Maint. | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Southwestern Power Administration** | | | |
| **Systems Operation and Maintenance** | | | |
| Systems Operation and Maintenance | 13,896 | 16,680 | 17,006 |
| **Purchase Power and Wheeling** | | | |
| Purchase Power and Wheeling | 83,000 | 20,000 | 93,000 |
| **SWPA Construction** | | | |
| Construction | 12,486 | 14,932 | 16,875 |
| **Program Direction** | | | |
| Program Direction | 31,516 | 32,372 | 32,995 |
| **Total, Southwestern Power Administration** | **140,898** | **83,984** | **159,876** |
| **Total, Southwestern Power Admin. - Operation & Maint.** | **140,898** | **83,984** | **159,876** |

# Western Area Power Administration

# Western Area Power Administration

**Construction, Rehabilitation, Operation and Maintenance**
**Western Area Power Administration**
**Proposed Appropriation Language**

*For carrying out the functions authorized by title III, section 302(a)(1)(E) of the Act of August 4, 1977 (42 U.S.C. 7152), and other related activities including conservation and renewable resources programs as authorized, $265,142,000, including official reception and representation expenses in an amount not to exceed $1,500, to remain available until expended, of which $265,142,000 shall be derived from the Department of the Interior Reclamation Fund: Provided, That notwithstanding 31 U.S.C. 3302, section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s), and section 1 of the Interior Department Appropriation Act, 1939 (43 U.S.C. 392a), up to $175,770,000 collected by the Western Area Power Administration from the sale of power and related services shall be credited to this account as discretionary offsetting collections, to remain available until expended, for the sole purpose of funding the annual expenses of the Western Area Power Administration: Provided further, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year 2019 appropriation estimated at not more than $89,372,000 of which $89,372,000 is derived from the Reclamation Fund: Provided further, That notwithstanding 31 U.S.C. 3302, up to $306,408,000 collected by the Western Area Power Administration pursuant to the Flood Control Act of 1944 and the Reclamation Project Act of 1939 to recover purchase power and wheeling expenses shall be credited to this account as offsetting collections, to remain available until expended for the sole purpose of making purchase power and wheeling expenditures: Provided further, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred (excluding purchase power and wheeling expenses).*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

There is no change in the appropriation language.

**Public Law Authorizations**

P.L. 57-161, "The Reclamation Act of 1902"
P.L. 78-534, "Flood Control Act of 1944"
P.L. 95-91, "Department of Energy Organization Act" (1977)
P.L. 102-486, "Energy Policy Act of 1992"
P.L. 66-389, "Sundry Civil Appropriations Act" (1922)
P.L. 76-260, "Reclamation Project Act of 1939"
P.L. 80-790, "Emergency Fund Act of 1948"
P.L. 102-575, "Reclamation Projects Authorization and Adjustment Act of 1992"
"Economy Act" of 1932, as amended (41 stat. 613)
"Interior Department Appropriation Act of 1928" (44 Stat. 957)
P.L. 70-642, "Boulder Canyon Project Act" (1928)
P.L. 75-756, "Boulder Canyon Project Adjustment Act" (1940)
P.L. 98-381, "Hoover Power Plant Act of 1984"
P.L. 75-529, "The Fort Peck Project Act of 1938"
P.L. 84-484, "The Colorado River Storage Project Act of 1956"
P.L. 90-537, "The Colorado River Basin Project Act of 1968"
The Act of June 18, 1954 (68 Stat. 255)
P.L. No 111-5, "American Recovery and Reinvestment Act of 2009"

**Falcon and Amistad Operating and Maintenance Fund**
**Proposed Appropriation Language**

*For operation, maintenance, and emergency costs for the hydroelectric facilities at the Falcon and Amistad Dams, $5,207,000, to remain available until expended, and to be derived from the Falcon and Amistad Operating and Maintenance Fund of the Western Area Power Administration, as provided in section 2 of the Act of June 18, 1954 (68 Stat. 255): Provided, That notwithstanding the provisions of that Act and of 31 U.S.C. 3302, up to $4,979,000 collected by the Western Area Power Administration from the sale of power and related services from the Falcon and Amistad Dams shall be credited to this account as discretionary offsetting collections, to remain available until expended for the sole purpose of funding the annual expenses of the hydroelectric facilities of these Dams and associated Western Area Power Administration activities: Provided further, That the sum herein appropriated for annual expenses shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year 2019 appropriation estimated at not more than $228,000: Provided further, That for purposes of this appropriation, annual expenses means expenditures that are generally recovered in the same year that they are incurred: Provided further, That, for fiscal year 2019, the Administrator of the Western Area Power Administration may accept up to $122,000 in funds contributed by United States power customers of the Falcon and Amistad Dams for deposit into the Falcon and Amistad Operating and Maintenance Fund, and such funds shall be available for the purpose for which contributed in like manner as if said sums had been specifically appropriated for such purpose: Provided further, That any such funds shall be available without further appropriation and without fiscal year limitation for use by the Commissioner of the United States Section of the International Boundary and Water Commission for the sole purpose of operating, maintaining, repairing, rehabilitating, replacing, or upgrading the hydroelectric facilities at these Dams in accordance with agreements reached between the Administrator, Commissioner, and the power customers.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

There is no change in the appropriation language.

**Public Law Authorizations**
P.L. 103-236, "Foreign Relations Authorization Act, Fiscal Years 1994 and 1995"
The Act of June 18, 1954 (68 Stat. 255)

**Western Area Power Administration**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|---|
| Gross | 1,172,454 | --- | 1,184,369 |
| Offsets | -1,100,480 | --- | -1,117,769 |
| **Net BA** | **71,974** | **71,485** | **66,600** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

Western Area Power Administration's (WAPA) mission is to market and reliably deliver cost-based Federal hydroelectric power. WAPA markets power in 15 central and western states from Federally-owned power plants operated primarily by the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation and the Department of State's International Boundary and Water Commission. WAPA operates and maintains a high-voltage, integrated transmission system, including approximately 17,000 circuit-miles of high-voltage transmission lines, more than 300 substations/switchyards and associated power system controls, and communication and electrical facilities.

WAPA serves a diverse group of nearly 700 wholesale customers, including municipalities, cooperatives, public utility and irrigation districts, Federal and state agencies and Native American tribes. In turn, WAPA's customers provide service to millions of retail consumers.

WAPA's base program is funded through three appropriation accounts: 1) the Construction, Rehabilitation, Operation and Maintenance Account (CROM); 2) Falcon and Amistad Operating and Maintenance Fund; and 3) Colorado River Basins Power Marketing Fund (CRBPMF). Within these three accounts, there are seven subprograms; four in the CROM Account, one in the Falcon and Amistad Operating and Maintenance Fund and two in CRBPMF.

**Highlights and Major Changes in the FY 2019 Budget Request**

Consistent with the FY 2018 budget request, the FY 2019 budget request includes a proposal to authorize the Federal government to sell the transmission assets of WAPA and a proposal to repeal the $3.25 billion borrowing authority managed by WAPA's Transmission Infrastructure Program (TIP). The FY 2019 budget request includes a proposal to change WAPA's statutory rate structure requirement from cost recovery to a market based structure that takes into consideration rates charged by comparable utilities and could allow for faster recoupment of the taxpayer investment.

**Western Area Power Administration**
**Funding by Congressional Control**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Construction, Rehabilitation, Operation and Maintenance (CROM)** | | | | |
| Operation and Maintenance | 76,697 | --- | 77,056 | +359 |
| Construction and Rehabilitation | 62,442 | --- | 32,632 | -29,810 |
| Purchase Power and Wheeling | 581,634 | --- | 567,362 | -14,272 |
| Program Direction | 226,497 | --- | 238,483 | +11,986 |
| Subtotal, CROM Program | 947,270 | --- | 915,533 | -31,737 |
| Alternative Financing | | | | |
| Operation and Maintenance | 0 | --- | -7,758 | -7,758 |
| Construction and Rehabilitation | -43,884 | --- | -27,077 | +16,807 |
| Purchase Power and Wheeling | -214,625 | --- | -260,954 | -46,329 |
| Program Direction | -6,343 | --- | -39,136 | -32,793 |
| Subtotal, Alternative Financing | -264,852 | --- | -334,925 | -70,073 |
| Offsetting Collections from Colorado River Dam Fund | | | | |
| Operation and Maintenance | -1,548 | --- | -1,455 | +93 |
| Program Direction | -6,717 | --- | -7,603 | -886 |
| Subtotal, Offsetting Collections from Colorado River Dam Fund | -8,265 | --- | -9,058 | -793 |
| Offsetting Collections, annual Operation and Maintenance and Program Direction | | | | |
| Operation and Maintenance | -27,122 | -26,938 | -25,009 | +2,113 |
| Program Direction | -150,441 | -149,419 | -150,761 | -320 |
| Subtotal, Offsetting Collections, annual Operation and Maintenance and Program Direction | -177,563 | -176,357 | -175,770 | +1,793 |
| Offsetting Collections, Purchase Power and Wheeling | -367,009 | -179,000 | -306,408 | +60,601 |
| Use of Prior Year Balances | | | | |
| Annual Operation and Maintenance | -6,000 | --- | 0 | +6,000 |
| Annual Program Direction | -28,000 | --- | 0 | +28,000 |
| Subtotal, Use of Prior Year Balances | -34,000 | --- | 0 | +34,000 |
| **Subtotal, CROM** | **95,581** | **94,932** | **89,372** | **-6,209** |
| Rescission of prior year balances | -839 | -833 | 0 | 0 |
| **Total, CROM** | **94,742** | **94,099** | **89,372** | **-5,370** |
| **Federal FTEs** | **1,202** | | **1,210** | **+8** |
| **Falcon and Amistad Operating and Maintenance Fund** | 4,393 | --- | 5,329 | +936 |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Offsetting Collections, annual Operation and Maintenance | -3,838 | -3,812 | -4,979 | -1,141 |
| Alternative Financing | -323 | --- | -122 | +201 |
| **Total, Falcon and Amistad** | **232** | **230** | **228** | **-4** |
| **Federal FTEs** | **0** | | **0** | **0** |
| | | | | |
| **Colorado River Basins Power Marketing Fund (CRBPMF)** | 213,530 | --- | 220,337 | +6,807 |
| Offsetting Collections | -236,530 | --- | -243,337 | -6,807 |
| **Total, CRBPMF** | **-23,000** | **---** | **-23,000** | **0** |
| **Federal FTEs** | **302** | | **293** | **-9** |
| | | | | |
| **Transmission Infrastructure Program Fund (TIP)** | 7,261 | --- | 43,170 | +35,909 |
| Advance Funding | -3,500 | --- | -4,500 | -1,000 |
| Offsetting Collections | -3,761 | --- | -38,670 | -34,909 |
| **Total TIP** | **0** | **0** | **0** | **0** |
| **Federal FTEs** | **17** | | **18** | **+1** |
| | | | | |
| **Total, Western Area Power Administration** | **71,974** | **---** | **66,600** | **-5,374** |
| **Federal FTEs** | **1,521** | | **1,521** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Construction, Rehabilitation, Operation and Maintenance**
**Western Area Power Administration**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|---|
| Gross | 947,270 | --- | 915,533 |
| Offsets | -852,528 | --- | -826,161 |
| **Net BA** | **94,742** | **94,093** | **89,372** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**
WAPA markets and delivers reliable, cost-based Federal hydroelectric power and related services. WAPA's marketing efforts and delivery capability provide for recovery of annual operational costs, including the generating agencies' hydropower related costs, and repayment of taxpayer investment in the Federal hydropower program. WAPA repays the Federal investment for which it is responsible within the timeframes established by law and regulations.

WAPA's Construction, Rehabilitation, Operation and Maintenance Account (CROM) is comprised of four subprograms:

- Operation and Maintenance
- Construction and Rehabilitation
- Purchase Power and Wheeling
- Program Direction

**Highlights of the FY 2019 Budget Request**
The FY 2019 request continues to support WAPA's ongoing mission and programs, using a variety of financing methods including appropriations, alternative financing (primarily customer advances), and use of receipt authorities. Consistent with the FY 2018 budget request, the FY 2019 budget request includes a proposal to authorize the Federal government to sell the transmission assets of WAPA. The FY 2019 budget request also includes a proposal to change WAPA's statutory rate structure requirement from cost recovery to a market based structure.

**Operation and Maintenance Funding ($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Operation and Maintenance** | | | | |
| Regular Operation and Maintenance | 35,134 | --- | 34,715 | -419 |
| Replacements and Additions | 41,563 | --- | 42,341 | +778 |
| **Total, Operation and Maintenance** | **76,697** | **---** | **77,056** | **+359** |
| Alternative Financing | 0 | --- | -7,758 | -7,758 |
| Use of Receipts from Colorado River Dam Fund | -1,548 | --- | -1,455 | +93 |
| Offsetting Collections | -27,122 | -26,938 | -25,009 | +2,113 |
| Use of Prior Year Balances | -6,000 | --- | 0 | +6,000 |
| **Total, Operation and Maintenance (Budget Authority)** | **42,027** | **41,742** | **42,834** | **+807** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Description**
The Operation and Maintenance (O&M) subprogram is to assure continued reliability of the Federal power system by operating and maintaining WAPA's transmission system at or above industry standards, including replacement of aging equipment and removal of constraints that would impede power flows.

The budget request includes a proposal to authorize the Federal government to sell the transmission assets of WAPA. Until such time as this proposal is approved, WAPA will continue its plans for construction, maintenance, and equipment upgrades.

**Regular Operation and Maintenance**
Supplies and materials necessary to respond to routine and emergency situations in WAPA's high-voltage interconnected transmission system will be purchased. This includes miscellaneous equipment and software used for power billing, transmission planning, e-tagging, and energy scheduling, as well as supplies and materials such as wood poles (individual pole replacement only; excludes whole line replacements), instrument transformers, meters, relays, etc.

**Replacements and Additions**
WAPA's planned replacements and additions activity is based on an assessment of condition and criticality of equipment, maintenance/frequency of problems on individual items of equipment, availability of replacement parts, safety of the public and WAPA's personnel, environmental concerns and an orderly work plan. Cost estimates are based on an analysis of system operation/maintenance requirements and concerns, customer-coordinated work plans, actual costs of recent similar projects, and bottom-up budgeting techniques. Planned activity is detailed by category below.

Electrical Equipment
Electrical equipment, such as circuit breakers, transformers, relays, batteries and chargers, reactors, meters, buses, surge arresters, capacitor banks and disconnect switches, will replace obsolete equipment at facilities throughout WAPA's 15-state area. Test equipment used by maintenance crews, such as metering and relaying test sets, pentameters, Ohm testers, oil dielectric testers, battery load testers, and specialized communication and environmental control test equipment is also included. Also included in this request is funding for WAPA's wood pole replacement program. This is a continuing program to replace aging wood transmission line structures, line hardware, and repair damaged conductors and static wires. Many of WAPA's wood transmission line structures were built in the 1950's and 1960's, with the facilities reaching ages in excess of recommended lifespan. Due to age, woodpecker damage, vibratory fatigue, and general deterioration, the system requires constant maintenance upgrades and repairs in order to eliminate the weak links and improve the reliability to our customers.

Communications Equipment
Key to system reliability, replacement of aged or obsolete remote terminal units (RTU), telephone systems, microwave and mobile radio systems with new generation digital radio and fiber optic systems continues. Manufacturers are discontinuing support of obsolete time domain multiplexing (TDM) digital technology equipment in favor of newer packet/internet protocol (IP) based technology as the industry transitions to packet-based networks. WAPA continues with its migration plans to incorporate packet technologies as the current TDM based equipment reaches its end-of-life. Manufacturers have discontinued support of the digital mobile radio equipment WAPA is operating due to obsolescence; this equipment is being replaced with new digital mobile radio technology equipment now and will continue for the next several years. WAPA's communication systems are currently made up of approximately 12 percent fiber optics, 76 percent fixed radio, and 12 percent mobile radio. WAPA currently has 1,278 radio frequency authorizations for fixed radio bands, all of which are digital. This funding will not be used to replace equipment impacted by the Spectrum Relocation initiative.

In addition, WAPA will continue to upgrade its existing supervisory control and data acquisition (SCADA) systems which control WAPA's electric power system. These hardware and software upgrades improve grid reliability by allowing the main SCADA computer to communicate with RTUs in over 300 substations across WAPA's territory, thus allowing the power

system dispatcher to operate a device in any of these substations to rapidly make changes in response to electric power industry requirements or system emergencies.

Spectrum Relocation Equipment

The Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494) of 2004, created the Spectrum Relocation Fund (SRF) to streamline the relocation of Federal systems from specific radio spectrum bands. These spectrum bands will accommodate commercial users and the SRF will facilitate reimbursement to affected agencies for relocation costs. The Federal Communications Commission has allocated this spectrum for Advanced Wireless Services. Funds have been made available to agencies from the crediting of auction receipts to the SRF during fiscal year 2007 and system relocation efforts are underway. WAPA received $108.2 million for this effort. This amount includes WAPA's estimated relocation costs, as approved by the Office of Management and Budget, and as reported to the Congress by the Department of Commerce in December 2005. Since receipt of these funds, WAPA has completed all design work including radio path analysis, tower load analysis, communication building upgrades and replacements, acquiring radio frequency authorizations, and completing a majority of the radio and other communication equipment purchases and installation. The phased replacement of 2 GHz radio systems is nearing completion with just two site projects remaining. System clean-up, which includes removal of old equipment, buildings, and all associated systems, is anticipated to be completed in FY 2018. Project closing activity began in the second quarter of FY 2015 and is also anticipated to be complete in FY 2018. WAPA anticipates returning approximately $16 million received in excess of actual relocation costs to the SRF. No appropriations are being requested for this activity.

Capitalized Movable Equipment

Information technology (IT) purchases of hardware and/or software supporting cyber security, network, infrastructure, supervisory control and data acquisition (SCADA), enterprise applications, power marketing and management, and operations and maintenance technology are a major component of this category. IT investments are a high priority to WAPA, DOE and the Administration and this activity replaces aging infrastructure and systems to ensure the continued safe, secure and reliable operation and maintenance of WAPA's transmission system.

Another major component of this category is specialized vehicles required to support WAPA's O&M activities. WAPA leases the majority of its vehicles from GSA (including all sedans, vans, SUVs, and light trucks). However, GSA cannot always provide the necessary specialized vehicles (bucket trucks, bull dozers, pressure diggers, and other heavy duty vehicles), especially in the Upper Great Plains Region and the Desert Southwest Region, where they must be equipped for extreme weather and terrain conditions. In these instances, WAPA purchases its specialized vehicles in accordance with the Federal Management Regulations guidelines, the same guidelines used by GSA.

Other capitalized movable equipment in this estimate includes:

- Operations and maintenance equipment such as substation test equipment, brush chippers, and map board replacements
- Security equipment at various sites throughout WAPA's service area including perimeter intrusion detection devices, card readers and associated software, security cameras and recording devices
- Helicopters and related equipment replacements that add value to the helicopters or extend their service life, such as engine, rotor blades, avionics, airframe, and other major components

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Operation and Maintenance $76,697,000** | **$77,056,000** | **+$359,000** |
| • *Regular O&M ($35,134,000)*<br>• The continuing maintenance of WAPA's transmission system at or above industry standards supports DOE and WAPA missions by minimizing sudden failure, unplanned outages, and possible regional power system disruptions. Safe working procedures are discussed before work begins to optimize safety for the public, WAPA's staff, and equipment. The request is based on projected work plans for activities funded from this account. Estimates are based on historical data of actual supplies needed to operate and maintain the transmission system and recent procurement of similar items. | • *Regular O&M ($34,715,000)*<br>• Requested funding is to continue the ongoing activities of maintaining WAPA's transmission system. | • *Regular O&M (-$419,000)*<br>• The decrease in regular O&M is attributed to lower annual expense requirements for maintenance activities and related environmental efforts. The decrease is slightly offset by inflationary factors. |
| • *Replacements and Additions ($41,563,000)*<br>• Replacement needs are based on age, reliability, and safety of equipment, customer-coordinated review, cost analysis of rebuild versus replacement, availability of replacement parts, and obsolescence of diagnostic maintenance tools. Estimates are determined using actual costs of similar items. | • *Replacements and Additions ($42,341,000)*<br>• Requested funding is to continue ongoing efforts. | • *Replacements and Additions (+$778,000)*<br>• The increase in Replacement and Additions follows WAPA's maintenance schedule and is primarily attributable to an increased emphasis on IT software systems and associated moveable capital equipment. |

**Construction and Rehabilitation Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Construction and Rehabilitation** | | | | |
| Transmission Lines and Terminal Facilities | 41,408 | --- | 20,091 | -21,317 |
| Substations | 18,773 | --- | 8,725 | -10,048 |
| Other | 2,261 | --- | 3,816 | +1,555 |
| **Subtotal, Construction and Rehabilitation** | **62,442** | **---** | **32,632** | **-29,810** |
| Alternative Financing | -43,884 | --- | -27,077 | +16,807 |
| **Total, Construction and Rehabilitation** | **18,558** | **18,432** | **5,555** | **-13,003** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Construction, Rehabilitation, Operation and Maintenance**
**Construction and Rehabilitation**

**Description**
The Construction and Rehabilitation (C&R) subprogram supports WAPA's mission to deliver reliable, clean Federal hydroelectric power by emphasizing the replacement, upgrade, and modernization of the electrical system infrastructure to bring continued reliability, improved connectivity, and increased flexibility and capability to the power grid.

Financing of the FY 2019 C&R budget, planned at $32.6 million, will continue to rely heavily on voluntary stakeholder participation in alternative methods for capital financing. Approximately 83 percent of the program funding, or $27.1 million, will be required from stakeholders, requiring significant partnering efforts.

WAPA has initiated a formalized asset management program to capture data uniformly and systematically on condition, consequences of failure data, and other relevant asset information. The improvements to WAPA's current asset management practices include stronger, more objective data driven evidence, risk-informed priority and decision making, and greater transparency to stakeholders in the allocation of limited resources.

The request incorporates the most current information to identify and schedule necessary C&R projects. WAPA assigns priority to those situations that pose the highest risk to safety and system reliability, while meeting the mandates for open access to our transmission system. When conditions change, WAPA shifts funding as necessary to ensure the highest program priorities continue to be met to maintain the reliability and integrity of WAPA's power transmission system.

All replacement and rehabilitation plans are coordinated with stakeholders to help establish the timing and scope of work at specific substations. When upgrades or additional capacity are required, WAPA actively pursues partnering with neighboring utilities to jointly finance activities, resulting in cost savings and increased efficiencies for participants.

Unless otherwise provided by law, all C&R costs are recovered from ratepayers with interest over the useful life of the asset providing a revenue stream to the U.S. Treasury. In rare cases, where a C&R project is abandoned, costs are still recovered, but may be expensed.

Transmission Lines and Terminal Facilities
WAPA's 17,000 circuit-mile transmission infrastructure was primarily constructed in the 1940s through 1960s. Thousands of miles of transmission line already exceed their design life. For FY 2019, there is continued focus on replacement and upgrade of deteriorating and inadequate infrastructure across WAPA's service area using non-appropriated alternative financing, with continued emphasis on deteriorating transmission lines in the Parker-Davis systems in Arizona. In addition, activities are underway to address voltage support problems in the Colorado front-range, impacts of growing loads in the Pick-Sloan Missouri Basin service territory, and reliability or compliance concerns in northern California.

Substations
WAPA owns and operates more than 300 substations across its 15-state service territory. Many of these facilities were designed and constructed more than 50 years ago. As substation equipment (such as power transformers, circuit breakers, and control equipment) ages, maintenance costs increase, replacement parts become unavailable, risk of outages increase, and system reliability declines. The normal service life for power transformers and circuit breakers is 40 years and 35 years, respectively. This activity funds the construction, replacement, or upgrade of the substations and its components necessary to sustain reliable power delivery and support a stable, flexible interconnected power grid.

Other
The Other category includes C&R activities not otherwise included in the Substations or Transmission Lines and Terminal Facilities categories. These include communication system equipment and other miscellaneous projects covering items like construction or major rehabilitation of maintenance facilities, access roads, and facility decommissioning and removal costs.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Construction and Rehabilitation $62,442,000** | **$32,632,000** | **-$29,810,000** |
| **Transmission and Terminal Facilities $41,408,000** | **$20,091,000** | **-$21,317,000** |
| *Continuing Work ($26,492,000)*<br>• Continue rehabilitation and construction required on WAPA's transmission lines and terminal facilities to cost-effectively market and deliver clean renewable Federal hydropower and promote a strong record of reliability and safety.<br>• No appropriations provided for this activity.<br>• Alternative financing ($26,492,000) sought for the following projects:<br>o Estes-Flatiron (CO) transmission line rebuild to improve reliability and accessibility of the deteriorating 17-mile transmission line serving the city of Estes Park, CO<br>o Complete facility rating mitigation projects (AZ) to meet NERC compliance requirements, secure line capacity ratings, and improve reliability and safety of the Parker-Davis transmission system<br>o Gila-Knob (AZ) 161-kV transmission line re-route of 2-mile segment in advance of neighboring utility 500-kV transmission line build<br>o Headgate Rock-Parker (AZ) 161-kV transmission line rebuild to improve reliability and safety, and reduce maintenance costs<br>o Lovell-Yellowtail (WY) 115-kV transmission line rebuilds to replace deteriorating structures and improve capacity, communications and reliability<br>o Sidney-Pietz-Sterling (CO/NE) transmission line rebuild and re-conductor to improve reliability, upgrade the transfer capability of | *Continuing Work($12,869,000)*<br>• Continue rehabilitation and construction required on WAPA's transmission lines and terminal facilities to cost-effectively market and deliver clean renewable Federal hydropower and promote a strong record of reliability and safety.<br>• Appropriations ($200,000) are requested for the following ongoing projects in FY 2019:<br>o Gila-Wellton Mohawk Interstate 8 Crossings (AZ) rebuild of 13-mile segment to comply with NERC standards, improve safety at interstate crossings, improve life span of the transmission line, and reduce maintenance costs<br>o Kofa-Dome Tap (AZ) 161-kV rebuild of a 7.3-mile segment to comply with NERC standards and improve the engineered life span of the transmission line<br>• Alternative financing ($12,669,000) sought for the following projects:<br>o Dome Tap – Gila (AZ) 161-kV T-line rebuild of a deteriorating 7.6-mile segment to increase reliability, improve safety, and reduce maintenance costs<br>o Estes-Flatiron (CO) transmission line rebuild to improve reliability and accessibility of the deteriorating 17-mile transmission line serving the city of Estes Park, CO<br>o Cottonwood-Olinda (CA) substation rating upgrade of relays on two transmission lines to match new conductor and increase transfer capacity and eliminate potential NERC standard violation | *Continuing Work (-$13,623,000)*<br>• Decrease attributed to large projects coming to completion where investment has already been made. Continuing work reflects improving reliability and safety and reducing maintenance costs by upgrading and replacing aging and inadequate infrastructure. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| the 65-year, 39-mile line and avoid estimated loss of $1.5 million annually | o Keswick-Airport and Airport-Cottonwood (CA) 230-kV transmission line reconductoring to increase transfer capacity and improve maintenance flexibility on 20.15-miles of existing single circuit line<br>o Gila-Knob (AZ) 161-kV transmission line re-route of 2-mile segment in advance of neighboring utility 500-kV transmission line build<br>o Lovell-Yellowtail (MT) rebuild of 15-miles of two 115-kV transmission lines and deteriorating structures to increase reliability and reduce maintenance costs | |
| *Rehabilitation Starts ($14,916,000)*<br>• Address additional system reliability risk and operational problems.<br>• Appropriations ($5,100,000) requested for critical project starts in FY 2017:<br>o Coolidge-Oracle(AZ) 115-kV transmission line re-conductor to improve reliability, safety, and reduce maintenance costs for this heavily congested aging transmission line<br>o Rodgers-Coolidge (AZ) 230-kV transmission line re-conductor to increase current rating and reduce transmission congestion<br>• Alternative financing ($9,816,000) sought for the following projects:<br>o Groton South-Ordway (SD) new 115-kV transmission line build to mitigate low voltage issue causing outage conditions on the Ordway-Groton transmission line<br>o Pinal Central-Electrical District 5 (AZ) 230-kV addition to existing transmission lines for interconnection increasing capacity and reliability | *Rehabilitation Starts ($7,222,000)*<br>• Address additional system reliability risk and operational problems.<br>• Appropriations ($1,832,000) are requested for critical project starts in FY 2019:<br>o Snowy Range-Laramie (WY) construction of a new 1.5-mile 115-kV double circuit transmission line to mitigate low voltage to comply with FERC and NERC standards<br>• Alternative financing ($5,390,000) sought for the following project:<br>o Headgate Rock-Parker (CA and AZ) 116-kV double circuit rebuild and relocation of 16-miles of deteriorating transmission line and structures to improve reliability of service, improve safety, and reduce maintenance costs<br>o Groton South-Ordway (SD) 115-kV reconductoring on an aging 15-mile transmission line to increase reliability and reduce maintenance costs | *Rehabilitation Starts (-$7,694,000)*<br>• Decrease is attributed to large projects coming to completion where investment has already been made. It is normal for the number of new project starts to increase or decrease from year to year. The program is in line with the 10-year capital investment plan. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Substations $18,773,000** | **$8,725,000** | **-$10,048,000** |
| *Continuing Work ($9,847,000)*<br>• Continue construction, modification, and rehabilitation of WAPA's substations to ensure power system reliability and stability.<br>• Appropriations ($8,105,000), targeted for two of Western's most critical reliability risks, provide for the following activities:<br>o Brookings Substation (SD) upgrade to improve reliability of power delivery under fault conditions and resolve heavy flooding conditions in existing control building; upgrade includes breaker, switching, control board, control building replacement and bus re-configuration<br>o Groton South (SD) Substation construction to provide greater reliability and prevent low voltage impacting the city of Aberdeen, SD during system faults<br>• Alternative financing ($1,742,000) sought for the following projects:<br>o Gila (AZ) Substation 230-kV yard rebuild to eliminate reliability, safety, and environmental hazards at the aging facility<br>o Jamestown (ND) Control Panel and Control Building replacement including associated protection and communication equipment to improve reliability and safety | *Continuing Work ($3,110,000)*<br>• Continue construction, modification, and rehabilitation of WAPA's substations to ensure power system reliability and stability.<br>• Appropriations ($361,000) requested for the following projects in FY 2019:<br>o Devil's Lake Substation (ND) transformer replacement due to age (60+ years) and deteriorating conditions which could result in catastrophic failure, reliability, and customer outages<br>• Alternative financing ($2,749,000) sought for the following projects:<br>o Martin Substation (SD) 115-kV oil breakers, control panels, and relay replacements to ensure reliability and load serving responsibilities to customers<br>o Keswick, Airport, and Cottonwood substations (CA) rating upgrades to improve capacity and operational and maintenance flexibility<br>o Folsom Substation (CA) transformer installation to eliminate a single point of failure and provide operation and maintenance flexibility<br>o Gila Substation (AZ) 69-kV yard rebuild to improve reliability and safety of deteriorating facilities, and reduce rising maintenance costs and outage risk impacting the Parker-Davis, Salinity Control Project, and Colorado River Front Work and Levee system | *Continuing Work (-$6,737,000)*<br>• Decrease attributed to large projects coming to completion where investment has already been made. Continuing work reflects improving reliability and safety and reducing maintenance costs by upgrading and replacing aging and inadequate infrastructure. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| *Rehabilitation Starts ($8,926,000)*<br>• Address additional system reliability risk and operational problems.<br>• Appropriations ($5,353,000) provide for the following activities:<br>o Olinda-O'Banion-Elverta (CA) 230-kV shunt reactive control equipment additions to improve reliability by controlling high transmission system voltage without need to remove lines from service<br>o Gila Substation (AZ) 69-kV yard rebuild to improve reliability and safety of deteriorating facilities, and reduce rising maintenance costs and outage risk impacting the Parker-Davis, Salinity Control Project, and Colorado River Front Work and Levee system<br>• Alternative financing ($3,573,000) sought for the following activities:<br>o Additional financing needed for Olinda-O'Banion-Elverta (CA) 230-kV shunt reactive control equipment additions<br>o Cheyenne (WY) Substation 115-kV bus replacement providing for greater reliability and load capability<br>o Devils Lake (ND) Substation transformer replacement, including replacement of deteriorating control building and equipment to improve reliability and safety | *Rehabilitation Starts ($5,615,000)*<br>• Address additional system reliability risk and operational problems.<br>• Appropriations ($3,162,000) provide for the following activities:<br>o Lovell Substation (WY) 30 MAR 115-kV capacitor bank addition to improve reliability of voltage support in the Lovell/Basin area during outage conditions<br>o Watertown Unit substations (SD) replacement of two aging (40+ years) unit substations to provide reliable station service power for critical operation and maintenance facilities<br>o Sioux City 2 Substation (IA) transformer replacement is needed due to deteriorating conditions creating an environmental hazard and will provide for increased reliability and load growth<br>• Alternative financing ($2,453,000) sought for the following activities:<br>o Maurine Substation (SD) aging (40+ years) transformer replacement to ensure reliability and mitigate risk of catastrophic failure<br>o Grand Forks Substation (ND) replacement of all 230, 115, 69, and 12.47-kV control panels for improved reliability, and construction of a new control building to house the control panels and comply with current safety regulations<br>o Mount Vernon Substation (SD) transformer and oil breaker replacement due to age and deteriorating conditions which could result in reliability and outage conditions as well as environmental impacts<br>o Fargo Substation (ND) control panel replacement for 115-kV and lower voltage equipment to ensure reliability and load growth and reduce maintenance costs | *Rehabilitation Starts (-$3,311,000)*<br>• The decrease is attributed to the new starts being for smaller investment amounts. The number of new projects remains steady. It is normal for the construction program to increase or decrease from year to year. The program is in line with the 10-year capital investment plan |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Other $2,261,000** | **$3,816,000** | **+$1,555,000** |
| *Communication Systems ($311,000)*<br>• No Appropriations ($0) requested<br>• Alternative financing ($311,000) sought for continued communication system improvements for the Pick-Sloan Missouri Basin Program | *Communication Systems ($95,000)*<br>• No Appropriations ($0) requested<br>• Alternative financing ($95,000) sought for the following activities:<br>o Replacement of existing overhead ground wire with optical fiber ground wire for continued system improvements for the Pick-Sloan Missouri Basin Program<br>o Crossman Peak microwave facility to increase reliability of service on the WAPA microwave backbone from Phoenix to the Hoover substation in AZ | *Communication Systems (-$216,000)*<br>• The decrease is attributed to ongoing communications projects coming to a close where the investment has already been made |
| *Miscellaneous ($1,950,000)*<br>• No Appropriations ($0) requested<br>• Alternative financing ($1,950,000) sought for the following activities:<br>o Replacement of uninterruptible power supply and distribution equipment for Western's Rocky Mountain Region Power Marketing Operations Complex (CO) to provide redundant power sources for mission critical systems | *Miscellaneous ($3,721,000)*<br>• No Appropriations ($0) requested<br>• Alternative financing ($3,721,000) sought for the following activities:<br>o Substation service upgrades at eight substations in CA to mitigate safety hazards and increase reliability<br>o Replace Sioux Falls (SD) maintenance building (+60 years old) with new building for crew, shop, vehicles, and equipment/materials storage<br>o Bismarck maintenance facility (ND) addition of a 60' x 100' cold storage building to house critical vehicles and equipment required for maintenance activities<br>o Rapid City Substation (SD) maintenance building replacement (+40 years old) will accommodate crew quarters, shop areas, house vehicles, and provide equipment storage and enable WAPA to be more efficient in maintenance and response to emergencies | *Miscellaneous (+$1,771,000)*<br>• The increase is attributed to the addition and replacement of maintenance buildings and facilities to support reliable power delivery |

**Purchase Power and Wheeling Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Purchase Power and Wheeling** | | | | |
| Central Valley | 345,347 | --- | 328,870 | -16,477 |
| Pick-Sloan Missouri Basin and other Programs | 236,287 | --- | 238,492 | +2,205 |
| **Subtotal, Purchase Power and Wheeling** | **581,634** | **---** | **567,362** | **-14,272** |
| Alternative Financing Needed | -214,625 | --- | -260,954 | -46,329 |
| Offsetting Collections | -367,009 | -179,000 | -306,408 | +60,601 |
| **Total, Purchase Power and Wheeling (New Budget Authority)** | **0** | **0** | **0** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Construction, Rehabilitation, Operation & Mainenance**
**Purchase Power and Wheeling**

**Description**
The Purchase Power and Wheeling subprogram continues to support WAPA's marketing efforts and delivery capability which spans a 1.3 million square mile area serving a diverse group of several hundred wholesale customers, including municipalities, cooperatives, public utility and irrigation districts, Federal and state agencies and Native American tribes. No appropriated budget authority is necessary.

For a historical perspective, WAPAs Purchase Power and Wheeling subprogram is highly variable; it is affected by reservoir storage levels, annual and long-term drought conditions, downstream flow concerns due to icing, flooding, environmental, health and safety, recreation, irrigation and navigation requirements. To illustrate the extent of the variability, WAPA Purchase Power and Wheeling costs during FY 2008, an adverse water year, was nearly $600M; whereas in FY 2016, a much improved water year, costs were half that at just over $300 million. Year-to-year changes can be extensive, and during long-term drought scenarios, the increased purchase power requirements can last several years.

The FY 2019 budget request reflects potentially adverse hydro generation conditions. WAPA can review and revise its FY 2019 Purchase Power and Wheeling estimates, providing for more current assessment of conditions, following the FY 2018 winter snowpack and spring thaw seasons.

Central Valley Project
WAPA continues to deliver on its contractual power commitments to customers under the Central Valley Project's Post 2004 Marketing Plan. The budget request assumes current full load service customers will continue to choose service from WAPA through "Custom Product" contractual agreements. WAPA also purchases power to support variable resource customers on a pass-thru basis. If project net generation is not sufficient, WAPA may also purchase to support project use load, First Preference Customer load, and sub-control area reserve requirements. As part of the Order 741, FERC promulgated guidance requiring RTO/ISOs to take physical title/ownership to the energy bought/sold in their respective markets, making it necessary for WAPA to acknowledge that customers receive the financial, and not the physical benefit of their Federal power allocations. In order to provide service in the state, WAPA is voluntarily participating in the California greenhouse gas cap-and-trade program which became effective January 1, 2013.

Pick-Sloan Missouri Basin and Other Programs
The budget request continues to support long-term firm power commitments to customers of the eastern and western divisions of the Pick-Sloan Missouri Basin Program, the Fryingpan-Arkansas Project, and the Parker-Davis Project commensurate with the levels of average firm hydroelectric energy marketed by WAPA. The request also provides transmission support for the Pacific Northwest-Southwest Intertie Project. The total program estimates shown are based primarily on market pricing of short term firm energy, negotiated transmission rates, and WAPA and generating agency's forecasts.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Central Valley Project** | | |
| *Program Requirements ($345,347,000)*<br>• The Purchase Power and Wheeling subprogram supports WAPA's power marketing effort by providing for power purchases to firm the variable hydropower resource and securing transmission services as necessary to meet its contractual power delivery obligations. | *Program Requirements ($328,870,000)*<br>• The Purchase Power and Wheeling subprogram continues to support WAPA's power marketing effort by providing for power purchases to firm the variable hydropower resource and securing transmission services as necessary to meet its contractual power delivery. | *Program Requirements (-$16,477,000)*<br>• Decrease associated with purchase power prices and loss of potential customer. Amounts are for offsetting collection authority and alternative financing; no direct appropriations are requested for this activity. |
| *Alternative Financing (-$166,277,000)*<br>• Contractual arrangements made with customers provide opportunities for alternative financing of the purchase power requirements. Alternative financing methods include net billing, bill crediting, energy exchanges, and direct customer funding. | *Alternative Financing (-$160,152,000)*<br>• Contractual arrangements made with customers provide opportunities for alternative financing of the purchase power requirements. Alternative financing methods include net billing, bill crediting, energy exchanges, and direct customer funding. | *Alternative Financing (+$6,125,000)*<br>• The slight decrease is due to change in customer estimates for energy and capacity needs for supplemental purchase. Amounts are for alternative financing; no direct appropriations are requested for this activity. |
| **Pick-Sloan Missouri Basin** | | |
| *Program Requirements ($236,287,000)*<br>• The Purchase Power and Wheeling subprogram continues to support WAPA's power marketing effort by providing for power purchases to firm the variable hydropower resource and securing transmission services as necessary to meet its contractual power delivery obligations. | *Program Requirements ($238,492,000)*<br>• The Purchase Power and Wheeling subprogram continues to support WAPA's power marketing effort by providing for power purchases to firm the variable hydropower resource and securing transmission services as necessary to meet its contractual power delivery. | *Program Requirements (+$2,205,000)*<br>• Net increase is due to wheeling costs. Amounts are for offsetting collection authority and alternative financing; no direct appropriations are requested for this activity. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| *Alternative Financing (-$48,348,000)*<br>• Alternative financing methods negotiated with customers provide an offset to the total program receipt financing requirement. Alternative financing methods include net billing, bill crediting, energy exchanges, and direct customer funding. | *Alternative Financing (-$100,802,000)*<br>• Contractual arrangements made with customers provide opportunities for alternative financing of the purchase power requirements. Alternative financing methods include net billing, bill crediting, energy exchanges, and direct customer funding. | *Alternative Financing (-$52,454,000)*<br>• Alternative financing increases due to WAPA's participation in the Southwest Power Pool. No direct appropriations are requested for this activity. |

## Program Direction

### Overview

WAPA's Program Direction subprogram provides compensation and all related expenses for its workforce, including those employees that operate and maintain WAPA's high-voltage interconnected transmission system and associated facilities; those that plan, design, and supervise the construction of replacements, upgrades and additions (capital investments) to the transmission facilities; those that market the power and energy produced to repay annual expenses and capital investment; and those that administratively support these functions.

The Program Direction subprogram supports WAPA's mission. To attain reliability performance, dispatchers match generation to load minute-by-minute to meet or exceed performance levels established by NERC. Energy schedulers maximize revenues from non-firm energy sales and power rates are reviewed and adjusted to support repayment of the Federal investment. WAPA trains its employees on a continuing basis in occupational safety and health regulations, policies and procedures, and conducts safety meetings at employee, supervisory and management levels to keep the safety culture strong. Accidents are reviewed to ensure lessons are learned and proper work protocol is in place.

The Program Direction subprogram further supports WAPA's Human Capital Management (HCM) Workforce Plan, which includes the following activities: exploring ways to increase Human Resource efficiency through consolidation; development of defined educational skill sets and cross-functional training by occupational series; the development and/or expansion of intern/apprenticeship programs in the occupations of energy marketing, dispatcher, lineman, and electrician; introduction of an under-study program in Power Marketing, prior to an incumbent retiring; rotational training programs for engineers; strategic use of knowledge sharing and training events in critical occupations; and, succession planning development programs for mid- to upper-level graded Federal positions. By design, costs for these HCM programs will be minimal as local area expertise and facilities are used to the maximum extent possible.

In consultation with its customers, WAPA reviews required replacements and upgrades to its existing infrastructure to sustain reliable power delivery to its customers and to contain annual maintenance expenses. The timing and scope of these replacements and upgrades are critical to assure that WAPA's facilities do not become the "weak link" in the interconnected system. WAPA pursues opportunities to join with neighboring utilities to jointly finance activities, which avoid redundant facilities and result in realized cost savings and/or increased efficiencies for all participants.

### Highlights of the FY 2019 Budget Request

The FY 2019 request provides for the continuation of WAPA's CROM account activities related to Program Direction at the level necessary to meet mission requirements. The account reflects an increase of 8 FTE which are cyclical shifts between the CROM and CRBPMF accounts.

**Program Direction Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Program Direction** | | | | |
| Salaries and Benefits | 153,234 | --- | 161,966 | +8,732 |
| Travel | 10,521 | --- | 10,573 | +52 |
| Support Services | 27,323 | --- | 31,786 | +4,463 |
| Other Related Expenses | 35,419 | --- | 34,158 | -1,261 |
| **Total, Program Direction** | **226,497** | **---** | **238,483** | **+11,986** |
| Use of Alternative Financing | -6,343 | --- | -39,136 | -32,793 |
| Use of Receipts from Colorado River Dam Fund | -6,717 | --- | -7,603 | -886 |
| Offsetting Collections, Other Expenses | -150,441 | -149,419 | -150,761 | -320 |
| Use of Prior Year Balances | -28,000 | --- | 0 | +28,000 |
| **Total, Program Direction** | **34,996** | **34,758** | **40,983** | **+5,987** |
| **Federal FTEs** | **1,202** | | **1,210** | **+8** |
| | | | | |
| **Support Services** | | | | |
| Technical Support | | | | |
| Economic and Environmental Analysis | 4,897 | --- | 8,052 | +3,155 |
| **Total, Technical Support** | **4,897** | | **8,052** | **+3,155** |
| Management Support | | | | |
| Automated Data Processing | 11,081 | --- | 14,222 | +3,141 |
| Training and Education | 1,685 | --- | 1,910 | +225 |
| Reports and Analysis Management and General Administrative Support | 9,660 | --- | 7,602 | -2,058 |
| **Total Management Support** | **22,426** | **---** | **23,734** | **+1,308** |
| **Total, Support Services** | **27,323** | | **31,786** | **+4,463** |
| | | | | |
| **Other Related Expenses** | | | | |
| Rent to GSA | 2,432 | --- | 2,139 | -293 |
| Communication, Utilities, Misc. | 5,920 | --- | 5,921 | +1 |
| Printing and Reproduction | 63 | --- | 116 | +53 |
| Other Services | 15,495 | --- | 11,369 | -4,126 |
| Training | 40 | --- | 11 | -29 |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Purchases from Gov. Accounts | 992 | --- | 1,045 | +53 |
| Operation and Maintenance of Equipment | 1,034 | --- | 5,575 | +4,541 |
| Supplies and Materials | 4,097 | --- | 2,612 | -1,485 |
| Equipment | 2,416 | --- | 2,995 | +579 |
| Working Capital Fund | 2,930 | --- | 2,375 | -555 |
| **Total, Other Related Expenses** | **35,419** | **---** | **34,158** | **-1,261** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

## Program Direction

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $226,497,000** | **$238,483,000** | **+$11,986,000** |
| **Salaries and Benefits $153,234,000** | **Salaries and Benefits $161,966,000** | **Salaries and Benefits +$8,732,000** |
| • Salary and benefits provide for Federal employees who construct and replace, operate and maintain, on a continuing basis, WAPA's high-voltage interconnected transmission system. Salary and benefits funds those FTEs assigned to this account, including those salaries determined through negotiations. | • Requested funding supports ongoing activities.<br>• | • The salary and benefits are for the FTE required to support mission related O&M and C&R program direction activities within the CROM account and also reflect salary adjustments for FY 2017 and FY 2018. The increase reflects a cyclical shift of 8 FTE between the CROM and CRBPMF accounts, primarily for routine scheduled maintenance activities. These positions are critical to WAPA's mission activities. |
| • **Travel $10,521,000** | • **Travel $10,573,000** | • **Travel +$52,000** |
| • Planned essential travel supports WAPA's mission-related operation and maintenance activities. WAPA continues its effort to minimize travel costs by limiting travel associated with general agency operations, administrative training, and conferences. Also, WAPA will strive to find alternatives to attain required training by means other than by traveling. | • Requested funding supports ongoing activities. | • The slight increase reflects WAPA's continued effort to use technological capabilities to decrease travel requirements and slight offset for inflationary factors. |
| • **Support Services $27,323,000** | • **Support Services $31,786,000** | • **Support Services +$4,463,000** |
| • Support Services funded in this category include information processing, warehousing, job related training and education, engineering, miscellaneous advisory and assistance services, and general administrative support. | • Requested funding supports ongoing activities. | • Increase to this activity is driven by planned IT system enhancements with emphasis on cybersecurity and technical support along with inflationary factors. Increase is partially offset by decrease in general administrative service support. |
| • **Other Related Expenses $35,419,000** | • **Other Related Expenses $34,158,000** | • **Other Related Expenses -$1,261,000** |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • Other related expenses include rental space, utilities, supplies and materials, telecommunications, computers, printing and reproduction, training tuition, and DOE's working capital fund distribution. Rental space costs assume the General Services Administration's (GSA) inflation factor. Other costs are based on historical usage and actual cost of similar items. | • Requested funding supports ongoing activities. | • The decrease to this activity is primarily attributable to a shift between operation and maintenance services related to IT network and cybersecurity activities and contractual services. Other decreases are in GSA rental space, the distribution of DOE's Working Capital Fund to this account. Other offsetting decreases within this activity include supplies and materials and equipment and training. Utilities increase is inflationary. |

**Falcon and Amistad Operating and Maintenance Fund**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|---|
| Gross | 4,393 | --- | 5,329 |
| Offsets | -4,161 | --- | 5,101 |
| **Net BA** | **232** | **230** | **228** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

The Falcon and Amistad Operating and Maintenance fund (Maintenance Fund) was established in the Treasury of the United States as directed by the Foreign Relations Authorization Act, FYs 1994 and 1995. The Maintenance Fund is administered by WAPA's Administrator for use by the Commissioner of the U. S. Section of the International Boundary and Water Commission (IBWC) to defray administrative, O&M, replacement, and emergency costs for the hydroelectric facilities at the Falcon and Amistad Dams. IBWC owns and operates the U.S. portion of the projects, and Federal staff funded under this program continues to be allocated to the U.S. Section of IBWC by the Department of State. The Falcon and Amistad project supports WAPA's program goals by providing power to rural electric cooperatives through WAPA. With the exception of monies received from the Government of Mexico, all revenues collected from the sale of electric power generated at the Falcon and Amistad Dams are credited to the Maintenance Fund. Monies received from the Government of Mexico are credited to the General Fund of the U.S. Treasury. Revenues collected in excess of operating expenses are used to repay, with interest, the cost of replacements and original investments. Full funding will support 24-hour/day operation and maintenance of the two power plants to ensure response to ever-changing water conditions, customer demand, and continual coordination with operating personnel of the Government of Mexico.

**Highlights of the FY 2019 Budget Request**

In FY 2019, WAPA's request has been formulated to meet its power marketing and contractual power delivery obligations with continued high marks for reliability. Revenues collected from customers to recover the costs of the Federal Power Program will be sufficient to provide for WAPA's FY 2019 planned expenses for the power plants in the IBWC. The FY 2019 request also allows for U.S. Customer(s) of the Falcon and Amistad Dams to contribute funds for use by the IBWC in fulfilling their duties in accordance with agreements between WAPA, IBWC, and the power customers. This will allow work to be accomplished using customer advances/alternative financing, a funding mechanism used throughout WAPA under the Contributed Funds Act, 43 USC 395. The customer contributed funds are planned to predominantly assist in capitalized replacement projects.

**Falcon and Amistad Operating and Maintenance Fund Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Western Area Power Administration | | | | |
| Falcon and Amistad Operating and Maintenance Fund | 4,393 | --- | 5,329 | +936 |
| **Subtotal, Falcon and Amistad Operating and Maintenance Fund** | **4,393** | **---** | **5,329** | **+936** |
| | | | | |
| Offsetting Collections | -3,838 | -3,812 | -4,979 | -1,141 |
| Alternative Financing | -323 | -321 | -122 | +201 |
| **Total, Falcon and Amistad Operating and Maintenance Fund** | **232** | **230** | **228** | **-4** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

## Falcon and Amistad Operating and Maintenance Fund

**Description**

The Falcon and Amistad Project consists of two international dams located on the Rio Grande River between Texas and Mexico. The United States and Mexico operate separate power plants on each side of the Rio Grande River. The Operating and Maintenance Fund was established in the Treasury of the United States and is administered by WAPA's Administrator for use by the Commissioner of the U.S. Section of the IBWC to defray administrative, O&M, replacement, and emergency costs for the hydroelectric facilities at the Falcon and Amistad Dams.

Salaries and Benefits

This activity funds salaries and benefits for the 40 positions of the U.S. Section of the IBWC who operate and maintain the two power plants on a 24-hour/day basis, including planned maintenance activities, required safety services, and emergency response to flood operations and/or equipment failure.

Routine Services

This activity funds routine services such as inspection and service of the HVAC and air compressor system, fire suppression systems, elevators, self-contained breathing apparatus, recharge and hydro-testing of fire extinguishers, calibration of test equipment, rebuild of electric motors, and repair of obsolete equipment when replacement parts are no longer available.

Miscellaneous Expenses

This activity funds travel, training, communications, utilities, printing, and office supplies and materials for the IBWC employees and technical advisors. The request includes essential training for employees to comply with standards of the Interagency Commission on Dam Safety, Occupational and Health Administration, and the National Dam Safety Act.

Marketing, Contract, Repayment Studies

This activity funds interest payments to the U.S. Treasury. Estimates are based on Power Repayment Studies for the Projects funded in this account. This activity funds power marketing, administration of power contracts, and preparation of rate and repayment studies. Based on accurate studies, staff ensures power revenues are set at an appropriate level to recover annual expenses and meet repayment schedules.

## Falcon and Amistad Operating and Maintenance Fund

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Falcon and Amistad Operating and Maintenance Fund $4,393,000** | **$5,329,000** | **+$936,000** |
| • *Salaries and Benefits ($3,079,000)*<br>• This activity funds the salaries and benefits for those employees assigned to the U.S. Section of the IBWC who operate and maintain the two power plants. | • *Salaries and Benefits ($3,155,000)*<br>• Requested funding supports ongoing activities. | • *Salaries and Benefits (+$76,000)*<br>• The net increase in salaries and benefits is primarily attributed to inflationary factors. |
| • *Routine Services ($1,006,000)*<br>• This activity funds routine services such as equipment inspections and maintenance services. | • *Routine Services ($1,848,000)*<br>• Requested funding supports ongoing activities. | • *Routine Services (+$842,000)*<br>• The net increase is primarily attributed to inspection work on intake gates at Falcon Dam as recommended by the Corps of Engineers Plant Assessment Report.<br>• |
| • *Miscellaneous Expenses ($274,000)*<br>• This activity funds travel, training, communications, utilities, printing, and office supplies and materials for the IBWC employees and technical advisors. | • *Miscellaneous Expenses ($296,000)*<br>• Requested funding supports ongoing activities. | • *Miscellaneous Expenses (+$22,000)*<br>• The increase is primarily due to increased costs for travel, communications, and utilities, as well as inflationary factors. |
| • *Marketing, Contracts, Repayment Studies ($34,000)*<br>• This activity funds interest payments to the U.S. Treasury, power marketing, administration of power contracts, and preparation of rate and repayment studies. | • *Marketing, Contracts, Repayment Studies ($30,000)*<br>• Requested funding supports ongoing activities. | • *Marketing, Contracts, Repayment Studies*<br>• *(-$4,000)*<br>• The decrease is attributed to cost savings in travel by WAPA personnel, rates and repayment studies and contract administration. |

**Colorado River Basins Power Marketing Fund**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|---|
| **Gross** | **213,530** | **---** | **220,337** |
| **Offsets** | **-236,530** | **---** | **-243,337** |
| **Net BA** | **-23,000** | **-22,844** | **-23,000** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**
WAPA operates and maintains the transmission system for the projects funded in this account to ensure an adequate supply of reliable electric power in a clean and environmentally safe, cost-effective manner. The Colorado River Basins Power Marketing Fund Program (CRBPMF) is comprised of two power systems: the Colorado River Storage Project, including the Dolores, Seedskadee and Olmsted Projects; and the Fort Peck Project. WAPA is responsible for construction, maintenance, and operation of facilities for transmitting and marketing the electrical energy generated in these power systems.

**Highlights of the FY 2019 Budget Request**
In FY 2019, WAPA's request has been formulated to meet its power marketing and contractual power delivery obligations with continued high marks for reliability. Revenues collected from customers to recover the costs of the Federal Power Program will be sufficient to provide for WAPA's FY 2019 planned expenses for the power systems in the CRBPMF.

**Colorado River Basins Power Marketing Fund Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Colorado River Basins Power Marketing Fund** | | | | |
| **Equipment, Contracts and Related Expenses** | | | | |
| Supplies, Materials and Services | 17,279 | --- | 18,489 | +1,210 |
| Purchase Power Costs | 113,082 | --- | 109,062 | -4,020 |
| Capitalized Equipment | 13,963 | --- | 24,838 | +10,875 |
| Interest/Transfers | 7,000 | --- | 5,000 | -2,000 |
| **Total, Equipment, Contracts and Related Expenses** | **151,324** | **---** | **157,389** | **+6,065** |
| **Program Direction** | **62,206** | **---** | **62,948** | **+742** |
| **Total, Operating Expenses from new authority** | **213,530** | **---** | **220,337** | **+6,807** |
| Offsetting Collections Realized | -236,530 | --- | -243,337 | -6,807 |
| **Total, Obligational Authority** | **-23,000** | **-22,844** | **-23,000** | **0** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Colorado River Basins Power Marketing Fund**
**Equipment, Contracts and Related Expenses**

**Description**

WAPA's equipment, contracts and related expenses are necessary to operate and maintain this activity. Revenues from the sale of electric energy, capacity and transmission services replenish the fund and are available for expenditure for operation, maintenance, power billing and collection, program direction, purchase power and wheeling, interest, emergencies, and other power marketing expenses.

Supplies, Materials and Services

This activity funds the procurement of supplies, materials, and services necessary to respond to routine and emergency situations in the transmission system, and the continuation of reimbursements to the U.S. Army Corps of Engineers for operation and maintenance of the Fort Peck Power Plant. Estimates are based on recent actual costs for supplies needed to maintain transmission system reliability.

Purchase Power Costs

This activity funds the procurement of electrical power, transmission capacity and wheeling services on the open market. The request anticipates the results of continued low-steady-flow tests conducted at Glen Canyon Dam, as required by the Glen Canyon Dam Environmental Impact Statement Record of Decision. Additionally, the request includes obligation authority to accommodate replacement power purchases for customers served by the Colorado River Storage Project. The replacement power purchases, a provision of the Salt Lake City Area Integrated Projects electric power contracts, are made at the request of power customers at times when WAPA lacks sufficient generation to meet its full contract commitment. The funds for the replacement power purchases are advanced by the requesting customers prior to the purchase.

Capitalized Equipment

This activity funds the procurement of capitalized equipment including circuit breakers, transformers, relays, switches, transmission line equipment, microwave, SCADA, and other communication and control equipment to assure reliable service to WAPA's customers. Replacement and upgrade of aged power system components are crucial to system reliability

and transmission services. Planned communications equipment purchases include replacing existing ground wire with fiber optic ground wire and upgrading conductors. Included also is funding for the continuation of the project to replace analog microwave with fiber optic ground wire and fiber optic terminal. Cost comparisons have shown that fiber optics have a significant lower life cycle cost and higher bandwidth capacity than digital microwave.

Transmission line estimates include the purchase of poles, crossarms, conductors, fusion splicers, line switches, overhead ground wire and hardware for the continued transmission line rebuilds. This estimate includes line rebuilds with the anticipated completion of 10 miles a year.

Planned substation estimates include upgrades, replacement of breakers and circuit switches, and replacement of transformers, test equipment, as well as other aged equipment at various substations. WAPA cyclically replaces older electro-mechanical relays with microprocessor relays. The microprocessor relays assist in finding faults faster in order to more efficiently restore service to customers. Other miscellaneous items required for substation replacements include surge arrestors, batteries and chargers, and monitoring equipment.

Planned movable capitalized property estimates include replacements of special purpose trucks, replacement of generators to maintain the reliability and backup power to the communications system, and replacement of outdated test and recording equipment. Other estimates include the replacement of test equipment used to troubleshoot the new digital microwave radio system. Ongoing replacement is also planned for aging information technology support systems and routers. Other requests include funding for the continuation of the SCADA Upgrade program, as well as other minor enhancements that provide for the ease of maintenance, protection of equipment and materials, and environmental compliance.

Interest/Transfers

This activity funds interest payments to the U.S. Treasury. Estimates are based on Power Repayment Studies for the Projects funded in this account.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Equipment, Contracts and Related Expenses**<br>**$151,324,000** | **$157,389,000** | **+$6,065,000** |
| • *Supplies, Materials & Services ($17,279,000)*<br>• This activity funds the procurement of supplies, materials, and services necessary to respond to routine and emergency situations in the transmission system, and the continuation of reimbursements to the U.S. Army Corps of Engineers for operation and maintenance of the Fort Peck Power Plant. | • *Supplies, Materials & Services ($18,489,000)*<br>• Requested funding supports ongoing activities. | • *Supplies, Materials & Services (+$1,210,000)*<br>• The increase is due to increased U.S. Army Corps of Engineers costs for operation and maintenance of the Fort Peck Power Plant, depreciation of IT capital equipment, and operation and maintenance of transmission lines. |
| • *Purchase Power Costs ($113,082,000)*<br>• This activity funds the procurement of electrical power, transmission capacity and wheeling services on the open market. | • *Purchase Power Costs ($109,062,000)*<br>• Requested funding supports ongoing activities. | • *Purchase Power Costs (-$4,020,000)*<br>• The decrease to the purchase power cost estimates are based on 24-month study factors including water cycle, snow pack and market rates. |
| • *Capitalized Equipment ($13,963,000)*<br>• This activity funds the procurement of capitalized equipment including circuit breakers, transformers, relays, switches, transmission line equipment, microwave, SCADA, and other communication and control equipment to assure reliable service to WAPA's customers. | • *Capitalized Equipment ($24,838,000)*<br>• Requested funding supports ongoing activities. | • *Capitalized Equipment (+$10,875,000)*<br>• The increase is primarily attributable to shunt cap bank and breaker replacements at CRSP, transmission line rebuilds in Fort Peck, and IT investment. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • *Interest/Transfers ($7,000,000)*<br>• This activity funds interest payments to the U.S. Treasury. Estimates are based on Power Repayment Studies for the Projects funded in this account. | • *Interest/Transfers ($5,000,000)*<br>• Requested funding supports ongoing activities. | • *Interest/Transfers (-$2,000,000)*<br>• The decrease in interest/transfers is due to the ongoing annual debt service payments made on capital repayments as calculated in the Power Repayment Study. |

**Colorado River Basins Power Marketing Fund**
**Program Direction**

**Overview**

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Colorado River Basins Power Marketing Fund. WAPA trains its employees on a continuing basis in occupational safety and health regulations, policies and procedures, and conducts safety meetings at employee, supervisory and management levels to keep the safety culture strong. Accidents are reviewed to ensure lessons are learned and proper work protocol is in place.

**Highlights of the FY 2019 Budget Request**

The FY 2019 request provides for the continuation of WAPA's revolving fund activities related to Program Direction at the level necessary to meet mission requirements. The decrease in FTE reflects a cyclical shift of 8 FTE between the CRBPMF and CROM accounts and 1 FTE between CRBPMF and TIP accounts, primarily for routine scheduled maintenance activities. These positions are critical to WAPA's mission activities.

**Colorado River Basins Power Marketing Fund**
**Program Direction Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Program Direction** | | | | |
| Salaries and Benefits | 42,676 | --- | 44,278 | +1,602 |
| Travel | 2,923 | --- | 3,276 | +353 |
| Support Services | 6,336 | --- | 6,981 | +645 |
| Other Related Expenses | 10,271 | --- | 8,413 | -1,858 |
| **Total, Program Direction** | **62,206** | **---** | **62,948** | **+742** |
| **Federal FTEs** | **302** | **---** | **293** | **-9** |
| | | | | |
| **Support Services** | | | | |
| **Technical Support** | | | | |
| Engineering and Technical Services | 0 | --- | 2,388 | +2,388 |
| **Total, Technical Support** | 0 | --- | 2,388 | +2,388 |
| **Management Support** | | | | |
| Automated Data Processing | 2,569 | --- | 1,964 | -605 |
| Training and Education | 381 | --- | 915 | +534 |
| Reports and Analyses Management and General Administrative Support | 3,386 | --- | 1,714 | -1,672 |
| **Total, Management Support** | **6,336** | **---** | **4,593** | **-1,743** |
| **Total, Support Services** | **6,336** | | **6,981** | **+645** |
| | | | | |
| **Other Related Expenses** | | | | |
| Rent to GSA | 636 | --- | 536 | -100 |
| Communication, Utilities, Misc. | 1,562 | --- | 1,710 | +148 |
| Printing and Reproduction | 12 | --- | 30 | +18 |
| Other Services | 5,472 | --- | 2,247 | -3,225 |
| Training | 45 | --- | 15 | -30 |
| Purchases from Gov. Accounts | 235 | --- | 261 | +26 |
| Operation and Maintenance of Equipment | 213 | --- | 1,484 | +1,271 |
| Supplies and Materials | 991 | --- | 695 | -296 |
| Equipment | 584 | --- | 797 | +213 |
| Working Capital Fund | 521 | --- | 638 | +117 |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Total, Other Related Expenses** | **10,271** | **---** | **8,413** | **-1,858** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Colorado River Basins Power Marketing Fund**
**Program Direction**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $62,206,000** | **$62,948,000** | **+$742,000** |
| **Salaries and Benefits $42,676,000** | **Salaries and Benefits $44,278,000** | **Salaries and Benefits +$1,602,000** |
| • Salary and benefits supports a FY 2017 request level of 302 FTE. This includes General Schedule employees, as well as those salaries determined through negotiations. This activity provides for Federal employees who operate and maintain the Program's high-voltage integrated transmission system and associated facilities; plan, design, and supervise the replacement (capital investments) to the transmission facilities; and market the power and energy produced to repay annual expenses and capital investment. | • Requested funding supports ongoing activities. | • The increase in salaries and benefits supports the FTE charged to this account and also reflects salary and benefit adjustments for FY 2017 and FY 2018, including salaries determined by prevailing rates in the electric utility industry. The FTE decrease (-9) is a cyclical transfer to WAPA's CROM account (+8) and to the TIP account (+1) for a total request level of 293 FTE. |
| • **Travel $2,923,000** | • **Travel $3,276,000** | • **Travel +$353,000** |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| • This activity funds personnel travel and per diem expenses for essential mission-related activities, including the maintenance of transmission facilities. The request includes estimates for the rent/lease of GSA vehicles and other transportation. Costs are reduced by limiting travel associated with general agency operations, administrative training, and conferences. | • Requested funding supports ongoing activities. | • The increase in travel is in support of communication and substation equipment maintenance and inflationary increases. |
| • **Support Services $6,336,000** | • **Support Services $6,981,000** | • **Support Services +$645,000** |
| • Support services funded in this category include automated data processing support, warehousing, computer-aided drafting/engineering, job related training and education, and general administrative support. | • Requested funding supports ongoing activities. | • The increase is primarily driven by planned Engineering and Technical support as well as environmental studies with offsets in General Administrative support. |
| **Other Related Expenses $10,271,000** | **Other Related Expenses $8,413,000** | **Other Related Services -$1,858,000** |
| • Other related expenses include, but are not limited to, DOE's working capital fund<br>• distribution, space, utilities and miscellaneous charges, printing and reproduction, training tuition, maintenance of office equipment, supplies and materials, telecommunications, and office equipment to include computers. | • Requested funding supports ongoing activities. | • The decrease to this activity is primarily driven by other services, GSA rent, supplies and materials offset by increases in operation and maintenance of equipment, communication and utilities, equipment and distribution of working capital fund. Other increases are primarily inflationary. |

**Transmission Infrastructure Program**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 0 | 0 | 0 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

WAPA established the Transmission Infrastructure Program (TIP) and Office to implement Title III, Section 301 of the Hoover Power Plant Act of 1984 as amended by the American Recovery and Reinvestment Act of 2009 (Recovery Act), which provided WAPA borrowing authority of up to $3.25 billion for the purposes of: (1) constructing, financing, facilitating, planning, operating, maintaining, or studying construction of new or upgraded electric power transmission lines and related facilities with at least one terminus within the area served by WAPA; and (2) delivering or facilitating the delivery of power generated by renewable energy resources constructed or reasonably expected to be constructed after the Recovery Act's date of enactment.

TIP is expected to be an administratively self-sustaining program that relies on funding arrangements with project developers. When developers seek technical assistance, WAPA collects funds from the project developers to support development of eligible projects and to cover the overhead and administrative costs of the program. Reimbursable or Advance Funding Agreements with project developers are required prior to initiating efforts to evaluate the technical and financial merits of a potential project to ensure the full cost of services delivered are paid by project beneficiaries. For projects that are approved for use of WAPA's borrowing authority, the authority to cover the full amount of the loan is apportioned at the outset and cash is borrowed periodically from the Department of Treasury (Treasury) as needed. The debt is repaid according to the financial agreement terms and conditions of each project.
As mandated, the TIP program is completely separate and distinct from WAPA's power marketing program.
TIP has two projects currently using the borrowing authority for a total of $116 million in loan authority obligated.
All administrative costs for TIP are offset by advanced financing and collections. WAPA is not requesting any new annual appropriated funds for TIP.

**Highlights and Major Changes in the FY 2019 Budget Request**

The President's budget request includes a proposal to repeal the borrowing authority managed by the TIP program. This proposal to repeal the borrowing authority managed by the TIP program is in concert with the proposal in the FY 2019 Budget Request to eliminate DOE loan programs in accordance with Administration priorities. Construction and project debt estimates are based on preliminary information provided by the Project Sponsors/Proponents.

*Note:* Values for TIP are based on early stages of project development, forecasts of current projects, estimates of future project development, and departmental collaboration, which are subject to change. While based on knowledge and experience to date, these estimates are to be regarded as non-binding representations that are determined by Project Sponsors/Proponents.

**Transmission Infrastructure Program Funding**

**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Mandatory, Direct Budget Authority** | | | | |
| New Borrowing Authority | 800,000 | --- | 1,025,000 | +225,000 |
| | | | | |
| Use of Collections from Projects | 4,261 | --- | 4,470 | +209 |
| Collections from Projects | -4,261 | --- | -4,470 | -209 |
| **Total Mandatory** | **800,000** | **---** | **1,025,000** | **+225,000** |
| Repayment of Borrowing Authority | -3,600 | --- | -350,000 | -346,400 |
| **Federal FTEs (Mandatory)** | **9** | | **0** | **-9** |
| | | | | |
| **Discretionary, Reimbursable Budget Authority** | | | | |
| Program Direction | 7,261 | --- | 43,170 | +35,909 |
| Advance Funding | -3,500 | --- | -4,500 | -1,000 |
| Offsetting Collections | -3,761 | --- | -38,670 | -34,909 |
| **Total Discretionary** | **0** | **---** | **0** | **0** |
| **Federal FTEs (Discretionary)** | **8** | | **18** | **+10** |
| | | | | |
| **Total, Federal FTEs** | **17** | | **18** | **+1** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Direct Budget Authority $800,000,000** | **$1,025,000,000** | **+$225,000,000** |
| **New Borrowing Authority $800,000,000** | **$1,025,000,000** | **+$225,000,000** |
| • Estimated new projects approved for use of WAPA's borrowing authority. | • Requested funding supports ongoing activities. | • The increase is due to estimates provided by Project Sponsors/Proponents. |
| **Collections from Projects $4,261,000** | **$4,470,000** | **+$209,000** |
| • Collections in this category are from excess capacity offtake from borrowing authority funded projects. | • Requested funding supports ongoing activities. | • TIP estimates collecting $4.5 million in excess capacity from the ED5 energized line in FY 2019. These collections will all be obligated and used for costs associated with operating and maintaining those lines generating the capacity. |
| **Repayment of Borrowing Authority -$3,600,000** | **-$350,000,000** | **-$346,400,000** |
| • This activity represents repayments to Treasury from projects for principal. | • Requested funding supports ongoing activities. | • The decrease represents repayment of cash drawn for current projects according to the terms of each projects' lending agreement as they are anticipated to move into long term financing. |

**Transmission Infrastructure Program**
**Program Direction**

**Overview**

WAPA's TIP Program Direction subprogram provides compensation and all related expenses for its workforce, including those employees that are directly assigned to the program as project management, technical experts, finance and administration; those that provide expertise in land acquisition, engineering and environmental compliance; those that provide legal counsel; and those that administratively support these functions.

All TIP program direction costs are expected to be offset by customers over time, either through advanced funding agreements or offsetting collections. Advanced funding is provided to TIP from project applicants who use TIP's expertise in the development of their project. The advanced funding agreements fund federal and/or contract staff working on the development of a specific project. Other sources of funds include the overhead rate applied to each active project; service charges; interest rate differentials; and the advance collection of Project Proposal and Business Plan Proposal evaluation expenses. These collections offset the costs of administering the TIP program and provide a risk mitigation reserve.

The Program Direction subprogram supports DOE and WAPA missions, specifically in facilitating delivery of renewable energy resources to market.

**Highlights of the FY 2019 Budget Request**

In FY 2019 the TIP office will continue to recover programmatic expenses, and maintain a risk mitigation reserve.

**Program Direction Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Transmission Infrastructure Program Office** | | | | |
| Salaries and Benefits | 2,265 | --- | 2,315 | +50 |
| Travel | 140 | --- | 120 | -20 |
| Support Services | 1,995 | --- | 1,997 | +2 |
| Other Related Expenses | 2,861 | --- | 38,738 | +35,877 |
| **Subtotal, Program Direction** | **7,261** | **---** | **43,170** | **+35,909** |
| Use of Offsetting Collections | -7,261 | | -43,170 | -35,909 |
| **Total, Program Direction** | **0** | **---** | **0** | **0** |
| **Federal FTEs (Mandatory Direct)** | **9** | | **0** | **-9** |
| **Federal FTEs (Discretionary Reimbursable)** | **8** | | **18** | **+10** |
| **Federal FTEs (Total TIP)** | **17** | | **18** | **+1** |
| | | | | |
| Technical Support | | | | |
| Projects | 1,532 | --- | 1,809 | +277 |
| Total, Technical Support | 1,532 | --- | 1,809 | +277 |
| | | | | |
| Management Support | | | | |
| Financial Modeling | 132 | --- | 42 | -90 |
| Legal Policy and Review | 331 | --- | 146 | -185 |
| Total Management Support | 463 | --- | 188 | -275 |
| **Total, Support Services** | **1,995** | **---** | **1,997** | **+2** |
| | | | | |
| **Other Related Expenses** | | | | |
| Communications; utilities; miscellaneous charges | 348 | --- | 172 | -176 |
| Services from Non- Federal Sources | 1,418 | --- | 42 | -1,376 |
| Services from Loan Programs Office | 1,090 | --- | 3,221 | +2,131 |
| Supplies and materials | 5 | --- | 5 | 0 |
| Interest Payments | 0 | --- | 35,298 | +35,298 |
| **Total, Other Related Expenses** | **2,861** | **---** | **38,738** | **+35,877** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $7,261,000** | **$43,170,000** | **+$35,909,000** |
| **Salaries and Benefits $2,265,000** | **$2,315,000** | **+$50,000** |
| • Salary and benefits provide for Federal employees that are directly assigned to the TIP program as project management, technical experts, finance and administration; those that provide expertise in land acquisition, engineering and environmental compliance; those that provide legal counsel; and those that administratively support these functions. FTE assigned to this account charge TIP's mandatory as well as discretionary funding accounts. | • Requested funding supports ongoing activities. | • The increase in salaries and benefits is due to an increase in the direct and indirect support provided to this account. |
| **Travel $140,000** | **$120,000** | **-$20,000** |
| • Planned essential travel supports TIP's mission related activities. TIP supports efficient spending initiatives and is cognizant of travel costs associated with general program operations. TIP focuses on using alternative means to conduct meetings and training sessions where appropriate. | • Requested funding supports ongoing activities. | • The decrease in travel reflects commitment to use lower cost alternatives including video conferencing and web-based meetings where appropriate. The sensitive nature of financial discussions with proponents and interested potential applicants does necessitate face-to-face meetings on a regular basis. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Support Services $1,995,000** | **$1,997,000** | **+$2,000** |
| • Support services funded in this category include technical support costs directly associated with TIP projects; to include Environmental, Lands, Engineering, and Project Management activities. Also within this category are costs to cover legal and financial support activities to include financial modeling, outside legal counsel for contract review, policy issues and legislative concerns. | • Requested funding supports ongoing activities. | • No significant change. |
| **Other Related Expenses $2,861,000** | **$38,738,000** | **+$35,877,000** |
| • Other related expenses include communications, utilities, training, depreciation, WAPA overhead rates, supplies and materials. Services from the DOE Loan Program Office (LPO) are also included in this category and interest loan payments. | • Requested funding supports ongoing activities. | • The increase is due to anticipated loan interest payments. |

**Western Area Power Administration**
**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **WAPA - Repayment of Investment Performance - Ensure unpaid investment (UI) is equal to or less than the allowable unpaid investment (AUI) in accordance with DOE Order RA 6120.2 and Reclamation Law.** | | |
| Target | .996 billion dollars AU | .85 billion dollars AU | 8.0 8 billion dollars AU |
| Result | Met - 5.263 | TBD | TBD |
| Endpoint Target | Continue to meet legislated cost recovery requirements for timely repayment of Federal investment in maintaining financial integrity of projects/program. | | |
| Performance Goal (Measure) | **WAPA - System Reliability Performance - NERC Rating - Attain average North American Electric Reliability Corporation (NERC) compliance ratings for NERC Control Performance Standard 1 (CPS1) of greater than or equal to 100 percent.** | | |
| Target | 100 CPS1 Rating | 100 CPS1 Rating | 100 CPS1 Rating |
| Result | Met - 154.44 | TBD | TBD |
| Endpoint Target | Ensure the reliability of the electrical grid by attaining a NERC CPS1 rating of equal to or greater than 100 percent each year. | | |
| Comment | CPS1 measures generation/load balance on one-minute intervals. | | |
| Performance Goal (Measure) | **WAPA Operating Cost - Annual Operating Cost Performance: Provide power at the lowest possible cost by keeping total operation and maintenance cost per kilowatt-hour generated at or below the National median for public power for 100+ customers.** | | |
| Target | N/A | N/A | 0.068 $/KWh |
| Result | N/A | N/A | TBD |
| Endpoint Target | Control annual Operations and Maintenance costs, thereby providing power at the lowest possible cost. | | |
| Comment | Due to the seasonal nature of hydropower generation throughout the fiscal year, a rolling 1-year total will be calculated for both Operating & Maintenance (O&M) expense information as well as Net Generation. O&M data is obtained through the financial management system, while generation data is compiled from the power operations reports of each contributing generating agency. The annual target for each performance reporting cycle is determined by referencing the latest annual report on financial and operating ratios as published by the American Public Power Association (APPA). Specifically, WAPA will refer to the "Median Values by Customer Size Class" table. The APPA compiles benchmark information from both a survey instrument and data residing with the Energy Information Administration. | | |

## Estimate of Gross Revenues [1]

(Dollars in Thousands)

| | FY 2017[2] | FY 2018 | FY 2019 |
|---|---|---|---|
| Boulder Canyon Project | 70,927 | 96,877 | 84,312 |
| Central Valley Project | 219,278 | 416,600 | 398,279 |
| Falcon-Amistad Project | 6,113 | 7,082 | 7,201 |
| Fryingpan-Arkansas Project | 41,013 | 20,588 | 20,177 |
| Pacific Northwest-Southwest Intertie Project | 38,507 | 41,765 | 40,410 |
| Parker-Davis Project | 69,380 | 71,520 | 73,748 |
| Pick-Sloan Missouri Basin Program | 616,262 | 530,152 | 529,135 |
| Provo River Project | 432 | 211 | 211 |
| Washoe Project | 329 | 465 | 465 |
| Salt Lake City Area Integrated Projects | 243,637 | 179,569 | 179,648 |
| Other | 135,842 | 0 | 0 |
| **Total, Gross Revenues** | **1,441,720** | **1,364,829** | **1,333,586** |

## Estimate of Proprietary Receipts

(Dollars in Thousands)

| | FY 2017 Actual | FY 2018 | FY 2019 |
|---|---|---|---|
| **Mandatory Receipts** | | | |
| Falcon Amistad Maintenance Fund | 1,898 | 2,000 | 2,000 |
| Sale and Transmission of Electric Power, Falcon and Amistad Dams | 400 | 400 | 400 |
| Sale of Power and Other Utilities Not Otherwise Classified | 20,034 | 30,000 | 30,000 |
| Sale of Power–WAPA–Reclamation Fund | 338,136 | 157,112 | 176,291 |
| **Total, Mandatory Receipts** | **360,468** | **189,512** | **208,691** |
| | | | |
| **Discretionary Receipts** | | | |
| Offsetting Collections from the Recovery of Power Related Expenses – WAPA CROM | 367,009 | | 306,408 |
| Less Purchase Power and Wheeling Expenses | -367,009 | | -306,408 |

[1] Amounts for FY 2018 and FY 2019 are based on the FY 2016 Final Power Repayment Studies (PRS).

[2] FY 2017 amounts are actuals from the preliminary annual financial reports. For Central Valley Project, FY 2017 amounts reported amounts exclude contractual pass-through purchase power arrangements which are included in the PRS estimates. The 'Other' FY 2017 amounts shown represent WAPA activities reported in the financials that are not reimbursable through the power and transmission rate-setting process, and are not forecasted through the PRS.

(Dollars in Thousands)

| | FY 2017 Actual | FY 2018 | FY 2019 |
|---|---|---|---|
| Subtotal, WAPA CROM Recovery of Power Related Expenses | 0 | 0 | 0 |
| | | | |
| Offsetting Collections from the Recovery of Annual Expenses – WAPA CROM | 177,563 | | 175,770 |
| Less Operating and Maintenance expenses | -27,122 | | -25,009 |
| Less Program Direction Expenses | -150,441 | | -150,761 |
| Subtotal, WAPA CROM Recovery of Annual Expenses | 0 | 0 | 0 |
| | | | |
| Offsetting Collections from the recovery of power related expenses – Falcon and Amistad | 3,838 | | 4,979 |
| Less Operating and Maintenance expenses | -3,838 | | -4,979 |
| Subtotal, Falcon and Amistad Recovery of Power Related Expenses | 0 | 0 | 0 |
| **Total, Discretionary Receipts** | **0** | **0** | **0** |
| **Total, Proprietary Receipts** | **360,468** | **189,512** | **208,691** |

**Western Area Power Administration**
**Estimate of Offsetting Collections for Reimbursable Work and Work for Others**

| | (Dollars in Thousands) | | |
|---|---|---|---|
| | FY 2017 | FY 2018 | FY 2019 |
| **Construction, Rehabilitation, Operation and Maintenance (CROM)** | | | |
| **Offsetting Collections for Reimbursable Work** [1] | | | |
| Alternative Financing | | | |
| Operations and Maintenance | 0 | 0 | 7,758 |
| Construction and Rehabilitation | 43,884 | 40,500 | 27,077 |
| Purchase Power and Wheeling (PPW) | 214,625 | 289,072 | 260,954 |
| Program Direction | 6,343 | 8,056 | 39,136 |
| Subtotal, Alternative Financing | 264,852 | 337,628 | 334,925 |
| | | | |
| Offsetting Collections not anticipated for obligation in budget year | 65,131 | 67,437 | 35,002 |
| Less PPW net billing, bill crediting, energy exchange | -201,248 | -275,371 | -248,985 |
| Offsetting collections from Colorado River Dam Fund | 8,265 | 9,306 | 9,058 |
| **Subtotal, Offsetting Collections for Reimbursable Work** | **137,000** | **139,000** | **130,000** |
| | | | |
| **Offsetting Collections for Reimbursable Work-for-Others** [2] | **387,000** | **504,000** | **469,000** |
| **Total, Offsetting Collections for Reimbursable** | **524,000** | **643,000** | **599,000** |

[1] WAPA relies significantly on alternative financing arrangements with customers to finance much of its direct mission work on a reimbursable basis.

[2] WAPA has partnering arrangements with many power customers and Federal agencies to perform electrical systems operations, maintenance, construction, purchase power, and transmission services on a reimbursable basis. WAPA's reimbursable authority and partnerships were displayed following the severe hurricane damage in the U.S. Virgin Islands and Puerto Rico. WAPA responded to help restore the energy infrastructure and access to power in the U.S. Virgin Islands and is supporting the U.S. Army Corps of Engineers' emergency power restoration efforts on Puerto Rico.

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Western Area Power Admin. Const.,Rehab.,O&M | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Western Area Power Administration** | | | |
| **Systems Operation and Maintenance** | | | |
| | 220,154 | 218,395 | 199,347 |
| | **682,418** | **495,087** | **580,608** |
| Systems Operation and Maintenance | 462,264 | 276,692 | 381,261 |
| **Program Direction** | | | |
| Program Direction | | | |
| **Total, Western Area Power Administration** | | | |
| **Total, Western Area Power Admin. Const.,Rehab.,O&M** | **682,418** | **495,087** | **580,608** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Falcon & Amistad - Operating & Maintenance Fund | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Western Area Power Administration** | | | |
| **Falcon & Amistad Operating and Maintenance Fund** | | | |
| Falcon & Amistad - Operating and Maintenance | 4,070 | 4,042 | 5,207 |
| **Total, Western Area Power Administration** | **4,070** | **4,042** | **5,207** |
| **Total, Falcon & Amistad - Operating & Maintenance Fund** | **4,070** | **4,042** | **5,207** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Colorado River Basins Power Marketing Fund | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Western Area Power Administration** | | | |
| **Equipment, Contracts and Other Related Expenses** | | | |
| | 62,206 | 58,341 | 62,948 |
| | **213,530** | **185,396** | **220,337** |
| Colorado River Storage Project | 151,324 | 127,055 | 157,389 |
| **Program Direction** | | | |
| Program Direction | | | |
| **Total, Western Area Power Administration** | | | |
| **Total, Colorado River Basins Power Marketing Fund** | **213,530** | **185,396** | **220,337** |

# Bonneville Power Administration

# Bonneville Power Administration

**Bonneville Power Administration (Bonneville, BPA)**
**Proposed Appropriations Language**

*Expenditures from the Bonneville Power Administration Fund, established pursuant to Public Law 93-454, are approved for official reception and representation expenses in an amount not to exceed $5,000: Provided, that during fiscal year 2019, no new direct loan obligations may be made.*

Note. –A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Explanation of Changes**

The proposed appropriations language restricts new direct loans in FY 2019 as in FY 2018. This bill language is drafted consistent with the Credit Reform Act of 1990.

**Please Note - The FY 2019 Bonneville Power Administration Congressional Budget submission includes FY 2018 budget estimates.**

Bonneville operates under a business-type budget under the Government Corporation Control Act, 31 U.S.C 9101-10 and on the basis of the self-financing authority provided by the Federal Columbia River Transmission System Act of 1974 (Transmission Act) (Public Law 93-454). Bonneville has authority to borrow from the U.S. Treasury under the Transmission Act, the Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Pacific Northwest Power Act) (Public Law 96-501) for acquisition of energy conservation and renewable energy resources, investment in fish facilities, and other purposes, the American Recovery and Reinvestment Act of 2009 (Public Law 111-5), and other legislation. Authority to borrow from the U.S. Treasury is available to Bonneville on a permanent, revolving basis. The principal amount of U.S. Treasury borrowing outstanding at any time may not exceed $7.70 billion.[1] Bonneville finances its approximate $4.4 billion annual cost of operations and investments primarily using power and transmission revenues, and proceeds of borrowing from the U.S. Treasury.

This budget has been prepared in accordance with the Statutory Pay-As-You-Go Act (PAYGO) of 2010. Under PAYGO, all Bonneville budget estimates are treated as mandatory and are not subject to the discretionary caps included in the Budget Control Act of 2011. These estimates support activities that are separate from discretionary activities and accounts. Thus, any changes to Bonneville estimates cannot be used to affect any other budget categories, which have their own dollar caps. Because Bonneville's obligations are and will be incurred under pre-existing legislative authority, Bonneville is not subject to a "pay-as-you-go" test regarding its revision of current-law funding estimates.

[1] The outstanding principal amount of bonds issued by Bonneville to the U.S. Treasury can be found in tables BP-4A – 4D in the Additional Tables section.

**Bonneville Power Administration**

**Funding Profile by Subprogram** [1/]

(Accrued Expenditures in Thousands of Dollars)

| | Fiscal Year | | | |
|---|---|---|---|---|
| | 2017 Actuals | 2018 Original [/2] | 2018 Revised [/2] | 2019 Proposed |
| Capital Investment Obligations | | | | |
| Associated Project Costs [3/] | 206,870 | N/A | 242,795 | 264,735 |
| Fish & Wildlife | 5,402 | N/A | 50,532 | 44,000 |
| Subtotal, Power Services | 212,271 | N/A | 293,327 | 308,735 |
| Transmission Services | 297,019 | | 466,241 | 489,066 |
| Capital Equipment & Bond Premium | 11,328 | N/A | 28,860 | 28,860 |
| Total, Capital Obligations [3/] | 520,618 | 783,590 | 788,429 | 826,661 |
| Expensed and Other Obligations | | | | |
| Expensed | 3,371,458 | 3,360,901 | 3,128,229 | 3,140,939 |
| Projects Funded in Advance | 141,470 | 40,107 | 42,052 | 41,125 |
| Total, Obligations | 4,033,547 | 4,184,598 | 3,958,710 | 4,008,724 |
| Capital Transfers (cash) | 908,712 | 333,134 | 183,126 | 408,637 |
| Bonneville Total | 4,942,259 | 4,517,732 | 4,141,835 | 4,417,361 |
| Bonneville Net Outlays | 382,042 | | (27,242) | 23,061 |
| Full-time Equivalents (FTEs) | 2,891 | 3,100 | 3,000 | 3,000 |

**Public Law Authorizations include:**

Bonneville Project Act of 1937, Public Law No. 75-329

Federal Columbia River Transmission System Act of 1974, Public Law No. 93-454

Regional Preference Act of 1964, Public Law No. 88-552

Flood Control Act of 1944, Public Law No. 78-543

Pacific Northwest Electric Power Planning and Conservation Act of 1980 (Northwest Power Act), Public Law No. 96-501

**Outyear Funding Profile by Subprogram** [1/]

(Accrued Expenditures in Thousands of Dollars)

| | Fiscal Year | | | |
|---|---|---|---|---|
| | 2020 | 2021 | 2022 | 2023 |
| Capital Investment Obligations | | | | |
| Associated Project Costs [3/] | 313,375 | 338,652 | 345,501 | 352,223 |
| Fish & Wildlife | 38,033 | 33,599 | 29,047 | 29,291 |
| Subtotal, Power Services | 351,408 | 372,251 | 374,548 | 381,514 |
| Transmission Services | 591,313 | 587,667 | 597,679 | 558,149 |
| Capital Equipment & Bond Premium | 4,880 | 16,257 | 9,267 | 11,292 |
| Total, Capital Obligations [3/] | 947,601 | 976,175 | 981,494 | 950,955 |
| Expensed and Other Obligations | | | | |
| Expensed | 3,135,130 | 3,249,861 | 3,348,599 | 3,423,253 |
| Projects Funded in Advance | 35,855 | 34,705 | 34,645 | 32,581 |
| Total, Obligations | 4,118,585 | 4,260,740 | 4,364,738 | 4,406,790 |
| Capital Transfers (cash) | 318,370 | 351,560 | 352,048 | 372,400 |
| Bonneville Total | 4,436,955 | 4,612,300 | 4,716,786 | 4,779,189 |
| Bonneville Net Outlays | 49,356 | 105,487 | 123,468 | 79,365 |
| Full-time Equivalents (FTEs) | 3,000 | 3,000 | 3,000 | 3,000 |

**These notes are an integral part of this table.**

1/ This budget has been prepared in accordance with PAYGO. Under PAYGO all Bonneville budget estimates are treated as mandatory and are not subject to the discretionary caps included in the Budget Control Act of 2011. These estimates support activities that are separate from discretionary activities and accounts. Thus, any changes to Bonneville estimates cannot be used to affect any other budget categories which have their own dollar caps. Because Bonneville's oblligations are and will be incurred under pre-existing legislative authority, Bonneville is not subject to a "pay-as-you-go" test regarding its revision of current-law funding estimates.

2/ Original estimates reflect Bonneville's FY 2018 Congressional Budget Submission. Revised estimates, consistent with Bonneville's annual near-term funding review process, provide notification to the Administration and Congress of updated capital and expense funding levels for FY 2018.

3/ Includes infrastructure investments to address the long-term electric power related needs of the Northwest and significant changes affecting Bonneville's power and transmission markets.

**Additional Notes**

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Cumulative advance amortization payments as of the end of FY 2017 are $5,130 million.

Refer to 16 USC Chapters 12B, 12G, 12H, and Bonneville's other organic laws, including P.L. 100-371, Title III, Sec. 300, 102 Stat. 869, July 19, 1988, regarding Bonneville's ability to obligate funds.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses. Actual Net Outlays are volatile and are reported in Report on Budget Execution and Budgetary Resources (SF-133). Actual Net Outlays could differ from estimates due to changing market conditions, streamflow variability, continuing restructuring of the electric industry, and other reasons.

Revenues, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools, including upcoming rate adjustment mechanisms, a net revenue risk adjustment, debt service refinancing strategies and/or short-term financial tools to manage net revenues and cash. Some of these potential tools will reduce costs rather than generate revenue, causing the same Net Outlay result. Adjustments for depreciation and 4(h)(10)(C) credits of the Northwest Power Act are also assumed.

FY 2017 Net Outlays are based on Bonneville's FY 2017 audited actuals. FYs 2018 and 2019 Net Outlays are calculated using Bonneville's revenue forecast from the BP-18 rate case. FYs 2020 and 2021 assume no growth in Offsetting Collections compared to FYs 2018 and 2019. FYs 2022 and 2023 assume a growth in Offsetting Collections based on standard inflation factors.

FTE outyear data are estimates and may change. Bonneville is facing a dynamic and changing transmission marketplace and operations while, at the same time, many of its employees are eligible to retire in the near future. It is important that Bonneville continue to attract and retain skilled individuals to meet the growing demands of a competitive and rapidly changing industry. Accordingly, FTE estimates may need to be adjusted in the future.

Amounts in tables and schedules may not add to totals due to rounding.

**Major Outyear Considerations**

Bonneville's outyear estimates reflect ongoing efforts to achieve its long-term mission and strategic direction. The outyear estimates are developed with consideration and support of Bonneville's multi-year performance targets that lay out the course for achieving Bonneville's long-term objectives. Outyear capital investment levels support Bonneville's infrastructure program, hydro efficiency program, and its fish and wildlife mitigation projects.

Bonneville continues to incorporate the various aspects of the Energy Policy Act of 2005 related to its business, in particular the energy supply, conservation, and new energy technologies for the future that are highlighted in the legislation.

**Overview and Accomplishments**

Bonneville provides electric power, transmission, and energy efficiency throughout the Pacific Northwest. Bonneville serves a 300,000 square mile area including Oregon, Washington, Idaho, western Montana, and small parts of eastern Montana, California, Nevada, Utah, and Wyoming with a population of about 13.3 million people. Bonneville markets the electric power produced from 31 federal hydro projects in the Pacific Northwest owned by the U.S. Army Corps of Engineers (Corps) and the U.S. Department of Interior, Bureau of Reclamation (Reclamation)—the hydro projects are known as Associated Projects. Bonneville also markets power acquired from non-federal generating resources, including the power from a nuclear power plant, Columbia Generating Station (CGS). Bonneville uses the power from non-federal and federal projects primarily to meet the needs of its customer utilities. Bonneville currently maintains and operates 15,238 circuit miles of transmission lines, 260 substations, and associated power system control and communications facilities over which this electric power is delivered. Bonneville has capital and similar leases for certain transmission facilities. Bonneville also supports the protection and enhancement of fish and wildlife, and promotes conservation and energy efficiency, as part of its efforts to preserve and balance the economic and environmental benefits of the Federal Columbia River Power System (FCRPS).

The organization of Bonneville's FY 2019 Budget reflects Bonneville's business services basis for utility enterprise activities. Bonneville's two major areas of activity on a consolidated budget and accounting basis are Power Services (PS) and Transmission Services (TS) and include their related administrative costs. PS activities include line items for Fish and Wildlife, Energy Efficiency, Residential Exchange Program (REP), Associated Projects Operations & Maintenance (O&M) Costs, and Northwest Power and Conservation Council (Planning Council or Council).

The mission of Bonneville is to create and deliver the best value for its customers and constituents as it acts in concert with others to assure the Pacific Northwest has the following: (1) an adequate, efficient, economical, and reliable power supply; (2) an open access transmission system that is adequate for integrating and transmitting power from federal and non-federal generating units, providing service to Bonneville's customers, providing interregional interconnections, and maintaining electrical reliability and stability; and (3) mitigation of the FCRPS impacts on fish and wildlife. Bonneville is legally obligated to provide cost-based rates and public and regional preference in its marketing of power. Bonneville establishes rates as low as possible consistent with sound business principles and sufficient to ensure the full recovery of all of its costs, including timely repayment of the federal investment in the system. Bonneville's vision is to advance a Northwest power and transmission system that provides high reliability, low rates consistent with sound business principles, responsible environmental stewardship, and accountability to the region, all through a commercially successful business. Bonneville pursues this vision consistent with its four core values of safety, trustworthy stewardship of the FCRPS, collaborative relationships, and operational excellence.

**Preserving and Enhancing the FCRPS**

The FCRPS is one of the nation's largest nearly carbon-free energy sources and preserving and enhancing the value of the FCRPS for the future continues to be a major Bonneville focus. Bonneville's ongoing prioritization and execution of capital investment in transmission and FCRPS generation assets is the foundation for delivering clean, low cost power to support the communities and economies of the region well into the future.

Bonneville plays a key role in advancing energy efficiency across the region consistent with its statutes, including developing and promoting related technologies, and exploring demand-side management opportunities. Bonneville is making disciplined technology innovation investments and looking to apply new operational and market mechanisms that enhance the reliability, efficiency, and flexibility of system operations.

In addition to these efforts, Bonneville is committed to the quality of the Northwest's natural resources. Bonneville funds one of the largest fish and wildlife programs in the nation and continues to be a national leader on environmental protection and compliance.

Together, all of these efforts contribute to sustaining and advancing the region's resilience.

**Program Performance**

To validate and verify program performance, Bonneville conducts various internal and external reviews and audits. Bonneville conducts extensive reviews with regional stakeholders of both capital and expense programs. In addition, Bonneville's programmatic activities are subject to review by Congress, the U.S. Government Accountability Office (GAO),

the DOE's Inspector General, and other governmental entities. Bonneville's financial statements are audited annually by an independent external auditor. Bonneville has received unqualified audit opinions since the mid-1980s and no material weaknesses have been identified in controls over financial reporting.

**Legislative History**

The Bonneville Project Act of 1937 provides the original statutory foundation for Bonneville's power marketing responsibilities and authorities. In 1974, passage of the Federal Columbia River Transmission System Act (Transmission Act) applied provisions of the Government Corporation Control Act (31 U.S.C. §§ 9101-9110) to Bonneville. The Transmission Act provides Bonneville with "self-financing" authority, establishes the Bonneville Fund (a permanent, indefinite appropriation) allowing Bonneville to use its revenues from electric power and transmission ratepayers to fund all programs without further appropriation, and first authorizing Bonneville to sell bonds to the U.S. Treasury.

In 1980, enactment of the Pacific Northwest Electric Power Planning and Conservation Act (Northwest Power Act) expanded Bonneville's authorities, obligations, and responsibilities. The purpose of the act includes the following: to encourage electric energy conservation to meet regional electric power loads placed on Bonneville; to develop renewable energy resources within the Pacific Northwest; to assure the Northwest an adequate, efficient, economical, and reliable power supply; to promote regional participation and planning; and to protect, mitigate, and enhance the fish and wildlife of the Columbia River and its tributaries. The Northwest Power Act also established the statutory framework for Bonneville's administrative rate-setting process and established judicial review of Bonneville's final decisions in the U.S. Court of Appeals for the Ninth Circuit.

As of the end of FY 2017, Bonneville has revolving U.S. Treasury borrowing authority of $7.7 billion of which approximately $2.7 billion remains available to be drawn.

**The Columbia River Treaty**

The U.S. Government reached consensus on a high level position for negotiations of the post-2024 future of the Columbia River Treaty in June 2015, and received authorization to negotiate with Canada on the Columbia River Treaty in October 2016. Government Affairs Canada notified State Department in December 2017 of Canada's mandate to negotiate the Columbia River Treaty with the United States. Negotiations are expected to begin in January 2018.

**Judicial and Regulatory Activity**

The Energy Policy Act of 2005 authorized the Federal Energy Regulatory Commission (FERC) to approve and enforce mandatory electric reliability standards with which users, owners, and operators of the bulk power system, including Bonneville, are required to comply. These standards became enforceable on June 18, 2007, and compliance is monitored by the North American Electric Regulatory Corporation (NERC) and the regional reliability organizations.

**Fish and Wildlife Program Overview**

Bonneville is committed to continue funding its share of the region's efforts to protect and mitigate Columbia River Basin fish and wildlife. To the extent possible, Bonneville is integrating actions to protect species listed for protection under the Endangered Species Act (ESA) in response to the FCRPS Biological Opinions (BiOps), including the National Oceanic and Atmospheric Administration (NOAA) Fisheries Willamette River BiOp and the United States Fish and Wildlife Service's (USFWS) 2006 Libby Dam BiOp, with projects implemented consistent with the Council's Fish and Wildlife Program (Program). The Program, BiOps, and long-term agreements include prioritized strategies for mitigation actions to meet Bonneville's environmental compliance responsibilities under the ESA, Northwest Power Act, and other laws.
Included with the budget schedules section of this document is the current tabulation of Bonneville's fish and wildlife costs from FY 2007 through FY 2017.

**Infrastructure Investments**

Bonneville is reviewing infrastructure investments in the Pacific Northwest to meet transmission capacity and reliability needs and continues to support a competitive wholesale market in the Western Interconnection, which encompasses 14 western states, two Canadian provinces, and one Mexican state.

Bonneville has completed three major transmission lines since 2011 (i) the McNary-John Day line—completed in FY 2012, under budget and ahead of schedule—adding 79 miles, (ii) the Big Eddy-Knight 500kV transmission line and substation

project resumed construction in 2014 and was energized in November 2015, adding 28 miles, and (iii) the Central Ferry-Lower Monumental 500kV Reinforcement which began construction in May 2014 and was also energized in November 2015, adding 38 miles. Bonneville also completed the modernization of the Celilo Converter station at the northern end of the 846-mile Pacific Direct Current Intertie. The station was energized in January 2016, well ahead of schedule and within budget. Additionally, 265 miles of Direct Current line were upgraded to match the capacity of the station upgrade.

In FY 2012, Bonneville signed two agreements to participate with two investor-owned utilities in the environmental work and permitting for another transmission project, the proposed Boardman-to-Hemingway 500kV line. Participation in this preliminary review keeps Bonneville's options open for serving its six southeast Idaho Preference Customers following the expiration of legacy service agreements. Bonneville has not made a decision to co-develop or purchase capacity in these projects. On January 17, 2014, Public Law 113-76 was enacted into law, which provided Bonneville with expenditure authority approval to construct or participate in the construction of a transmission line to southeast Idaho, should Bonneville decide to continue pursuing that service arrangement.

On May 18, 2017, Bonneville announced its decision to not build the I-5 Corridor Reinforcement Project. Bonneville continues to work with constituents and stakeholders to study more cost effective options to mitigate the current limitations along this path. Public meetings began in July 2017 to address alternatives to building. Cumulative capitalized costs associated with this project of $130.0 million were reclassified in fiscal year 2017 from Construction work in progress to a Regulatory asset on the Combined Balance Sheets, as these costs are expected to be recovered through future rates.

Bonneville is also continuing to evaluate additional transmission investments across the Pacific Northwest to improve reliability and support both load and renewable generation needs.

Bonneville has experienced significant growth within its balancing area in installed variable renewable generation, primarily in the form of wind generation. Since 2001, installed wind generation connected to Bonneville's transmission system has grown from 115 MWs to 5,081 MWs through September 2017. Of the 5,081 MW of connected wind, 4,781 MW is currently in Bonneville's Balancing Authority Area (BAA). This substantial increase in variable renewable generation has resulted in additional uncertainties in the balance between load and generation required for maintaining a reliable grid. Wind is a non-dispatchable source of energy, meaning it cannot be relied upon for capacity. As a result, Bonneville has implemented and continues to study operational tools for integrating this variable generation more cost effectively and reliably. Further complicating matters, 2,408 MW of the wind energy currently in Bonneville's BAA is requesting to join different BAA's. Although this removes variable generation from Bonneville's BAA, these projects are still physically connected to Bonneville's system and continue to impact the daily operations of Bonneville. Off-setting the wind leaving Bonneville's BAA is the possibility that a large amount of utility scale solar photo-voltaic (PV) projects are being added to Bonneville's queue. Bonneville is currently studying approximately 2,000 MW of solar interconnection requests and new requests are coming in at an average rate of one per week. Solar, like wind, is a variable generation source, but its characteristics are different than wind. Bonneville will need to learn and adapt to this new generation type.

Bonneville is considering approaches, in addition to or in lieu of the use of its U.S. Treasury borrowing authority, to sustain funding for its infrastructure investment requirements. These approaches include reserve financing of some amount of transmission investments, or seeking, when feasible, third party financing sources. See the BP-5 Potential Third Party Financing Transparency table in the budget schedules section of this document. This FY 2019 Budget assumes $15 million of annual reserve financing in FYs 2018-2023 for transmission infrastructure capital, which is included in this budget under Projects Funded In Advance.

Consistent with the FY 2018 Budget Request, the FY 2019 Budget Request maintains the proposal that the Federal government be authorized to sell the transmission assets of Bonneville.

**Radio Spectrum Communications**

Bonneville's wireless communication system is used to operate and control critical national transmission grid infrastructure in a reliable, secure, and safe manner. Bonneville's communication systems are designed to meet strict reliability/availability objectives required by NERC and Western Electricity Coordinating Council (WECC) standards. Concerning proper spectrum stewardship, Bonneville designs highly efficient radio systems that use minimal radio frequency (RF) channel bandwidths to meet critical mission needs. However, in certain circumstances, efficiently designed

spectrum radio systems will require broad RF channels and/or lower state RF modulation schemes to meet existing and future requirements in order to meet operational and reliability/availability objectives.

In order to meet Bonneville's mission/operational requirements, RF communication equipment approved for system use goes through a rigorous evaluation and testing process. RF spectrum efficiency factors are considered during the evaluation/testing period. RF terminal equipment approved for use is normally purchased directly from vendors and is not typically supplied through a Request for Proposal process.

Bonneville's operational telecommunications and other capital equipment and systems are acquired using Bonneville's self-financing and procurement authorities. The Bonneville budget includes a system-wide electric reliability performance indicator, consistent with NERC rules, to track and evaluate performance.

Bonneville may share temporarily-available spare capacity on its RF communication system with other government agencies (both Federal and State), and with other electric utilities in the region whose power systems interconnect with Bonneville. Non-critical administrative traffic is typically supported by commercial carrier enterprises. However, to meet NERC/WECC electrical bulk transmission requirements, Bonneville exclusively operates highly critical transmission control traffic over its private telecommunication system as Bonneville has no control over the reliability/availability of the commercial enterprise or on how quickly critical operational control circuits are restored to active service during an interruption.

For high capacity communication system applications, Bonneville considers and operates non-spectrum dependent alternatives such as fiber optic cable infrastructure systems.

During FY 2014, Bonneville began upgrading the Very High Frequency (VHF) land mobile system and installing a number of digital Synchronous Optical Network (SONET) rings typically consisting of fiber segments in combination with point-to-point microwave hops operating in the 4 GHz and 7/8 GHz bands. These various telecommunication systems operate within Bonneville's approximate 300,000 square mile utility responsibility service territory (Oregon, Washington, Idaho, western Montana) with the majority of the RF infrastructure located in low population-rural areas.

The FCRPS hydroelectric projects, owned by the Corps and Reclamation, also utilize federal radio spectrum to preserve very high operational telecommunications and power system reliability.

In FY 2014, Bonneville completed work costing approximately $40 million, funded through the Spectrum Relocation Fund, to relocate its operational telecommunication systems from the 1710-55 MHz radio spectrum bands to alternative federal radio spectrum bands. In accordance with Federal law, Bonneville plans to return the approximately $8.2 million of excess funds to the U.S. Treasury, via the Spectrum Relocation Fund, as soon as the National Telecommunications and Information Administration (NTIA) officially notifies the Federal Communications Commission (FCC) that the DOE relocation effort is complete.

Bonneville began participating in a new spectrum relocation effort in FY 2015. The NTIA has approved and, in July 2014, web-posted federal agency relocation plans, including the Bonneville relocation plan. The FCC held an auction of this spectrum on November 13, 2014. Bonneville received an additional $5.2 million from the Spectrum Relocation Fund on July 29, 2015 to fully pay for this new relocation effort, including, as in the prior relocation, the purchase and installation of new digital radio equipment. Bonneville received obligational authority to proceed with this relocation effort by apportionment on July 24, 2015.

By the end of FY 2017, Bonneville had accomplished vacating three of four AWS-3 microwave segments/paths. Bonneville expects to relocate the last 1755MHz-1810MHz segment to the 7GHz - GHz band by July 31, 2018---allowing sufficient time for bad weather contingency, burning in the radio and operationally testing the radio to meet continuing high Federal Columbia River Transmission System (FCRTS) operational telecommunications requirements.

**Financial Mechanisms**

Bonneville's program is treated as mandatory and nondiscretionary. Bonneville is "self-financed" with its own revenues and does not rely on annual appropriations from Congress. Under the Transmission Act, Bonneville funds the expense portion of

its budget and repays the federal investment with revenues from electric power and transmission sales. Bonneville's revenues fluctuate for a variety of reasons, including in response to variations in market prices for fuels and stream flow in the Columbia River System due to variations in weather conditions and fish mitigation needs. Through FY 2017, Bonneville has returned approximately $33.8 billion to the U.S. Treasury, of which about $3.6 billion was for payment of FCRPS operation and maintenance (O&M) and other costs, $15.7 billion for interest, and $14.4 billion for amortization of appropriations and bonds.

In the FY 2019 Budget, the term Bonneville "bonds" refers to the debt instruments under which Bonneville receives advances of funds from the U.S. Treasury. This reference is consistent with section 13(a) of the Transmission Act, which defines "bonds" as all bonds, notes, and other evidences of indebtedness issued and sold by Bonneville to the U.S. Treasury.

As of September 30, 2017, debt instruments issued by non-federal entities but secured by payment and other financial commitments provided by Bonneville maintained their credit ratings as follows: Moody's at Aa1 with a stable outlook, Fitch at AA with a negative outlook, and Standard & Poor's at AA- with a stable outlook.

Bonneville and the U.S. Treasury have a comprehensive banking arrangement that covers Bonneville's short- and long-term federal borrowings. This provides Bonneville with the ability to borrow from the U.S. Treasury to finance assets and, on a short-term basis, to cover Northwest Power Act-related operating expenses. This latter ability provides Bonneville with much needed liquidity to help manage within-year cash flow needs and mitigate risk. Access to this use of U.S. Treasury borrowing authority has been incorporated into and relied upon in Bonneville's rate-setting process.

Bonneville undertook a Power Prepayment Program in FY 2013 under which all Bonneville preference customers had an opportunity to submit formal offers to provide lump-sum payments to Bonneville as prepayments of a portion of their power purchases through September 30, 2028, the termination date of the Long-Term Regional Dialogue Power Sales Contracts. Bonneville accepted power prepayments from four preference customers, as described below.

Upon Bonneville's receipt of the agreed-to, lump-sum prepayments, the selected preference customers became entitled to future portions of their electricity from Bonneville without further payment. The power prepayments are and will be recognized in the customers' future power bills from Bonneville as fixed, equal monthly prepayment credits. In effect, the amount of electricity that is prepaid may vary by month, depending on Bonneville's power rates and rate schedules that apply to electricity purchases by the prepaying customers in the related month. Because this is structured as a variable amount prepayment and not as a fixed-price/fixed-amount type of prepayment, Bonneville maintains flexibility to establish rates for the electric power that is prepaid.

As a result of the FY 2013 Prepayment solicitation, Bonneville received $340 million in prepayments, which Bonneville is using to fund needed FCRPS investments. The aggregate prepayment credits are set at $2.55 million per month through FY 2028.

Depending on a variety of factors it is possible that Bonneville may seek to implement later phases of the Power Prepayment Program in connection with future FCRPS hydroelectric investment needs.

**U.S. Treasury Payments and Budget Overview**

Bonneville's FY 2017 payment to the U.S. Treasury of $1,258 million was made on time and in full for the 34th consecutive year. The payment included $909 million in principal, which included $778 million in early retirement of higher interest rate U.S. Treasury debt, $271 million for interest, $51 million in irrigation assistance payments, and $28 million in pension and post-retirement benefits. Total credits associated with fish mitigation and recovery and applied toward Bonneville's U.S. Treasury payment were about $57 million for FY 2017. These credits are established and applied under section 4(h)(10)(C) of the Northwest Power Act. The FYs 2018 and 2019 U.S. Treasury payments are currently estimated at $514 million and $781 million, respectively. The FY 2018 and 2019 4(h)(10)(C) credits are estimated to be $93 million, and $92 million, respectively.

Estimates of interest and amortization levels for outyear U.S. Treasury payments are included in the FY 2018-2019 final transmission and power rates. Bond and Appropriations Interest will continue to be revised based on upcoming capital investments and debt management actions. These estimates may change due to revised capital investment plans and

actual U.S. Treasury borrowing. In recent years, Bonneville has made amortization payments in excess of those scheduled in its FERC-approved rate filings resulting in a balance of advance repayment. The cumulative amount of advance amortization payments as of the end of FY 2017 was about $5,130 million.

Bonneville has direct funding arrangements to fund the power-related portion of O&M and capital investments at the Corps and Reclamation facilities as well as the O&M costs of the U.S. Fish and Wildlife Service Lower Snake River Compensation Plan facilities. Direct funded Associated Projects capital costs, which had been funded exclusively through appropriations to the Corps and Reclamation prior to the initiation of direct funding, are now paid primarily from the proceeds of bonds issued by Bonneville to the U.S. Treasury. Certain power prepayments have also been a source of proceeds for direct funding. Bonneville's aggregate direct funding provided for capital and O&M was $591 million in FY 2017.

Starting in FY 2014, Bonneville and Energy Northwest, the Washington state joint operating agency that owns and operates the Columbia Generating Station nuclear plant, have been working together to implement a new phase of integrated debt management for their combined total debt portfolios. The debt service of these portfolios is borne by Bonneville and recovered from Bonneville ratepayers through Bonneville's rates. Energy Northwest-related debt, as refinanced under this effort, is called Regional Cooperation Debt Program. Bonneville currently has Energy Northwest Board approval for these types of transactions through FY 2020.

An important component of Regional Cooperation Debt is the issuance of new bonds by Energy Northwest to refund outstanding bonds shortly before their maturities when substantial principal repayments are due. The maturity extensions result in increased balances in the Bonneville Fund that are used to prepay higher interest rate federal obligations. The increased balances arise because Bonneville's rates are set assuming it would need funds to repay the maturing Energy Northwest bonds; however, when the maturing bonds are repaid with the proceeds of the new refunding bonds (and not from cash in the Bonneville Fund), the resulting 'freed up' balances in the Bonneville Fund become available to fund the early appropriations repayments. The net effect of refunding Regional Cooperation Debt and prepaying higher interest rate federal obligations is that the weighted-average interest rate of Bonneville's overall debt portfolio has been and will be reduced. In addition, Bonneville's aggregate principal balance of debt outstanding (federal and non-federal) does not and will not increase by virtue of the Regional Cooperation Debt program.

Energy Northwest accelerated site restoration efforts for the Energy Northwest Nuclear Projects 1 and 4 in the summer of 2015 and these efforts continue.

This FY 2019 Budget proposes estimated accrued expenditures of $3,141 million for operating expenses, $41 million for Projects Funded in Advance (PFIA), $827 million for capital investments, and $409 million for capital transfers in FY 2019.

The estimated spending levels in this budget are still subject to change to accommodate competitive dynamics in the region's energy markets, debt management strategies, continuing changes in the electric industry, and other factors.

**Current Financial Status**

Bonneville is striving to enhance its competitive, cost-effective delivery of utility products and services and the continued delivery of the public benefits of its operations, while ensuring it continues to make its scheduled payments to the U.S. Treasury on time and in full. Bonneville employs a strategic planning process using the balanced scorecard model to align all business units around specific goals and align resources to achieve these goals. Results from these efforts include continued efficiency gains, performance integration improvements, and a high assurance for repayment of both the bonds Bonneville issues to the U.S. Treasury and the appropriated investment in the FCRPS.

Through cost-based rates and attentive cost management efforts, Bonneville has maintained adequate financial reserve levels to assure full recovery of its costs and financial stability while meeting its overall responsibilities to the Pacific Northwest and U.S. taxpayers.

The Final Record of Decision for the FYs 2018-2019 rate case was issued on July 26, 2017. The rates were approved by FERC on an interim basis in late September pending final FERC review. The rates went into effect beginning October 1, 2017.

**Budget Estimates and Planning**

This FY 2019 Budget includes capital and expense estimates based on final spending proposals from Bonneville's 2016 Capital Investment Review (CIR), Integrated Program Review (IPR) and Integrated Program Review 2 (IPR2) processes. FY 2017 costs are based on Bonneville's FY 2017 audited financial statements. Consistent with the FY 2018 Budget Request, the FY 2019 Budget Request maintains the proposal that the Federal government be authorized to sell the transmission assets of Bonneville. The FY 2019 budget request also includes a proposal to change BPA's statutory rate structure requirements from cost recovery to a market based structure that takes into consideration rates charged by comparable utilities and which could allow for faster recoupment of the taxpayer investment.

Capital funding levels reflect Bonneville's capital asset management process and external factors such as changes affecting the West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region and national energy security goals.

Capital investment levels in this FY 2019 Budget reflect executive management decisions from Bonneville's Finance Committee and the associated capital review process. Bonneville utilizes a structured capital project selection process requiring submission of a standardized business case for review. Each business case consists of a description of the project, a clear statement of objectives, description and mitigation of risks, and a rigorous analysis of project costs and benefits including a status quo assumption and preferred alternatives. In addition, both annual and end-of-project targets are set for each project covering cost, scope, and schedule. Progress reports on these targets are provided to Bonneville's senior executives at least quarterly.

The FYs 2018-2023 revenue estimates in this budget, included in the Net Outlay formulation, are calculated consistent with cash management goals. The revenue estimates reflect assumed adjustments, which include the use of a combination of tools, including upcoming rate adjustment mechanisms, reduced cost estimates, a net revenue risk adjustment, debt management strategies, and/or short-term financial tools to manage net revenues and cash. The revenue estimates also include depreciation and U.S. Treasury repayment credit assumptions. These U.S. Treasury repayment credits offset, among other things, Bonneville's fish and wildlife program costs allocable to the non-power project purposes of the FCRPS, as provided under section 4(h)(10)(C) of the Northwest Power Act.

**Overview of Detailed Justifications**

In Bonneville's Detailed Justification Summaries, accrued expenditure is the basis of presenting Bonneville's program funding levels in the power and transmission rate making processes and the basis upon which Bonneville managers control their resources to provide products and services. Accrued expenditures relate period costs to period performance. Traditional budget obligation requirements for Bonneville's budget are assumed on the Program and Financing Summary Schedule prepared in accordance with Office of Management & Budget Circular A-11.

The organization of Bonneville's FY 2019 Budget and these performance summaries reflect Bonneville's business services basis for utility enterprise activities. Bonneville's major areas of activity on a consolidated budget and accounting basis include power and transmission, with administrative costs included. Power Services includes line items for Fish and Wildlife, Energy Efficiency, Residential Exchange Program, Associated Projects O&M Costs, and the Council. Environmental activities are shown in the relevant Power Services and Transmission Services sections, as are reimbursable costs. Bonneville's interest expense, pension and post-retirement benefits, and capital transfers to the U.S. Treasury are shown by program.

The first section of performance summaries, Capital Investments, includes accrued expenditures for investments in electric utility and general plant associated with the FCRPS generation and transmission services, fish and wildlife, and capital equipment. These capital investments are estimated to require budget obligations and expected use of $827 million in bonds to be issued and sold to the U.S. Treasury in FY 2019.

The near-term forecast of capital funding levels has undergone an extensive internal review as a result of Bonneville's capital asset management strategy. These capital reviews encompass project cost management initiatives, capital investment assessments, and categorization of capital projects to be funded based on risk and other factors. Consistent with Bonneville's near-term capital funding review process and Bonneville's standard operating budget process, this FY 2019 Budget includes updated capital funding levels for FY 2018. Utilizing this review process helps Bonneville in its

efforts as a participant in wholesale energy markets. Bonneville will continue to work with the Corps and Reclamation to optimize the mix of projects.

In addition to its internal management assessment of capital investments, Bonneville has developed and implemented an associated external capital investment review process that provides significant benefits to Bonneville. The combined internal and external processes add value by improving direction in making the FCRPS investments (tying investments more closely to agency strategy) and by improving how those investments are made (more detailed analysis and review of capital investments and their alternatives).

The second section of Bonneville's performance summaries, entitled Annual Operating Expenses, includes accrued expenditures for services and program activities financed by power sales revenues, transmission sales revenues, and projects funded in advance. For FY 2019, budget expense obligations are estimated at $3,141 million. The total program requirements of all Bonneville programs include estimated budget obligations of $4,008 million in FY 2019.

**Evidence and Analysis in the Budget**

Bonneville has undertaken several initiatives and processes to determine appropriate budget expenditures.

Bonneville's Integrated Program Review (IPR) process allows interested parties to see all relevant FCRPS expense and capital spending level estimates in the same forum. In addition, Bonneville's Integrated Program Review (IPR) process allows interested parties to review and comment on Bonneville's draft Asset Strategies and 10-year capital forecasts. The IPR and CIR processes were combined in 2016 and occur every two years, or just prior to each rate case, and provide participants with an opportunity to review and comment on Bonneville's program level estimates prior to spending levels being set for inclusion in rate cases. The 2016 IPR process concluded in the fall of 2016. Bonneville completed a second, targeted IPR (IPR2) process in early 2017 and used that information in preparing Bonneville's final rate proposal for FYs 2018-2019. The next IPR process is slated to begin in 2018 and will focus on FYs 2020-2021.

Bonneville is focused on institutionalizing operational excellence – continuous improvement that produces more efficient and effective ways to deliver on Bonneville's mission and vision. In FY 2015, Bonneville re-focused its continuous improvement efforts to concentrate on seven Key Strategic Initiatives (KSIs). In FY 2017 the Business Transformation Office (BTO) was implemented in order to ensure that Bonneville transformational initiatives, including the KSIs, are executed in the most efficient manner, from a time, cost and resource perspective. Additionally, the BTO will ensure KSI initiatives are aligned to Bonneville strategy and operating environment and are focused on delivering the value as required by our customers. The BTO will mature foundational capabilities such as portfolio, project, business process management, and organizational change management. The BTO is establishing an Enterprise Architecture capability with the responsibility for developing a disciplined approach to modeling and aligning the organization's business capabilities, processes, information, technology, and resources to business models that support Bonneville's value chain and value system. Enterprise Architecture will bring together business and Information Technology to deliver quality and cost effective solutions for transformational initiatives.

**Educational Activities**

Bonneville is a supporter of science, technology, engineering, and math (collectively known as "STEM") education programs. These programs provide support and encouragement to middle and high school students to study the sciences in school and to pursue careers in these fields. Working with Bonneville employees as volunteer ambassadors, the Bonneville education program provides value-added presentations, curricula, and activities to K-12 schools that enhance the learning experience for students and teachers, and extend awareness of the value of the region's hydroelectric system to future generations. As a regional leader in STEM education, Bonneville also proudly supports and organizes an award-winning Science Bowl. Bonneville also sponsors Science Fair competitions for students in Washington state, as well as a First Robotics tournament championship.

**Power Services - Capital Funding**
**Schedule by Activity Funding**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Power Services – Capital** | | | | | |
| Associated Project Costs | 206,870 | 242,795 | 264,735 | 21,940 | 9.0% |
| Fish & Wildlife | 5,402 | 50,532 | 44,000 | -6,532 | -12.9% |
| **Total, Power Services – Capital** | **212,271** | **293,327** | **308,735** | **15,408** | **5.3%** |

**Outyears**
**($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Power Services – Capital** | | | | | |
| Associated Project Costs | 264,735 | 313,375 | 338,652 | 345,501 | 352,223 |
| Fish & Wildlife | 44,000 | 38,033 | 33,599 | 29,047 | 29,291 |
| **Total, Power Services - Capital** | **308,735** | **351,408** | **372,251** | **374,548** | **381,514** |

**Program Overview**

Associated Project Costs provide for direct funding of additions, improvements, and replacements of existing Reclamation and Corps hydroelectric projects in the Pacific Northwest. The FCRPS hydro projects produce electric power that is marketed by Bonneville.

Maintaining the availability and increasing the efficiency of the FCRPS is critical to ensuring that the region has an adequate, efficient, economic, and reliable power supply. The FCRPS represents about 80 percent of Bonneville's firm power supply and includes 31 operating federal hydroelectric projects with over 200 generating units. These projects have an average age of about 50 years, with some that exceed 60 years of age. Through direct funding and the cooperation of the Corps and Reclamation, Bonneville uses its U.S. Treasury borrowing authority and other sources to make investments needed to restore generation availability and improve efficiency, reducing demand on Corps and Reclamation appropriations for power-related investments.

Since the beginning of direct funding in FY 1997, Bonneville, along with its joint operating partners, the Corps and Reclamation, has improved system performance. In 1999, at the direction of Congress, Bonneville issued a report that it soon began to implement called the "Asset Management Strategy for the FCRPS." In this report, Bonneville concluded that it needed to invest nearly $1 billion, in aggregate, in the hydroelectric projects over the ensuing 12 to 15 years. Supplementary analyses and experience with the system have revealed additional and ongoing investment needs.

These planned investments, included in the FY 2019 Budget estimates, will maintain the generation performance of the FCRPS. Moving forward with the cost-effective opportunities to expand the generation and to preserve and enhance the capability of the FCRPS is a smart, economic, and environmentally beneficial decision when compared to purchasing power from the market to serve growing Pacific Northwest electricity needs.

Fish and wildlife capital costs incurred by Bonneville are directed at activities that mitigate Columbia River Basin fish and wildlife resources. Bonneville uses capital to fund projects designed to increase juvenile and adult fish passage through the Columbia River system, to increase fish production and survival through construction of hatchery, acclimation and fish monitoring facilities, and to increase wildlife and resident fish populations through land acquisitions. These capital projects support both Northwest Power Act and ESA priorities and are integrated with the Program in order to efficiently meet Bonneville's responsibilities under the Northwest Power Act and other statutes to mitigate federal hydrosystem impacts to Columbia River Basin fish and wildlife.

Bonneville implements projects consistent with the Program and the purposes of the Northwest Power Act. Most projects recommended by the Council undergo independent scientific review as directed by the 1996 Energy and Water Appropriations Act, which added section 4(h)(10)(D) to the Northwest Power Act. As a result, the Council appoints an Independent Scientific Review Panel (ISRP) "to review a sufficient number of projects" proposed to be funded through Bonneville's annual fish and wildlife budget "to adequately ensure that the list of prioritized projects recommended is consistent with the Program." The Northwest Power Act further states that "in making its recommendations to Bonneville, the Planning Council shall consider the impact of ocean conditions on fish and wildlife populations; and shall determine whether the projects employ cost effective measures to achieve program objectives." Today, most mitigation projects funded by Bonneville receive ISRP review as part of the Council recommendation process. The Council uses a multi-year project review cycle during which the ISRP reviews categories of projects grouped together.

Under the Northwest Power Act, the Council must develop a Fish and Wildlife Program that protects, mitigates, and enhances Columbia River Basin fish and wildlife affected by the federal and non-federal hydroelectric projects in the basin while assuring the Pacific Northwest an adequate, efficient, economical, and reliable power supply. The Program, the FCRPS BiOp, other BiOps, and Bonneville's long-term agreements include prioritized strategies for mitigation actions and projects to meet Bonneville's responsibilities under the Northwest Power Act, the ESA, the Federal Clean Water Act, and other laws. When issues arise that potentially trigger the *in lieu* provision of the Northwest Power Act, which prohibits Bonneville from funding mitigation that other entities are authorized or required to undertake, Bonneville works with the Council and the regional fish and wildlife managers, customers, and tribes, as appropriate, to ensure ratepayers fund only appropriate mitigation.

To comply with the ESA, Bonneville funds capital investment actions to avoid jeopardizing listed species. Guidance for those actions is found in the most recent BiOp issued by NOAA in 2008, as supplemented in 2010 and 2014, and the USFWS BiOp in 2006/2010.

- In February 2006, USFWS issued a BiOp for Libby Dam for the Kootenai River white sturgeon and bull trout. A subsequent Settlement Agreement between USFWS and the Center for Biological Diversity was memorialized by modifying the BiOp in 2008. Additional consultation is occurring as part of the larger USFWS bull trout consultation.
- In 2010 USFWS designated critical habitat for bull trout (following USFWS's issuance in 2000 of a BiOp for FCRPS impacts on bull trout). The Action Agencies (Corps, Reclamation, and Bonneville) are preparing a biological assessment covering FCRPS operational effects on bull trout and designated bull trout critical habitat.
- In May 2008, NOAA issued a FCRPS BiOp for 13 listed species of salmon and steelhead, supplemented in a 2010 Supplemental BiOp that incorporated the Action Agency's Adaptive Management Implementation Plan, and further supplemented in a 2014 Supplemental BiOp. On January 17, 2014, NOAA released its 2014 Supplemental BiOp. In May 2016, the Federal District Court for the District of Oregon invalidated the BiOp on numerous grounds and found that the Corps and Reclamation violated the National Environmental Policy Act (NEPA) when they issued decision documents to implement the BiOp. The court ordered NOAA to complete a new BiOp by December 31, 2018, and ordered the Corps and Reclamation to complete a NEPA process in 2021. Most recently, in an order issued March 27, 2017, the court ordered additional spill beginning in 2018 and continuing through the BiOp remand period.
- In July 2008, USFWS and NOAA issued Willamette River BiOps to address impacts from 13 federal dams on salmon, steelhead, Oregon chub, and bull trout. Implementation of a BiOp measure related to hatchery fish in the McKenzie River was the subject of litigation in Federal District Court. The Action Agencies are currently engaged in discussions with NOAA related to BiOp implementation for downstream passage and for hatchery consultations.

Under these collective BiOps, the Action Agencies have committed to implement hydro, habitat, hatchery, and other actions throughout the Columbia River Basin to address impacts stemming from the operation of the federal hydro-electric dams on ESA-listed fish, and to ensure that operations of the federal dams do not jeopardize the continued existence of the ESA listed species or adversely modify their designated critical habitat.

The Action Agencies also signed the 2008 Columbia Basin Fish Accords (Fish Accords or Accords) with five Northwest Tribes and the states of Idaho and Montana. In 2009, an agreement was signed with the state of Washington and federal agencies (the state of Washington Estuary agreement). And in 2012, the Action Agencies signed an agreement with the Kalispel Tribe of Indians covering Albeni Falls Dam and FCRPS operations. Wildlife settlement agreements have been signed with the states of Oregon and Idaho to help complete mitigation for the flooding and inundation caused by FCRPS dams operating in those states. These Fish Accords and settlements complement the BiOps and provide firm commitments to prioritize mitigation actions and secure funding over the life of the agreements.

As noted above, BiOps, Fish Accords, and wildlife settlement commitments are integrated along with other projects and implemented through the Program under the Northwest Power Act. They provide the basis for the Bonneville Fish and Wildlife Program's planned capital investment.

**Accomplishments**

- Issued final Record of Decision for the FYs 2018-2019 rate case on July 26, 2017.
- Completed rotor pedestal installation at John Day Dam.
- Completed spillway gate modifications at Albeni Falls Dam.
- Completed powerhouse 2 transformer refurbishment at Bonneville Dam.
- The returns of adult salmon and steelhead to the Columbia River system from 2009 to 2017 vary by species, but many stocks (especially Snake River fall chinook and Snake River sockeye) have returned at the highest numbers in decades. Research shows that survival of juvenile salmon and steelhead migrating down the Snake and Columbia rivers has improved in recent years and is on track to meet performance standards of 96 percent survival per dam for spring-migrating fish and 93 percent survival for summer migrants.

**Explanation of Changes**

Bonneville's budget includes $308.7 million in FY 2019 for Power Services capital, which is a 5.3 percent increase over the FY 2018 forecasted level. The FY 2019 level reflects a continuing need for investment in the hydroelectric system assets and funding necessary to implement the BiOps, Fish Accords, and other Columbia Basin Fish and Wildlife activities.

The FY 2019 budget increases the levels for Associated Projects (+$21.9 million) and decreases the level for Fish & Wildlife (-$6.5 million), relative to FY 2018.

**Strategic Management**

Bonneville provides electric power while supporting the achievement of its vital responsibilities for fish and wildlife, energy efficiency, renewable resources, and low-cost power in the Pacific Northwest region. Bonneville will continue to implement the following strategies to serve the region:

1. Bonneville coordinates its power operational activities with the Corps, Reclamation, NERC, regional electric reliability councils, its customers, and other stakeholders to provide the most efficient use of federal assets.
2. Ongoing work with the Corps and Reclamation is focused on improving the reliability of the FCRPS, increasing its generation efficiency, and optimizing hydro facility operation.
3. Bonneville is committed to funding efforts to protect listed fish and wildlife species in the Columbia Basin under the ESA and working closely with the Council, regional fisheries managers, and other federal agencies to prioritize and manage projects to mitigate fish and wildlife affected by the FCRPS.
4. Bonneville's utility customers have been, and continue to be, a critical part of Bonneville's collaborative efforts to promote and foster the efficient use of energy.
5. Bonneville has assisted with a DOE Wind Power crosscutting initiative to strengthen energy security.

The following external factors present the most significant risk and impact to overall achievement of the strategies listed above:

1. Continually changing regional economic and institutional conditions;
2. Competitive dynamics; and
3. Ongoing changes in the electric industry.

## Associated Projects

**Overview**

Bonneville will work with both the Corps and Reclamation to reach mutual agreement on budgeting and scheduling capital improvement projects that are cost-effective and provide system or site-specific enhancements, increase system reliability, or provide generation efficiencies.

The work is focused on improving the reliability of the FCRPS and on increasing its generation efficiency or capacity through turbine runner replacements, optimizing hydro facility operation, and new unit construction. Also, limited investments may be made in joint-use facilities that are beneficial to both the FCRPS operations and to other Corps and Reclamation project purposes.

**Corps of Engineers Projects**

**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 167,830 | 157,972 | 122,298 |

*Bonneville Dam:*

- FY 2017. Completed powerhouse 2 transformer refurbishment. Continued main unit breaker and station service reconfiguration, and generator step up (GSU) transformer instrumentation. Began powerhouse 2 roof replacement, and fire protection projects for the control room and both oil storage rooms.
- FY 2018. Continue GSU transformer instrumentation and powerhouse 2 roof replacement. Continue main unit breaker and station service reconfiguration, tailrace gantry crane rehabilitation, and fire protection projects. Begin powerhouse 2 tailrace gantry crane rehabilitation.
- FY 2019. Continue GSU transformer instrumentation, powerhouse 2 roof replacement, main unit breaker and station service reconfiguration, tailrace gantry crane rehabilitation and fire protection projects.

*John Day Dam:*

- FY 2017. Completed rotor pedestal installation. Continued draft tube bulkhead refurbishment, Baldwin Lima Hamilton (BLH) turbine hub upgrades, 500kV disconnect replacement, and station service transformer replacement. Began SQ board (switchgear) replacement, emergency gantry crane replacement and Heating, Ventilating, Air Conditioning (HVAC) system upgrade.
- FY 2018. Complete draft tube bulkhead refurbishment. Continue 500kV disconnect replacement, station service transformer replacement, and HVAC system upgrade, emergency gantry crane replacement and SQ board replacement.
- FY 2019. Complete station service transformer replacements. Continue 500kV disconnect replacement, HVAC system upgrade, emergency gantry crane replacement and SQ board replacement. Begin powerhouse roof replacement.

*The Dalles Dam:*

- FY 2017. Continued transformer replacements, elevator rehabilitation, SR panel (switchgear) replacement, arc flash hazard reduction, and emergency crane rehabilitation. Began fish unit breaker replacement.
- FY 2018. Complete elevator rehabilitation. Continue transformer replacements, fish unit breaker replacement, SR panel replacement, arc flash hazard reduction and emergency crane rehabilitation.
- FY 2019. Continue transformer replacements, fish unit breaker replacement, SR panel replacement arc flash hazard reduction and emergency crane rehabilitation. Begin control room modernization and fish units runner replacement and generator rewinds.

*Willamette Plants:*

- FY 2017. Completed Hills Creek turbine runner and generator rewind, Cougar powerhouse and transformer oil water separator, Detroit digital governors replacement and Lost Creek butterfly valves replacement. Continued Foster bridge crane rehabilitation, Cougar digital governors, Hills Creek spillway gate rehabilitation, Detroit spillway gate rehabilitation and design for electric reliability upgrades at Foster. Continued Generic Data Acquisition and Control System (GDACS) installation and communication system upgrade at all Willamette Valley plants. Began powerhouse roof replacement at Cougar and turbine platform installations at all Willamette Valley plants.

- FY 2018. Complete Hills Creek spillway gate rehabilitation and digital governor replacements at Cougar. Continue Foster bridge crane rehabilitation, Detroit spillway gate rehabilitation, GDACS and turbine platform installations at all Willamette Valley plants, electrical reliability upgrades at Foster, and powerhouse roof replacement at Cougar Dam. Begin main unit breaker and electrical reliability upgrades and begin bridge crane replacement at Green Peter. Begin turbine and generator rehabilitation at Foster and bridge crane replacement at Lost Creek.
- FY 2019. Complete Foster bridge crane rehabilitation. Continue Detroit spillway gate rehabilitation, GDACS installation across the Willamette Valley, powerhouse bridge crane upgrades at Green Peter, electrical reliability upgrades and turbine and generator rehabilitation at Foster, powerhouse roof replacement at Cougar, main unit breaker and electrical reliability upgrades and bridge crane replacement at Green Peter, and bridge crane replacement at Lost Creek. Begin turbine runner replacement and generator rewinds at Green Peter. Begin installation of powerhouse and transformer oil water separators at Lookout Point and main unit breakers and electrical reliability upgrades at Hills Creek. Begin electrical reliability upgrades at Lookout Point.

*Albeni Falls Dam:*
- FY 2017. Completed spillway gate modifications. Continued station service switchgear replacement. Continued design for transformer replacement.
- FY 2018. Continue station service switchgear replacement. Continue design for transformer replacement.
- FY 2019. Complete station service switchgear replacement. Begin installation of main unit transformers.

*Libby Dam:*
- FY 2017. Continued powerhouse DC emergency lighting system installation and control console replacement.
- FY 2018. Complete powerhouse DC emergency lighting system installation. Continue control console replacement. Begin intake gantry crane replacement.
- FY 2019. Complete control console replacement. Continue gantry crane replacement.

*Chief Joseph Dam:*
- FY 2017. Completed utility corridor upgrades, generator cooling system upgrades and units 17-27 exciter replacements. Completed turbine runner replacements and DC and preferred AC upgrade. Began upgrades for station service units and intake and tailrace gantry crane replacements.
- FY 2018. DC and preferred AC upgrade. Continue intake and tailrace gantry crane replacement and upgrades for station service units. Begin generator rewinds.
- FY 2019. Complete intake and tailrace gantry crane replacement. Continue generator rewinds and upgrades for station service units. Begin powerhouse HVAC upgrade.

*Dworshak Dam*
- FY 2017. Completed digital governor upgrade. Continued exciter replacement, unit 3 stator and cooler replacement, and tailrace crane rehabilitation.
- FY 2018. Complete unit 3 stator and cooler replacement. Continue exciter replacement, and tailrace crane rehabilitation.
- FY 2019. Complete exciter replacement. Continue tailrace crane rehabilitation.

*McNary Dam*
- FY 2017. Continued turbine design, main unit cooling water strainers replacement, 4160-480V station service rehabilitation, and powerhouse bridge crane skew control. Began drainage system oil water separator.
- FY 2018. Complete powerhouse bridge crane skew control. Continue 4160-480V station service rehabilitation, turbine design and replacement, drainage system oil water separator and main unit cooling water strainers replacement. Begin spillway gates rehabilitation.
- FY 2019. Complete 4160-480V station service rehabilitation, main unit water strainers replacement, and drainage system oil water separator. Continue spillway gate rehabilitation and turbine design and replacement. Purchase 230kV transformer. Begin exciters upgrade.

*Ice Harbor Dam*

- FY 2017. Continued Units 1-3 turbine runner replacements and stator winding replacements. Began main unit surface air cooler upgrades and station service transformer replacements.
- FY 2018. Continue Units 1-3 turbine runner replacements, stator winding replacements, main unit surface air cooler upgrades, and station service transformer replacements. Begin 115kV disconnect upgrade.
- FY 2019. Complete station service transformer replacements and main unit surface air cooler upgrades. Continue Units 1-3 turbine runner replacements, stator winding replacements, and 115kV disconnect upgrade.

*Little Goose Dam*

- FY 2017. Continued station service transformers replacement, bridge crane rehabilitation, drainage and unwatering pump replacement, and oil water separator projects.
- FY 2018. Complete station service transformers replacement, bridge crane rehabilitation, and oil water separator project. Continue drainage and unwatering pump replacement.
- FY 2019. Complete drainage and unwatering pump replacement. Begin DC system and LV switchgear upgrade.

*Lower Granite Dam*

- FY 2017. Completed Unit 1 BLH linkage upgrade, digital governor upgrade and powerhouse HVAC system upgrade. Continued bridge crane rehabilitation.
- FY 2018. Complete bridge crane rehabilitation. Begin isophase bus and housing upgrade, drainage system oil water separator and DC system and LV switchgear upgrade. Purchase spare main unit bearing.
- FY 2019. Complete isophase bus and housing upgrade and drainage system oil water separator. Continue DC system and LV switchgear upgrade.

*Lower Monumental Dam*

- FY 2017. Completed Unit 1 BLH linkage upgrade and generator rewind, as well as drainage and unwatering pumps replacement. Continued governor replacements. Began breaker replacements.
- FY 2018. Complete breaker replacements. Continue governor replacements.
- FY 2019. Completed governor replacements. Begin drainage system oil water separator installation.

**Bureau of Reclamation Projects**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 39,041 | 84,823 | 142,437 |

*Grand Coulee Dam*

- FY 2017. Continued Units 22 and 23 wicket gate replacements, Supervisory Control and Data Acquisition (SCADA) replacement, G22-24 wear ring replacements, Units 1-18 windings, core, exciter and governor replacements, and compressed air system upgrades. Began Units 11-18 transformer replacements, and firehouse construction.
- FY 2018. Complete Units 22 and 23 wicket gate replacements and firehouse construction. Continue SCADA replacement, Units 11-18 transformer replacements and G22-24 wear ring replacements, Units 1-18 windings, core, exciter and governor replacements, and compressed air system upgrades. Begin crane control upgrades and Third Powerplant roof replacement
- FY 2019. Complete compressed air system upgrades. Continue SCADA replacement, Units 11-18 transformer replacements, G22-24 wear ring replacements, Units 1-18 windings, core, exciter and governor replacements, crane control upgrades and Third Powerplant roof replacement.

*Keys Pump Generating Plant*

- FY 2017. Completed PG7-PG12 circuit breaker replacement. Continued P5 and P6 impeller and core replacement and rewinds. Continued P1-P6 exciters, relays and unit controls and PG7-12 governors, exciters, relays and unit controls. Continued phase reversal switch replacement.
- FY 2018. Continue P5 and P6 impeller and core replacement and rewinds. Continue P1-P6 exciters, relays and unit controls and PG7-12 governors, exciters, relays and unit controls. Continue phase reversal switch replacement.
- FY 2019. Continue P5 and P6 impeller and core replacement and rewinds. Continue P1-P6 exciters, relays and unit controls and PG7-12 governors, exciters, relays and unit controls. Continue phase reversal switch replacement. Begin KP10B transformer replacement.

*Hungry Horse Dam*

- FY 2017. Continued SCADA replacement, and main unit transformer fire protection system replacement. Began powerplant crane controls and control room panel revisions.
- FY 2018. Continue powerplant crane controls, SCADA replacement, control room panel revisions, and main unit transformer fire protection system replacement.
- FY 2019. Complete SCADA replacement. Continue powerplant crane controls, control room panel revisions and main unit transformer fire protection system replacement.

*Chandler Dam*

- FY 2017. No capital projects underway.
- FY 2018. Begin design for Units 1 and 2 generator rewinds.
- FY 2019. Continue design for Units 1 and 2 generator rewinds.

*Palisades Dam*

- FY 2017. Continued microwave system backbone modernization, turbine runner replacement and switchyard modernization. Began arc flash mitigation.
- FY 2018. Complete turbine runner replacement. Continue microwave system backbone modernization, switchyard modernization, and arc flash mitigation.
- FY 2019. Complete arc flash mitigation, microwave system backbone modernization and switchyard modernization.

*Green Springs Dam*

- FY 2017. Continued exciter replacement.
- FY 2018. Continue exciter replacement.
- FY 2019. Complete exciter replacement.

*Black Canyon Dam*

- FY 2017. No capital projects underway.
- FY 2018. Begin switchyard replacement, trash rake system, and Units 1 and 2 upgrades.
- FY 2019. Continue switchyard replacement, trash rake system, and Units 1 and 2 upgrades.

*Anderson Ranch Dam*

- FY 2017. Completed station service upgrade.
- FY 2018. Begin design for turbine runner replacement.
- FY 2019. Continue Begin design for turbine runner replacement.

*Roza Dam*

- FY 2017. Continued switchyard rehabilitation and breaker upgrade.
- FY 2018. Continue switchyard rehabilitation and breaker upgrade.
- FY 2019. Continue switchyard rehabilitation and breaker upgrade.

*Minidoka Dam*

- FY 2017. Continued Units 8 and 9 governor replacements. Continued switchyard modernization, arc flash mitigation, and microwave system backbone modernization.
- FY 2018. Complete Units 8 and 9 governor replacements. Continue switchyard modernization, arc flash mitigation, and microwave system backbone modernization.
- FY 2019. Complete arc flash mitigation. Continue switchyard modernization and microwave system backbone modernization.

| Fish & Wildlife ($K) | | |
|---|---|---|
| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
| 5,402 | 50,532 | 44,000 |

**Overview**

Bonneville continues to develop budgets for the suite of fish and wildlife mitigation projects originally adopted in FY 2007 based on recommendations from the Council. Bonneville reaffirmed and expanded many project-specific commitments in subsequent agreements and processes, including BiOps and Fish Accords, and since then, virtually all these projects received independent science review through the Council and its project review processes. Bonneville's funding decisions embrace many of the management objectives and priorities in the Program and continue to integrate ESA compliance as described in the NOAA Fisheries' and USFWS's FCRPS BiOps. Coordination continues among Bonneville, Council, federal resource management agencies, states, tribes, and others to support the projects that satisfy Bonneville's mitigation responsibilities.

Bonneville intends to continue implementing the kinds of capital projects listed below. These projects are based upon the best available science and are regionally important in that they provide high priority mitigation and protection actions for fish and wildlife populations affected by the construction and operation of the FCRPS dams. Projects and facilities listed below deliver direct on-the-ground benefits to both ESA listed and non-listed fish and wildlife throughout the Columbia River Basin and have been evaluated and coordinated with the Council, state, federal and tribal fish and wildlife resource managers, local governments, watershed and environmental groups, and other interested parties. Specifically, as capital construction projects, hatchery facilities typically go through the Council's three-step process, which includes development of a Master Plan, environmental compliance, ESA consultation, value engineering analysis, and review by the Independent Science Review Panel.

The three types of fish and wildlife projects that Bonneville capitalizes are as follows:

1) Fish passage structures – Structures funded with capital that enhance fish access to habitat in the Columbia River Basin include wells, ladders, screens, pumping, culverts, diversion (irrigation) consolidation, piping to reduce water loss, irrigation efficiencies (drip irrigation), lining of ditches (seepage reduction), removal of objects impeding fish passage or pushup dams, and construction-related habitat restoration.
2) Hatchery facility construction – Projects and activities relating to the construction, improvement, and replacement of fish hatcheries, including related satellite facilities (acclimation ponds and collection weirs). This may also include construction-related habitat restoration.
3) Land acquisition and stewardship – Land acquisition projects protect, enhance, and maintain instream wetland and riparian habitat and provide credit to Bonneville, such as habitat units (HUs) or acres for wildlife or instream miles for resident fish, to fulfill the legal obligation of Bonneville to mitigate the impacts from construction and operation of the FCRPS.

Fish supplementation, production, and related hatchery facilities that may require capital funds in FY 2019 include the following:

<u>The Consolidated Appropriations Act, 2016 (Public Law 114-113) provided Expenditure Authority for the following projects:</u>
- Shoshone Paiute Trout Hatchery: The Shoshone Paiute Tribes of the Duck Valley Reservation propose that Bonneville fund the purchase and/or construction of a trout hatchery. The Tribes would own and operate the hatchery to produce trout for stocking in reservoirs located on the Duck Valley Reservation. Bonneville would fund the capital expenditure to meet contemporary aquaculture standards and achieve fish production goals. The Tribes believe they can reduce federal reservoir stocking costs—some of which Bonneville pays now on an annual basis.

- Spokane Tribal Hatchery: The Spokane Tribal Hatchery, funded by Bonneville in 1989 as partial mitigation for the impacts of the FCRPS, is owned and operated by the Spokane Tribe of Indians. The facility spawns, incubates, and rears Kokanee salmon and rainbow trout near Wellpinit, WA. In June 2015, the Tribe and Bonneville signed a 20-year agreement renewing

commitments to operate and maintain the facility. The renewed agreement also plans to upgrade aging infrastructure, including ground water pumps and rearing containers. Contracting for this work began in FY 2017.

- Snake River Sockeye Weirs: Bonneville funds efforts implemented by the Idaho Department of Fish and Game and the Shoshone Bannock Tribes to rebuild Snake River sockeye throughout their historic range. The combination of substantially increased numbers of returning adults as well as the completion of the Springfield Sockeye Hatchery in 2013 and its associated increased production has created the need for Bonneville to potentially fund the construction, operation, and maintenance of weirs to further sockeye management objectives.

The FY 2014 Omnibus Appropriations Act (Public Law No. 113-76) provided Expenditure Authority for the following projects:

- John Day Reprogramming and Construction: This project is being proposed by the Columbia River Inter-Tribal Fish Commission (CRITFC) under the Accords to work on the balance between upriver and down river salmon hatchery production mitigating for John Day and The Dalles Dams. Final reprogramming facilities and locations are still being analyzed by the Tribes, the Corps, and Bonneville. The project area encompasses the mainstem Columbia River from the base of McNary Dam downstream to The Dalles Dam. Capital dollars for this project will integrate with the Corps funds constructing additions to new or existing FCRPS hatchery facilities to accommodate the reprogramming of hatchery fish.

- Columbia River Basin White Sturgeon Hatchery: This project, proposed by the CRITFC under the Accords, will mitigate for white sturgeon population declines due to consistent poor recruitment upstream of Bonneville Dam. Expected production at a new or existing facility will be 15,000 - 20,000 yearling white sturgeon per year. The final project may include broodstock collection and holding, rearing wild-spawned juveniles, and acclimating juveniles prior to release. The site of the existing Marion Drain sturgeon facilities operated by Yakama Nation has been proposed as a location, near Toppenish, Washington. The project team is working on additional analyses to respond to Council comments and to begin the environmental review process.

- Kelt Reconditioning and Reproductive Success Evaluation Research: CRITFC, under the Accords, is proposing a facility to recondition female steelhead (kelts) after they have spawned. The fish will be held and fed until they have rematured and then be released into the Snake River where they will contribute to the spawning run. The capital portion of the project is expected to be constructed in the Snake River Basin, potentially at Lower Granite Dam. As specified in the 2008 FCRPS BiOp and Supplemental FCRPS BiOps issued in 2010 and 2014, Bonneville will implement the kelt reconditioning plan to improve the productivity of Snake River basin B-run steelhead populations that are listed for protection under the ESA. NOAA's analysis of Prospective Actions indicates that a combination of transportation, kelt reconditioning, and in-stream passage improvements (e.g., spill-flow modifications) could increase kelt returns enough to increase the number of returning Snake River B-run steelhead spawners to Lower Granite Dam by a target of six percent. The Master Plan for the facility is currently in step 2 of 3 in the amended, shortened Council 3 step process.

Ongoing Projects (Expenditure Authority previously received):

- Crystal Springs Hatchery Facilities: This proposed project is for facilities for rearing and out-planting resident and anadromous fish in central and southern Idaho. The facility would be located near the American Falls Reservoir in Idaho. It may produce Yellowstone cutthroat, a resident fish, and anadromous fish including Snake River spring chinook salmon, Snake River steelhead, and Snake River sockeye. The facility is expected to produce up to one million chinook smolts annually. The facility is sponsored by the Shoshone-Bannock Tribes under their Accord, who are expected to operate and manage the facility once it is complete. Currently the project is delayed due to water issues at the site, and tentative year for a Record of Decision (ROD) signing is expected in FY 2019.

- Redfish Lake Sockeye Salmon program: The Snake River sockeye salmon, an Evolutionarily Significant Unit (ESU), was listed under the Endangered Species Act in 1991 (56 FR 58619). The Snake River Sockeye Salmon Captive Broodstock Program has prevented the extinction of endangered Snake River sockeye salmon. The program has been able to help successfully conserve the genetic resources of the founding population and began producing fish for rebuilding the naturally spawning population in Redfish Lake. The program uses state of the art hatchery facilities and fish husbandry protocols, genetic support, and monitoring and evaluation to continue rebuilding numbers of fish. Currently, the program retains replicate, captive broodstock within multiple facilities (Eagle Fish Hatchery located in Idaho state and Burley Creek Fish Hatchery and

Manchester Research Station, both located in Washington state). Eggs produced from these locations are transferred to other facilities (Springfield Fish Hatchery and Burley Creek Fish Hatchery) for release programs. The project continues to expand by increasing the capacity of existing facilities and also by acquiring a new facility under the Idaho Fish Accord. The newly constructed Springfield Fish Hatchery located in Idaho produces additional smolts as called for in the NOAA Fisheries FCRPS BiOp. The expanded smolt releases have already resulted in an increase in the abundance and productivity of the naturally-spawning population. This strategy will greatly increase the likelihood of higher adult returns. Additional expansions include improvements at the Redfish Lake Creek trap and Sawtooth Fish Hatchery weir to hold/trap an increased number of adults to support increased smolt production from Springfield Fish Hatchery. The biological goals are to increase the number of adults spawning naturally in the Sawtooth Valley and transition the captive broodstock to a conventional hatchery production program that uses anadromous adults as broodstock.

- Klickitat Production Expansion: In 2008, the Klickitat River Master Plan was submitted by the Yakama Nation, reviewed by the Independent Science Review Panel, recommended with comments by the Council and approved by Bonneville. The plan's original goals were to protect and increase naturally producing populations of spring chinook and steelhead, localize brood collection of harvest stocks (fall chinook and coho), while protecting the biological integrity and the genetic diversity of indigenous fish stocks in the sub-basin. In 2009, a component of the Master Plan was implemented. Upgrades to Lyle Falls Fishway and Castile Falls Fishway were completed and a new bridge was constructed at Klickitat Hatchery. In July 2009, a new Klickitat Hatchery Complex EIS was initiated to examine options for the development and operation of new production and supplementation facilities, acclimation alternatives and additional upgrades to the existing hatchery facility. The Yakama Nation issued a revised Master Plan, July 2012, providing updates to their fish management plans. Bonneville put the NEPA process on hold while the Yakama Nation refined its proposal in response to site and budgetary limitations and comments on the draft EIS. Since that time, the National Marine Fisheries Service (NMFS) has completed their Mitchell Act EIS and BiOp, helping inform funding authority responsibilities in the subbasin. A new scope of work has been negotiated with the Yakama Nation and a revised Master Plan was submitted to Council in fall 2017, targeting design and construction activities to the expansion of the current spring chinook program only, from 600,000 to 800,000 smolt converting to a wild brood collection program along with general water supply and water abatement upgrades. Bonneville is finalizing plans to cancel the past NEPA process and initiate a new EIS process. Construction will occur after Bonneville issues a ROD and after NMFS, Bonneville and the Yakama Nation sign a three way funding agreement establishing expectations for operations and maintenance funding within the subbasin.

- Hood River Production Facility: This project has been ongoing since the early 1990s. It currently produces 150,000 spring chinook salmon smolts and 50,000 winter steelhead smolts annually. The Powerdale Dam Fish Trap formerly provided the foundation for many of the activities associated with implementation of the Hood River Production Program. These include monitoring escapement, collecting life history characteristics, and broodstock acquisition. PacificCorps' demolition of its Powerdale Dam and the associated fish trapping facility in 2010 necessitated the development of alternative adult broodstock trapping sites. One permanent fish trap on the West Fork of the Hood River was completed in 2013, and a temporary trapping site is operational on the East Fork Hood River. A permanent trap site on the East Fork is currently being evaluated. The Hood River Production Program has four primary goals: 1) re-establish naturally sustaining runs of spring chinook in the Hood River; 2) re-build naturally sustaining runs of winter steelhead in the Hood River; 3) maintain genetic characteristics of Hood River fish populations; and 4) provide fish for sustainable harvest by both sport and tribal fishers.

- Mid-Columbia Coho Restoration: This Yakama Accord project's vision is to re-establish naturally reproducing coho salmon populations in the Wenatchee River and Methow River sub-basins at biologically sustainable levels which provide significant harvest in most years. This program will construct a facility on the Wenatchee River for holding and spawning broodstock, incubating eggs, and rearing juveniles. Additional semi-natural ponds will also be constructed in the Wenatchee and Methow sub-basins for acclimating smolts prior to their release. The phased approach, including associated facilities, incorporates development of a mid-Columbia hatchery broodstock, local adaptation to tributaries in the Wenatchee and Methow Basins, and habitat restoration that will benefit coho as well as ESA-listed spring chinook, steelhead, and bull trout. Major facility construction is expected to occur over the FYs 2017-2019 timeframe.

- Walla Walla Hatchery: The Walla Walla Hatchery is proposed by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) under their Accord. The Tribes would own and operate the hatchery, which will produce up to 500,000 spring chinook smolts annually for release into the Walla Walla River. A 30 percent design was completed in June 2015, however due to budget overruns, the project has been on hold. A draft EIS was completed in September 2016. The design

and construction of the expanded hatchery has successfully been rebid with construction expected to commence in summer 2018. The facility will hold, spawn, incubate and rear spring chinook on the South Fork Walla Walla River near Milton-Freewater, Oregon.

- Yakima Coho Facility: This hatchery is proposed by the Confederated Tribes and Bands of the Yakama Nation under the Yakama Nation Accord, and is presented in the Yakima River Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan. The Yakama Nation would own and operate the hatchery which will produce up to 700,000 coho smolts using broodstock collected at Roza and Sunnyside dams. Bonneville holds the design and construction contract on behalf of the Yakama Nation. The 50 percent design is complete and the 90 percent design is undergoing internal review. Bonneville published a draft EIS on March 17, 2017, and published a final EIS in October 2017 and will issue a Record of Decision once water rights are secured, estimated by Tribe to be in February or March 2018. If approved, construction would likely begin in spring 2018.

Potential non-construction capital Wildlife and Resident Fish Habitat Acquisitions (including Conservation Easements) eligible for capitalization are:

- Albeni Falls Wildlife Mitigation
- Willamette Wildlife Habitat Acquisitions
- Libby and Hungry Horse Reservoirs Resident Fish Acquisitions
- Southern Idaho Habitat Acquisitions

**Activities and Explanation of Changes**

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes<br>FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Power Services – Capital $293,327,000** | **$308,735,000** | **+$15,408,000/+5.3%** |
| **Associated Projects $242,795,000**<br>Milestones[1]:<br>• Complete unit 3 stator and cooler replacement at Dworshak.<br>• Complete elevator rehabilitation at The Dalles.<br>• Complete draft tube bulkhead refurbishment at John Day.<br>• Complete turbine runner replacement at Palisades. | **$264,735,000**<br>Milestones:<br>• Complete compressed air system upgrades at Grand Coulee.<br>• Complete SCADA replacement at Hungry Horse.<br>• Complete arc flash mitigation at Minidoka.<br>• Complete exciter replacement at Green Springs.<br>• Complete station service switchgear replacement at Albeni Falls. | **+$21,940,000/+9.0%**<br>• The increase reflects a reshaping of funding needs for investment in the hydroelectric system assets. |
| **Fish & Wildlife $50,532,000**<br>Milestones:<br>• Continue implementation of the Program, BiOps and Fish Accords. | **$44,000,000**<br>Milestones:<br>• Continue implementation of the Program, BiOps and Fish Accords. | **$-6,532,000/-12.9%**<br>• Small decrease but will continue long-term, planned effort to reshape funding necessary to implement the BiOps, Fish Accords, Columbia River Basin Fish and Wildlife activities. |

[1] FY 2018 milestones have been updated from the FY 2018 Congressional submission due to updated forecasts.

**Transmission Services – Capital Funding**
**Schedule by Activity Funding**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Transmission Services – Capital** | | | | | |
| Main Grid | 11,815 | 2,804 | 39,968 | 37,165 | 1325.6% |
| Area & Customer Services | 30,528 | 76,389 | 47,871 | -28,518 | -37.3% |
| Upgrades & Additions | 44,587 | 76,290 | 71,708 | -4,582 | -6.0% |
| System Replacements | 210,088 | 310,759 | 329,519 | 18,760 | 6.0% |
| Projects Funded in Advance | 141,470 | 42,052 | 41,125 | -927 | -2.2% |
| **Total, Transmission Services - Capital** | **438,489** | **508,293** | **530,191** | **21,897** | **4.3%** |

**Outyears**
**($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Transmission Services - Capital** | | | | | |
| Main Grid | 39,968 | 89,710 | 97,447 | 119,643 | 63,329 |
| Area & Customer Services | 47,871 | 40,932 | 56,420 | 46,479 | 47,463 |
| Upgrades & Additions | 71,708 | 51,177 | 51,678 | 50,985 | 46,166 |
| System Replacements | 329,519 | 409,493 | 382,122 | 380,572 | 401,191 |
| Projects Funded in Advance | 41,125 | 35,855 | 34,705 | 34,645 | 32,581 |
| **Total, Transmission Services - Capital** | **530,191** | **627,167** | **622,371** | **632,324** | **590,730** |

## Transmission Services – Capital

**Overview**

Transmission Services (TS) is responsible for about 75 percent of the Pacific Northwest's high-voltage transmission. TS provides funding for all additions and upgrades (Expansion Investments), and replacements (Sustain Investments) to the Bonneville transmission system, resulting in reliable service to northwest generators and transmission customers. The Bonneville transmission system also facilitates the sale and exchange of power to and from the region. The TS Capital Program is structured with a balanced focus on Expansion and Sustain investments.

In addition to replacing aging and obsolete equipment, TS continues to make significant infrastructure improvements and additions to the system to assure reliable transmission in the Northwest. These improvements and additions will help the Bonneville transmission system continue to comply with national reliability standards and remove constraints that limit economic trade or the ability to maintain the system. Many of the proposed TS projects will be funded through Bonneville lease-purchase agreements. The lease-purchases obligate Bonneville to make expenditures to acquire the use of the related facilities and are identified on an as needed basis. Bonneville may also make related expenditures to facilitate lease-purchase opportunities. Consistent with the FY 2018 Budget Request, the FY 2019 Budget Request maintains the proposal that the Federal government be authorized to sell the transmission assets of Bonneville.

Expansion Investments

Expansion investments continue to make significant infrastructure improvements and additions to the Bonneville transmission system to assure reliable transmission operations in the Northwest and fall into two categories:

- Internally driven Expansion requests, which are derived from system engineering studies, technology innovation research, system operations and maintenance functions, and system event analysis.
- Externally driven Expansion Investment requests, which are derived from governmental initiatives and regulations, consumer demand, and the integration of customer load service and generation needs.

These investments are categorized into:

1. Main Grid – System investments affecting the major interties or internal paths and flowgates that transfer bulk power across the system.
2. Area & Customer Service – System investments related to geographical load service areas.
3. Upgrades & Additions – Upgrades are system investments that replace existing assets to increase capacity, reliability, or functionality and Additions are net new assets added to the system.
4. Projects Funded in Advance – System investments that are requested, and funded in advance, by customers.

Congressionally-approved Production Tax Credits (PTC) for renewable energy enacted in 2005 were extended through 2016. The PTC begins to phase out after 2018. The incentives created by these credits, along with Renewable Portfolio Standards (RPS) mandates implemented by the states of Oregon, Washington, and California, have spurred a large number of renewable interconnection requests to the Bonneville transmission grid. As of September 2017, Bonneville has interconnected a total of 5,265 MW of renewable qualified generation. Bonneville has more than 9,000 MW in additional renewable (wind, solar, biomass, geothermal, etc.) interconnection requests still remaining in the study queue. Solar interconnection requests are currently making up the majority of the new requests in Bonneville's queue. The current projections are possibly 8,500 of renewable generation interconnected MW by 2025. Much of the remaining generation demand is the result of the Renewable Portfolio Standards enacted by Oregon and Washington that require utilities to acquire more than 8,000 MW of renewable energy in the Northwest by 2025. Exports to California are limited now by California laws and are expected to remain at 2,000 MW to 2,500 MW during the same period. Also in the interconnection queue is approximately 800 MW of natural gas fired generation. Efficiency improvements to the FCRPS hydro units that qualify as renewable are also proposed between 2017 and 2023.

In June 2008, Bonneville's first Network Open Season (NOS) received 153 requests from 28 customers for 6,410 MW of new service, about three-fourths for wind energy integration. Bonneville subsequently offered 1,782 MW of new transmission service on its existing system. Bonneville identified four new Main Grid capital projects from the 2008 NOS: (1) McNary-John Day 500 kV transmission line (part of West of McNary Reinforcements Group 1); (2) Big Eddy-Knight 500 kV transmission line and substation (part of West of McNary Reinforcements Group 2); (3) Central Ferry- Lower Monumental 500 kV Reinforcement (formerly Little Goose Area Reinforcement); and (4) I-5 Corridor 500 kV Reinforcement. Construction

of the McNary-John Day 500 kV transmission line is complete and Bonneville has completed construction of the Big Eddy-Knight project and the Central Ferry-Lower Monumental 500 kV Reinforcement project. On May 18, 2017, Bonneville announced its decision to not build the I-5 Corridor Reinforcement Project. Bonneville continues to work with constituents and stakeholders to study more cost effective options to mitigate the current limitations along this path. Public meetings began in July 2017 to address alternatives to building.

Bonneville's 2009, 2010, 2013, and 2016 study processes for new Transmission Service Requests (TSR) total 11,027 MW, including 5,240 MW of wind project interconnection and 240 MW of solar project interconnection. The 2010 study process identified the Montana to Washington project, for which environmental review was begun, however, the requests to support this project have been subsequently withdrawn and so all work on the project was terminated. The 2016 study process re-identified the Montana to Washington and Garrison to Ashe projects to move new wind generation in Montana to the Northwest. The 2013 study process identified upgrades to the Monroe-Novelty Hill 230-kV transmission line which were re-identified for additional new requests in the 2016 study process. The 2016 study process also identified network upgrades in Central Oregon, Walla Walla and across the Raver-Paul flowgate. Efforts are currently underway to evaluate the financial impacts and move forward with required agreements and processes within the TSR Study and Expansion Process (TSEP).

Sustain Investments

Sustain investments are made to maintain the health of the existing infrastructure to assure reliable transmission in the Northwest. These replacements enable continued compliance with national reliability standards, replace aging and obsolete equipment, and remove constraints that limit economic trade or the ability to maintain the transmission system.

In 2009, TS began implementing best practice frameworks that provide a standardized structure and approach to Asset Management. As a result, TS's Asset Management Strategies, derived from Agency Strategies, drive Bonneville's Asset Plans, which determine its capital and expense investment priorities. Sustain investments are forecasted, prioritized within asset programs, and optimized across the asset base for asset planning and approval. We now bundle both sustain and expand capital projects in an effort to improve executability and lower risks and costs. TS's capital program is still fluid and subject to changes as the complexity of the transmission system produces unexpected needs resulting from equipment failure, climate/weather incidents, changes in performance and/or operation of connected systems, outage schedules and conflicts, updated regulations, customer interconnection requests, etc. For these and other reasons, specificity with Sustain investments in the transmission system is somewhat limited.

The TS Sustain Program Asset Programs include:

1. Steel Lines – Transmission lines with steel structures including footings, insulators assemblies, vibration dampers, grounding systems, conductor, ground wire.
2. Wood Lines – Transmission lines with wood structures including cross arm systems, insulator assemblies, vibration dampers, grounding systems, conductor, ground wire.
3. Rights-of-Way – Real property including land parcels, easements, use right, access roads.
4. AC Substations – Substations managing AC current including transformers, reactors, shunt capacitors, power circuit breakers, circuit switchers, series capacitors, disconnect switches.
5. Power System Controls and System Telecommunications – Control and communication equipment including SCADA, transfer trips, fiber, communications, SONET, Telephone, RAS.
6. System Protection and Control – Control equipment including relays, Control Houses, meters.
7. DC Substations – Celilo DC converter station, Static VAR Compensators, DC control systems.
8. Control Centers – Various control equipment and software.
9. Tools and Equipment Acquisition Program (TEAP) –Tools, equipment, fleet.
10. Facilities – Non-electric facilities including warehouses, operational structures, hanger, maintenance centers.
11. Aircraft – Fixed wing and rotary aircraft.

Notwithstanding that the capital program for TS is subject to change, Bonneville has identified several general areas where capital program investment will occur.

Bonneville will continue to fund fiber optic communications facilities needed to meet Bonneville's projected operational needs. To the extent that these investments create temporary periods of excess fiber optic capacity, such dark fiber capacity can be made available to telecommunications providers and to non-profits to meet public benefit internet access needs for rural areas and other needs in Bonneville's service area. Bonneville's investments in fiber optics, including the role of the private sector in building fiber optic networks, is consistent with the "Fiber Optic Cable Plan" submitted to Congress on May 24, 2000, accompanying the FY 2000 Energy and Water Development Appropriations Act. In accordance with this plan, when possible, Bonneville will establish partnerships with fiber optic facility and service providers to meet its needs.

In December 2004, Congress passed and the President signed the Commercial Spectrum Enhancement Act (CSEA, Title II of P.L. 108-494), creating the Spectrum Relocation Fund (SRF) to streamline the relocation of federal systems from certain spectrum bands to accommodate commercial use by facilitating reimbursement to affected agencies of relocation costs. The Federal Communications Commission has auctioned licenses for reallocated federal spectrum, which will facilitate the provision of Advanced Wireless Services to consumers. Funds were made available to agencies in FY 2007 for relocation of communications systems operating on the affected spectrum. These funds are mandatory and will remain available until expended, and agencies will return to the SRF any amounts received in excess of actual relocation costs. The estimated Bonneville cost of this relocation was $48.7 million. The project was completed in November 2013 with a cost of approximately $40 million and the operational system performance was being observed during FY 2014 and early FY 2015 to determine that it has achieved comparable capability as defined under the CSEA. Bonneville determined in December 2014 that comparable capability had been achieved.

Bonneville began participating in a new spectrum relocation effort in FY 2015. The NTIA has approved and, in July 2014, web-posted federal agency relocation plans, including the Bonneville relocation plan. The FCC held an auction of this spectrum on November 13, 2014. Bonneville received an additional $5.2 million from the Spectrum Relocation Fund on July 29, 2015, to fully pay for this new relocation effort, including, as in the prior relocation, the purchase and installation of new digital radio equipment.

As part of the Homeland Security Presidential Directives, Bonneville has completed a physical security assessment of all critical facilities and is implementing security enhancements at these facilities. These security enhancements increase controlled access to Bonneville's facilities and provide video surveillance and monitoring capabilities.

**Accomplishments**

- Issued final Record of Decision for the FYs 2018-2019 rate case on July 26, 2017.
- Integrated 5,081 MW of wind through September 2017 on Bonneville's transmission system.
- Completed construction of the Alvey Substation Reactors.
- Completed construction of the McNary Substation 500/230 kV Bank Addition.
- Completed construction of the Bell-Boundary #DC SONET Ring Upgrade.

**Explanation of Changes**

Bonneville's budget includes $530.1 million in FY 2019 for TS Capital which is a 4.3 percent increase from the FY 2018 forecasted level. The increase reflects increased investment in Main Grid and Systems Replacements.

The FY 2019 budget increases the levels for Main Grid (+$37.2 million) and System Replacements (+$18.8 million). The budget decreases levels for Area & Customer Services (-$28.5 million) Upgrades & Additions (-$4.6 million) and PFIA (-$0.9 million).

**Strategic Management**

Bonneville provides transmission and energy services while integrating renewable resources in the Pacific Northwest. Bonneville will continue to implement the following strategies to serve the region:

1. To improve system adequacy, reliability, and availability, Bonneville has embarked on major transmission infrastructure projects. The projects reinforce the region's transmission system and help deliver the region's future power needs. These projects address multiple challenges, such as integration of renewable energy, the need to relieve a number of congested transmission paths, the challenge to keep up with growing energy demands, and the need to meet changing regulatory and customer requirements.

2. Open access policy in support of competitive markets for load and generation.

3. The replacement of aging assets is vital to the reliability of the existing transmission system. To that end, TS has developed specific long-term strategies for the following asset categories:
    a. Substations AC
    b. Power System Control/System Telecommunications
    c. Wood Lines
    d. Steel Lines
    e. Rights of Way (ROW), (Land Rights, Access Roads, and Vegetation Management)
    f. System Protection and Control
    g. Control Centers
    h. Non-Electric Facilities

The following external factors present the strongest impact to overall achievement of the program's strategic goal:

- Continually changing economic and institutional conditions
- Competitive dynamics
- Ongoing changes in the electric industry
- Siting issues

**Main Grid**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 11,815 | 2,804 | 39,968 |

**Overview**

Bonneville's strategic objectives for Main Grid projects are to assure compliance with the NERC and Western Electricity Coordinating Council (WECC) reliability criteria, provide voltage support, provide a reliable transmission system for open access, and provide for relief of transmission system congestion. During this budgeting period, projects are planned that will provide transmission reinforcement and voltage support to major load areas that are primarily west of the Cascade Mountains.

Continued investments in Main Grid assets include:

*I-5 Corridor Reinforcement*

- FY 2017. Completed NEPA work. On May 18, 2017, Bonneville announced that it will not build this project.

*Big Eddy-Knight (West of McNary Reinforcements Group 2)*

- FY 2017. Completed fiber addition.

*Monroe Line Re-termination*

- FY 2017. Completed design and began construction.
- FY 2018. Continue construction.
- FY 2019. Complete construction.

*Continue Planning Studies to*: (all years)

- Identify infrastructure additions.
- Identify projects driven by NERC and WECC reliability criteria.
- Identify system reactive needs to mitigate unacceptable low or high voltage problems and other system additions.
- Relieve transmission system congestion and integrate new generation facilities.

**Area & Customer Service**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 30,528 | 76,389 | 47,871 |

**Overview**

Bonneville's strategic objective for Area and Customer Service projects is to assure that Bonneville meets reliability standards and contractual obligations to its load service areas.

Continued investments in Area & Customer Service assets include:

*Hooper Springs Substation*

- FY 2017. Continued construction.
- FY 2018. Continue construction.
- FY 2019. Continue construction.

*Midway-Grandview 115 kV Line upgrade*

- FY 2017. Continued construction.
- FY 2018. Complete construction.

*Puget Sound Area Northern Intertie (PSANI)*

- FY 2017. Continued construction.
- FY 2018. Continue construction.
- FY 2019. Complete construction.

*Alvey Substation Reactors*

- FY 2017. Completed construction.

*McNary Substation 500/230 kV Bank Addition*

- FY 2017. Completed construction.

*Paul Substation 500 kV Shunt Reactor Addition*

- FY 2017. Continued construction.
- FY 2018. Complete construction.

*Big Eddy Breaker Additions*

- FY 2018. Begin design.
- FY 2019. Begin construction.

*Drummond 115kV Breaker Additions*

- FY 2017. Completed design and began construction.
- FY 2018. Complete construction.

*Midway –Ashe Double Circuit 230kV Line*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Complete construction.

*Carlton Substation Upgrade*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Complete construction.

*Conkelley Substation Retirement*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Continue construction.

*Continuous Activities (all years)*

- Continue preliminary engineering and design for miscellaneous facilities required to meet contractual obligations and maintain reliable service for Bonneville's service area.

**Upgrades & Additions**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 44,587 | 76,290 | 71,708 |

**Overview**

Bonneville's strategic objectives for Upgrades and Additions are to replace older 60 Hz (Hertz) communications and controls with newer technology including fiber optics in order to maintain or enhance the capabilities of the transmission system; to implement special remedial action control schemes to accommodate new generation and mitigate immediate operational and market constrained paths; and to support communications and remedial action schemes, among other proposals.

During this budget period, Bonneville will complete design, material acquisition, construction, and activation of several fiber optics facilities to provide bandwidth capacity and high-speed data transfers to eventually replace microwave analog radios, which are technologically obsolete and nearing the end of their useful life. Temporarily, in some areas, excess dark fiber capacity is being offered for a term to telecommunications providers or to public entities such as public utilities, schools, libraries, and hospitals, providing them access to high-speed telecommunication services as a public benefit.

Continued investments in Upgrades & Additions assets include:

*VHF Radio System Upgrade*

- FY 2017. Continued construction.
- FY 2018. Continue construction.
- FY 2019. Continue construction.

*Synchrophasor Project*

- FY 2017. Continued construction.
- FY 2018. Complete construction.

*Bell-Boundary #DC SONET Ring Upgrade*

- FY 2017. Completed construction.

*Operational Megabit Ethernet (OMET) System*

- FY 2017. Continued construction.
- FY 2018. Continue construction.
- FY 2019. Complete construction.

*500 kV Spares at Wind Integration Substations*

- FY 2017. Continued construction.
- FY 2018. Continue construction.
- FY 2019. Complete construction.

*Continuous Activities (all years)*

- Upgrading two miles of fiber between Bonneville Power House and Bonneville Control House.
- Planning, design, material acquisition, and construction of special remedial action control schemes required for interconnecting new generation projects and mitigating immediate constrained paths.
- Planning, design, material acquisition, and construction of various system additions and upgrades necessary to maintain a reliable system for Bonneville's service area.
- Construction of secondary fiber related projects and digital radio system upgrades to improve the operational telecommunication system.
- Material procurement and construction to upgrade the main fiber optic backbone system (#KC and #NC systems).

**System Replacements**

**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 210,088 | 310,759 | 329,519 |

**Overview**

Bonneville's strategic objectives for the Sustain Program are to replace high-risk, obsolete, and maintenance-intensive facilities and equipment and to reduce the chance of equipment failure by: (1) replacing high voltage transformers and power circuit breakers which are at or near the end of their useful life; (2) replacing risky, outdated and obsolete control and communications equipment and systems, including mandated replacements due to legislation; and (3) replacing all other existing high-risk equipment and facilities affecting the safety and reliability of the transmission system. Transmission Services uses a total economic cost model to determine priorities for replacement.

Continued investments in System Replacements assets include:
*Continuous Activity (all years)*

*Non-Electric Replacements*

- Continue non-electric replacements as necessary.
- Continue the design, material acquisition, and construction for the Access Road program capital component and the Land Rights program capital component in support of the Lines and ROW Programs.
- Continue design and construction of capital improvements for identified existing facilities.
- Continue replacement of tools, equipment, vehicle fleet, fixed wing aircraft, and rotary aircraft infrastructure.
    - Specific investments include the acquisition of four replacement aircraft (two fixed wing and two rotary wing) during FY 2018 and FY 2019 to replace aging assets, utilizing General Services Administration exchange sale authority, and to comply with new Federal Aviation Administration regulations. Two additional rotary aircraft will be replaced in FY 2020.

*Electric Replacements*

- Continue replacement of system protection and control equipment and other substation and line facilities as needed to maintain reliability using Reliability Centered Maintenance criteria. Such replacements include relays, annunciators, oscillographs, metering, and various types of communication related equipment replacing and migrating analog to digital technology and SCADA equipment.
- Continue replacement of under-rated and high maintenance substation equipment.
- Continue replacing insulators and refurbishing foundations on 500 kV Lines.
- Continue replacement of older generations of digital equipment that is obsolete.
- Continue replacing critical, operational tools and business systems at the Dittmer and Munro Control Centers.
- Continue replacing deteriorating wood pole transmission line structures, spacer dampers, and insulators.

**Projects Funded in Advance**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 141,470 | 42,052 | 41,125 |

**Overview**

This category includes those facilities and/or equipment where Bonneville retains control or ownership but which are funded or financed by a third party or with reserves, either in total or in part.

Continued investments in PFIA assets include:

*Umatilla Electrical Cooperative - Phase 2*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Complete construction.

*Summit Ridge Wind Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Complete construction.

*Bakeoven Wind Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Continue construction.

*Quennett Creek Load Service Project*

- FY 2017. Began and completed design and began construction.
- FY 2018. Complete construction.

*PacifiCorps' Ponderosa Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Continue construction.

*Midway Ashe Line Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Complete construction.

*Avangrid Montague 1 Wind Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Continue construction.

*Invenergy's Heppner Wind Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Continue construction.

*Morrow Solar Project*

- FY 2017. Began design.
- FY 2018. Complete design and begin construction.
- FY 2019. Continue construction.

*Willow Creek Fiber Addition Project*

- FY 2018. Begin design.
- FY 2019. Complete design and begin construction.

*2 Morrow Energy LLC's Ella 3 Wind Project*

- FY 2019. Begin design.

*Whistling Ridge 230 kV Ring Bus Project*

- FY 2019. Begin design.

*Continuous Activity (all years)*

- Continue to integrate various new generation and line/load projects into Bonneville transmission grid based on requests placed and processed in accordance with transmission tariff.
- Continue planning studies to identify system impacts and needs regarding proposed new generation projects.
- Engineer and begin construction of several large wind generation interconnection substations.

**Activities, Milestones, and Explanation of Changes**

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes<br>FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Transmission Services – Capital $508,293,000** | **$530,191,000** | **+$21,897,000/+4.3%** |
| **Main Grid $2,804,000**<br>Milestones:<br>• Continue construction of Monroe-Echo Lake 500 kV Line Re-termination #2. | **$39,968,000**<br>Milestones:<br>• Complete construction of Monroe-Echo Lake 500 kV Line Re-termination #2. | **+$37,165,000/+1325.6%**<br>• The increase is due to increased construction planned for FY 2019. |
| **Area & Customer Service $76,389,000**<br>Milestones:<br>• Complete construction of Midway-Grandview 115kV Line upgrade.<br>• Complete construction of Paul Substation 500kV Reactor.<br>• Complete design and begin construction of Midway- Ashe Double Circuit 230kV line.<br>• Continue construction of the PSANI project.<br>• Complete construction of Drummond 115kV Breaker Additions. | **$47,871,000**<br>Milestones:<br>• Complete construction of Carlton Substation Upgrade.<br>• Complete construction of the PSANI project.<br>• Complete construction of Midway- Ashe Double Circuit 230kV line.<br>• Continue construction of Hooper Springs Substation. | **$-28,518,000/-37.3%**<br>• The decrease reflects projects under construction nearing completion. |

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes<br>FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Upgrades & Additions $76,290,000**<br>Milestones:<br>• Continue construction of 500kV spares at wind integration substations.<br>• Complete construction at multiple sites of the Synchrophasor project. | **$71,708,000**<br>Milestones:<br>• Complete construction of 500kV spares at wind integration substations.<br>• Continue construction of VHF Radio System Upgrade. | **$-4,582,000/-6.0%**<br>• The decrease reflects the movement of spare transformers for wind projects between years. |
| **Systems Replacements $310,759,000**<br>Milestones:<br>• Continue design and construction of capital improvements for identified existing facilities.<br>• Continue non-electric replacements as necessary.<br>• Continue replacement of system protection and control equipment and other substation and line facilities as needed to maintain reliability using Reliability Centered Maintenance criteria. | **$329,519,000**<br>Milestones:<br>• Continue design and construction of capital improvements for identified existing facilities.<br>• Continue non-electric replacements as necessary.<br>• Continue replacement of system protection and control equipment and other substation and line facilities as needed to maintain reliability using Reliability Centered Maintenance criteria. | **+$18,760,000/+6.0%**<br>• The increase reflects an increase in the number of replacement projects. |
| **Projects Funded in Advanced $42,052,000**<br>Milestones:<br>• Continue to integrate new generation as requested.<br>• Continue planning studies on needs and impacts of proposed new generation. | **$41,125,000**<br>Milestones:<br>• Continue to integrate new generation as requested.<br>• Continue planning studies on needs and impacts of proposed new generation. | **$-927,000/-2.2%**<br>• Slight decrease, however, milestones remain the same. |

**Capital Information Technology & Equipment/Capitalized Bond Premium Funding**
**Schedule by Activity Funding**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Capital Information Technology (IT) & Equipment/Capitalized Bond Premium** | | | | | |
| Capital IT & Equipment | 11,328 | 26,860 | 26,860 | 0 | 0.0% |
| Capitalized Bond Premium | 0 | 2,000 | 2,000 | 0 | 0.0% |
| **Total, Capital IT & Equipment/Capitalized Bond Premium** | **11,328** | **28,860** | **28,860** | **0** | **0.0%** |

**Outyears**
**($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Capital Information Technology (IT) & Equipment/Capitalized Bond Premium** | | | | | |
| Capital IT & Equipment | 26,860 | 2,880 | 14,257 | 7,267 | 9,292 |
| Capitalized Bond Premium | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| **Total, Capital IT & Equipment/Capitalized Bond Premium** | **28,860** | **4,880** | **16,257** | **9,267** | **11,292** |

## Capital Information Technology & Equipment/Capitalized Bond Premium

**Overview**

Capital Information Technology (IT) provides for the acquisition of general and some dedicated special purpose capital information technologies, and acquisition of special-use capital and IT equipment in support of Bonneville's strategic objectives. This category also includes Bonneville's on-going efforts to facilitate delivery of a highly resilient organization able to anticipate, withstand, and effectively respond to disruptive events affecting it and its partners in the Northwest region. The four main areas of resiliency focus continue to include asset management, emergency management, crisis management, and continuity of operations.

Bonneville continues to move its IT infrastructure to a more efficient architecture. This FY 2019 Budget supports this effort. IT continues to eliminate redundancies in tools and applications, establish an agency-wide IT architecture with standardized IT purchasing criteria, standardize software licensing processes and minimize agency liabilities through stronger contracts, apply continuous improvement practices to IT project management, and implement an agency IT portfolio cost management strategy. The IT estimates in this FY 2019 Budget under Capital IT and Equipment include all IT functions within the agency except TS grid operations. See the Capital Program – TS section of this budget for additional discussion of grid operations-related IT requirements acquisitions.

Capital equipment provides for the acquisition of general and some dedicated special purchases of capital office furniture and equipment.

Bonneville can incur a bond premium when it repays a U.S. Treasury bond before the due date. When bonds are refinanced and premiums are incurred, the bond premiums can be capitalized. Historically, Bonneville generally has chosen to finance capitalized bond premiums with bonds issued to the U.S. Treasury, as envisioned by the Transmission Act.

**Capital IT & Equipment**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 11,328 | 26,860 | 26,860 |

**Overview**

This category includes enhancements to Bonneville's information technology processes to provide cost effective efficiencies for secure, timely, and accurate information. Investments will enable continued enhancements to Bonneville's enterprise systems that are designed to link key information systems throughout Bonneville and improve business processes. Current efforts include continued functional process improvements in areas not included in the initial development phase. Other investments include acquisition of capital office furniture and equipment, capital automated data processing (ADP) based administrative telecommunications equipment, ADP equipment (hardware), and support of capital software development for certain Bonneville programs.

Continued investments in Capital IT & Equipment assets include:
*Continuous Activity (all years)*
Capital system developments in support of:

- Corporate IT Projects
- IT Infrastructure Projects
- Power IT Projects
- Transmission Services IT Projects (excluding grid operations)

**Capitalized Bond Premium**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 0 | 2,000 | 2,000 |

**Overview**

Continue to assess financial market and when cost-effective, refinance available bonds as prudent.

**Activities, Milestones, and Explanation of Changes**

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes<br>FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Capital Information Technology & Equipment/Capitalized Bond Premium $28,860,000** | **$28,860,000** | **$0/0.0%** |
| **Capital Information Technology & Equipment $26,860,000**<br>Milestones:<br>Capital system developments in support of:<br>• Corporate IT Projects<br>• IT Infrastructure Projects<br>• Power IT Projects<br>• Transmission Services IT Projects | **$26,860,000**<br>Milestones:<br>Capital system developments in support of:<br>• Corporate IT Projects<br>• IT Infrastructure Projects<br>• Power IT Projects<br>• Transmission Services IT Projects | **$0/0.0%**<br>• No change in funding. |
| **Capitalized Bond Premium $2,000,000**<br>Milestones:<br>• Possible refinancing of outstanding federal bonds. | **$2,000,000**<br>Milestones:<br>• Possible refinancing of outstanding federal bonds. | **$0/0.0%**<br>• No change in funding. |

**Power Services – Operating Expense Funding**
**Schedule by Activity Funding**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Power Services - Operating Expenses** | | | | | |
| Production | 934,440 | 1,102,855 | 1,098,201 | -4,655 | -0.4% |
| Associated Projects Costs | 438,145 | 476,762 | 475,160 | -1,602 | -0.3% |
| Fish & Wildlife | 254,556 | 276,713 | 276,704 | -10 | 0.0% |
| Residential Exchange Program | 219,265 | 315,984 | 318,350 | 2,366 | 0.7% |
| NW Power & Conservation Council | 10,766 | 11,624 | 11,914 | 290 | 2.5% |
| Energy Efficiency & Renewable Resources | 149,693 | 164,599 | 165,247 | 648 | 0.4% |
| **Total, Power Services - Operating Expenses** | **2,006,864** | **2,348,537** | **2,345,575** | **-2,962** | **-0.1%** |

**Outyears**
**($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Power Services - Operating Expenses** | | | | | |
| Production | 1,098,201 | 1,055,615 | 1,108,912 | 1,119,992 | 1,136,775 |
| Associated Projects Costs | 475,160 | 493,874 | 508,132 | 522,848 | 538,000 |
| Fish & Wildlife | 276,704 | 281,812 | 286,915 | 292,322 | 297,873 |
| Residential Exchange Program | 318,350 | 251,015 | 250,645 | 265,744 | 265,744 |
| NW Power & Conservation Council | 11,914 | 12,149 | 12,397 | 12,658 | 12,926 |
| Energy Efficiency & Renewable Resources | 165,247 | 173,274 | 172,634 | 175,275 | 170,682 |
| **Total, Power Services - Operating Expenses** | **2,345,575** | **2,267,738** | **2,339,635** | **2,388,839** | **2,422,000** |

## Power Services – Operating Expense

**Overview**

Production includes all Bonneville non-federal debt service (including Energy Northwest debt service), O&M costs for power system generation resources (including a large nuclear plant, business operations, and short- and long-term power purchases[3]), electric utility marketing of power, and oversight of the FCRPS hydroelectric projects and CGS. Bonneville develops products and services to meet the needs of Bonneville's customers and stakeholders and acquires power as needed.

In FY 2010, Bonneville completed a long-term Resource Program to guide potential future resource acquisitions needed to meet Bonneville's supply obligations. In the event that Bonneville does acquire output from a resource on a long-term basis, Bonneville will modify its budget to reflect the acquisition.

Associated Projects Costs represents funding for operation and maintenance costs for the FCRPS hydroelectric projects, minor additions, improvements and replacements, and liabilities of the Corps and Reclamation hydroelectric projects in the Pacific Northwest, which serve many purposes. All agencies emphasize efficient power production from existing facilities and improvement of the performance and availability of power generating units. Bonneville pays additional financing costs of the FCRPS facilities through its Interest Expense and Capital Transfer budget programs. Bonneville provides funding for the operations and maintenance costs that are part of the USFWS's Lower Snake River Compensation Plan (LSRCP) hatcheries. Bonneville is responsible for annual payments to the Confederated Tribes of the Colville Reservation for their contribution to the production of hydropower by the Grand Coulee Dam in accordance with the Settlement Agreement between the United States and the Colville Tribes (April 1994).

Bonneville's Fish and Wildlife Program provides for extensive protection, mitigation, and enhancement of Columbia River Basin fish and wildlife adversely affected by the development and operation of the FCRPS. Bonneville satisfies its fish and wildlife responsibilities by funding projects and activities designed to be consistent with the Program under the Northwest Power Act. Through the Program, Bonneville also implements measures to aid in the protection of fish and wildlife in the Columbia River and its tributaries, both listed as threatened or endangered as well as unlisted, under the ESA (see ESA discussion in the Power Services – Capital Overview section).

Bonneville's mitigation expenditures will focus on activities that benefit Columbia River Basin fish and wildlife resources, following priorities established through ESA consultations, agreements with resource managers, and the Program, including actions that:

- increase survival of ESA-listed and non-listed fish at FCRPS dams and reservoirs;
- increase survival of ESA-listed and non-listed fish throughout their life cycle by protecting and enhancing important habitat areas;
- protect and enhance important wildlife habitat;
- use hatcheries to contribute to conservation and recovery of ESA-listed and non-listed fish;
- provide offsite mitigation projects and habitat, passage, and other improvements that address factors limiting improvements of target species; and
- support a focused and well-coordinated research, monitoring, and evaluation program.

The Energy and Water Development Appropriations Act of 1996 added section 4(h)(10)(D) to the Northwest Power Act, directing the Council to appoint an ISRP "to review a sufficient number of projects" proposed to be funded through Bonneville's annual fish and wildlife budget "to adequately ensure that the list of prioritized projects recommended is consistent with the Program." The Northwest Power Act further states that "in making its recommendations to Bonneville, the Council shall consider the impact of ocean conditions on fish and wildlife populations and shall determine whether the projects employ cost effective measures to achieve program objectives." Today, most mitigation projects funded by Bonneville receive ISRP review as part of the Council recommendation process. The Council has shifted to a multi-year project review cycle during which the ISRP reviews categories of projects grouped together.

[3] Including expenses associated with the use of power financial instruments to hedge Bonneville's exposure to market price risk and certain index sales contract provisions as permitted by Bonneville's internal power transacting risk management guidance.

The Council's major activities include the periodic preparation of a Northwest Conservation and Electric Power Plan (a 20-year electric energy demand and resources forecast and conservation program – known as the Power Plan) and the Fish and Wildlife Program. The Northwest Power Act directs that expenses of the Council, subject to certain limits based on forecasted Bonneville power sales, shall be included in Bonneville's annual budget to Congress. The cost of funding the Council is recovered through Bonneville's power rates.

Bonneville's Energy Efficiency program promotes the efficient use of energy in the Pacific Northwest and acquires conservation resources consistent with the Council's Power Plan. Such actions will: 1) meet energy efficiency targets; 2) achieve a least cost resource mix; 3) lessen the cost impacts of power purchases; 4) avoid the costs of ramping programs and infrastructure up and down; 5) extend the value of the FCRPS to customers; and 6) build the region's resource portfolio with energy efficiency. Bonneville is also exploring how best to integrate demand-side management, distributed generation, and other leading edge technologies into its generation and transmission planning processes.

Bonneville's Energy Efficiency program offers several ways for customer utilities to participate in energy efficiency. Program components include: (1) standard offer efficiency measures and custom projects, which result in customer proposals to conserve energy through such programs as residential weatherization; commercial lighting; heating, ventilation, and air conditioning (HVAC); industrial processes and lighting; and irrigated agriculture; (2) third-party delivery programs, such as Simple Steps Smart Savings, Energy Smart Industrial, and the Green Motors programs; and (3) programs to help regional federal installations reduce energy use, including federal hatcheries and irrigation districts, and to support the Corps of Engineers and Bureau of Reclamation in their efforts to reduce energy use; (4) efficiency achieved independently through the market or through codes and standards, i.e. Momentum Savings; and (5) market transformation through the Northwest Energy Efficiency Alliance (NEEA).

Bonneville's Energy Efficiency budgets reflect BPA's commitment to acquire Public Power's share of the Northwest Power and Conservation Planning Council's 7th Power Plan which forecasts regional electricity demand and resource strategies for the next 20 years. The 7$^{th}$ Power Plan preferred resource strategy calls for the region to acquire 1,400 aMW of energy efficiency by 2021. Bonneville is pursuing a plan to achieve a portion of that goal (573.1 aMW).

In meeting its energy efficiency goals, Bonneville may employ resource acquisition agreements, as authorized by Northwest Power Act section 6, and customer self-funded conservation as well as research, evaluation, contract support, NEEA support, and emerging technology development.

The Residential Exchange Program (REP) was created by the Northwest Power Act to extend the benefits of low-cost federal power to the residential and farm customers of Pacific Northwest electric utilities that have high average system costs. Currently, the region's six investor-owned utilities (IOUs) and two of the region's consumer-owned utilities are actively participating in the REP. Payments under the REP are made to individual IOUs based on the difference between Bonneville's utility-specific Priority Firm (PF) Exchange rates and each utility's average system cost (ASC), times a utility's residential and farm loads. ASCs are determined in accordance with the 2008 Average System Cost Methodology (ASCM). Participating utility ASCs are established in a public process that occurs prior to and during Bonneville's power rate cases. Bonneville's utility-specific PF Exchange rates are determined each rate period. As described below, Bonneville and regional parties reached a settlement of the REP in 2011 under which the total amount of REP benefits available to the IOUs was established through 2028. Payments to the IOUs are made monthly based on historical invoiced exchange loads and the terms of the settlement.

Over the past decade, and prior to the settlement, regional parties filed multiple lawsuits challenging Bonneville's implementation of the REP. These lawsuits were consolidated into four cases that were stayed before the U.S. Court of Appeals for the Ninth Circuit. On July 26, 2011, Bonneville adopted a regionally supported settlement, referred to as the 2012 REP Settlement. Under the settlement, the region's six IOUs will receive about $4.1 billion in REP payments over the 17-year term of the settlement, beginning at $182.1 million in FY 2012, and increasing to $286.1 million in FY 2028. In addition to this settlement, Bonneville has reached related REP settlements with two consumer-owned utilities. A single challenge to the 2012 REP Settlement was dismissed by the U.S. Court of Appeals for the Ninth Circuit in October of 2013.

**Explanation of Changes**

Bonneville's budget includes $2,346 million in FY 2019 for Power Services operating expenses, which is a 0.1 percent decrease over the FY 2018 forecasted level.

The FY 2019 budget increases the level for Residential Exchange (+2.4 million), NW Power & Conservation Council (+$0.3 million), and Energy Efficiency & Renewable Resources (+$0.6 million) and decreases the level for Production (-$4.7 million), Associated Projects (-$1.6 million) and Fish & Wildlife (-$10 thousand).

**Production**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 934,440 | 1,102,855 | 1,098,201 |

**Overview**

Power Purchases: Includes power purchased to cover power supply obligations as well as balancing loads with generation from the hydro system. These purchases can be made in the form of long-term purchases to meet supply obligations based on long-term planning requirements or they can be made within the year due to the monthly shape of the loads and the monthly shape of the hydroelectric generation. Also, purchases can be made within the month and within the day to fill shortages due to fluctuations in the hydro system and load.

Power Scheduling/Marketing: Schedule and market (buy/sell) electric energy with Bonneville customers and the Pacific Northwest's interconnected utilities. Scheduling includes Power Services' implementation of physical and memo power schedules and associated transmission schedules, implementation of Electronic Tagging (ETag) in accordance with NERC and in accordance with FERC, and implementation of electronic scheduling.

Columbia Generating Station (CGS): Bonneville has acquired full lifetime project capability of CGS. CGS is on a 24-month fuel and outage cycle. A maintenance and refueling outage occurred in the spring of 2017 and will again in FY 2019.

Continued investments in Production include:
*Continuous Activity (all years)*

- Provide oversight of all power supply contracts and related projects from which Bonneville purchases generation capability to ensure that all Bonneville approval rights are protected; coordinate, communicate, and administer agreements, issues, and programs between Bonneville and the project owners.
- Provide wind resource integration services for wind generation.
- Power Purchases.
- Power Scheduling/Marketing.
- Provide oversight of all contracts signed to date. Pursue cost-effective means to mitigate capacity demands associated with interconnecting large amounts of wind into the Bonneville system.
- Pursue acquisition of additional cost-effective generation to meet load growth.
- Provide oversight on the wind resource integration services currently purchased by public power customers and offer additional renewable resource shaping services to such customers using wind generation to serve their load.

**Associated Projects**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 438,145 | 476,762 | 475,160 |

**Overview**

Support FCRPS project costs and work to strengthen interagency and regional relationships to improve project performance, supporting functions, and to better understand project resource requirements and costs. This helps to maintain FCRPS reliability and system performance, as well as to attain Bonneville's strategic business objectives.

Continued investments in Associated Projects include:

*Continuous Activity (all years)*

Bureau of Reclamation:

- Continue direct funding Reclamation O&M power activities.

Corps of Engineers:

- Continue direct funding Corps O&M power activities.

**Fish & Wildlife**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 254,556 | 276,713 | 276,704 |

**Overview**

Bonneville implements a mature fish and wildlife mitigation program based on recommendations made by the region's fish and wildlife management agencies and tribes to the Council. Several recent Council reviews have made additional fish and wildlife project recommendations to Bonneville. Bonneville, in coordination with the Council, reviews new and on-going projects for consistency with the Program and purposes of the Northwest Power Act. Bonneville reviews and resets project-specific funding commitments annually, including projects under the FCRPS BiOps and other agreements. Bonneville informs its funding decisions with the management objectives and priorities in the Program (including ISRP reviews) and the Accords as it integrates their implementation with actions necessary to fulfill ESA responsibilities. Regular coordination on implementation priorities continues among Bonneville, the Council, federal resource management agencies, states, Tribes, and others.

Continued investments in Fish &Wildlife include:
Continuous Activity (all years)

- Anadromous Fish: Continue implementing both ongoing and new projects that support ESA-listed species and other measures called for under the 2008 FCRPS BiOp and Supplemental FCRPS BiOps issued in 2010 and 2014, the Fish Accords, the Washington Estuary Agreement, the Kalispel Agreement, and the Willamette and Southern Idaho agreements. Prioritize projects that address the factors that contribute most to mitigation success and that fulfill Bonneville's responsibility for mitigating the impacts from the FCRPS. Implement and develop activities that protect and enhance tributary and estuary habitat, improve mainstream habitat, reduce potentially harmful hatchery practices on ESA-listed populations, and contribute to sustainable fisheries.
- Resident Fish: Implement activities to mitigate the impacts of the FCRPS on lamprey, sturgeon, and bull trout and promote the reproduction and recruitment of Kootenai River white sturgeon. These activities have been selected in response to the USFWS's 2000 bull trout and 2006 Libby BiOp, the Program, and the Fish Accords.
- Mitigation using resident fish to offset anadromous fish losses (substitution): mitigate for reservoir power operation impacts to resident fish and wildlife by seeking projects that benefit both simultaneously. Those resident fish habitat acquisition projects that meet Bonneville's Capitalization Policy will be funded under the capital portion of Bonneville's Fish and Wildlife budget and credited for both fish and wildlife where appropriate.
- Wildlife: Use existing Bonneville policies to continue the current effort to mitigate wildlife in a manner consistent with the Program and fulfill commitments in wildlife agreements such as the Kalispel Agreement, Willamette Wildlife Agreement, and Southern Idaho Wildlife Agreement. Those wildlife projects that meet Bonneville's Capitalization Policy will be funded under the capital portion of Bonneville's Fish and Wildlife budget and credited against both wildlife and fish obligations according to Bonneville's crediting policy and applicable mitigation contracts.

**Residential Exchange, Northwest Power and Conservation Council, and Energy Efficiency & Renewable Resources**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 379,724 | 492,207 | 495,511 |

**Overview**

**Residential Exchange Program (REP)**

- Includes forecasted REP benefits based on the 2012 REP Settlement.

**Northwest Power and Conservation Council**

- Continue support of the Council activities, as directed under the Northwest Power Act, including regional power plan development and maintenance and fish and wildlife program activities.

**Energy Efficiency Resources**

- Conservation Purchases: Provide programmatic savings reimbursements and energy efficiency incentives to Bonneville customers to purchase conservation savings. This includes performance payments and Energy Smart Reserved Power payments for federal installations and fish hatcheries and irrigation districts.

- Conservation Infrastructure: All support for programs and operations, including third-party program implementation, contract support, market research (Momentum Savings research), evaluation, and emerging technology research.

- Market Transformation: Support for NEEA's market transformation initiatives. NEEA identifies barriers and opportunities to increase the market adoption of efficiency by leveraging its regional partnerships.

**Activities, Milestones, and Explanation of Changes**

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Power Services - Operating Expense** | | |
| **$2,348,537,000** | **$2,345,575,000** | **$-2,962,000/-0.1%** |
| **Production $1,102,855,000**<br>Milestones:<br>• Continue to provide oversight of all signed contracts.<br>• Continue to provide wind resource integration services for customer wind generation. | **$1,098,201,000**<br>Milestones:<br>• Continue to provide oversight of all signed contracts.<br>• Continue to provide wind resource integration services for customer wind generation. | **$-4,655,000/-0.4%**<br>• The decrease is primarily due to lower CGS costs. |
| **Associated Project Costs $476,762,000**<br>Milestones:<br>• Continue direct funding of Corps and Reclamation O&M power activities. | **$475,160,000**<br>Milestones:<br>• Continue direct funding of Corps and Reclamation O&M power activities. | **$-1,602,000/-0.3%**<br>• The small decrease reflects changes to security, biological opinion requirements, non-routine extraordinary maintenance, WECC/NERC compliance activities, and improvements, replacements, and minor additions at the projects. |
| **Fish & Wildlife Costs $276,713,000**<br>Milestones:<br>• Continue implementing both ongoing and new projects that support ESA-listed species and other measures called for under the 2008, 2010, and 2014 FCRPS BiOps, the Fish Accords, the Washington Estuary Agreement, the Kalispel Agreement, the Southern Idaho Agreement, and the Willamette Agreement. | **$276,704,000**<br>Milestones:<br>• Continue implementing both ongoing and new projects that support ESA-listed species and other measures called for under the 2008, 2010, and 2014 FCRPS BiOps, the Fish Accords, the Washington Estuary Agreement, the Kalispel Agreement, the Willamette Agreement, and the Southern Idaho Agreement. | **$-10,000/0.0%**<br>• No material change in funding. The costs reflect funding associated with the Biological Opinions, Fish Accord commitments, and Northwest Power Act activities. |

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes<br>FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Residential Exchange Program $315,984,000**<br>Milestones:<br>• Continue to provide REP benefits. | **$318,350,000**<br>Milestones:<br>• Continue to provide REP benefits. | **+$2,366,000/+0.7%**<br>• The increase reflects the scheduled rise in the amount of REP payments payable to the IOUs prescribed by the Residential Exchange Settlement. |
| **NW Power & Conservation Council $11,624,000**<br>Milestones:<br>• Continue support of the Council activities, as directed under the Northwest Power Act, including regional power plan development and maintenance, and fish and wildlife program activities. | **$11,914,000**<br>Milestones:<br>• Continue support of the Council activities, as directed under the Northwest Power Act, including regional power plan development and maintenance, and fish and wildlife program activities. | **+$290,000/+2.5%**<br>• The increase reflects continuing emphasis on the NW Power and Conservation Council. |
| **Energy Efficiency & Renewable Resources $164,599,000**<br>Milestones:<br>• Continue close-out of the legacy conservation resource acquisition contracts, which support Bonneville's contractual obligation to serve customer loads.<br>• Continue to support utility incentive programs.<br>• Continue to support regional energy efficiency programs.<br>• Continue supporting energy efficiency at direct serve federal agencies. | **$165,247,000**<br>Milestones:<br>• Continue close-out of the legacy conservation resource acquisition contracts, which support Bonneville's contractual obligation to serve customer loads.<br>• Continue to support utility incentive programs.<br>• Continue to support regional energy efficiency programs.<br>• Continue supporting energy efficiency at direct serve federal agencies. | **+$648,000/+0.4%**<br>• The increase reflects continuing emphasis on the energy efficiency program consistent with the Power Plan. |

**Transmission Services – Operating Expense Funding**
**Schedule by Activity Funding**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Transmission Services - Operating Expense** | | | | | |
| Engineering | 110,378 | 111,753 | 112,591 | 838 | 0.8% |
| Operations | 168,254 | 192,265 | 193,255 | 989 | 0.5% |
| Maintenance | 194,346 | 205,387 | 206,999 | 1,612 | 0.8% |
| **Total, Transmission Services - Operating Expense** | **472,978** | **509,405** | **512,844** | **3,440** | **0.7%** |

**Outyears**
**($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Transmission Services - Operating Expense** | | | | | |
| Engineering | 112,591 | 129,956 | 134,736 | 141,816 | 147,820 |
| Operations | 193,255 | 197,311 | 197,338 | 199,935 | 202,558 |
| Maintenance | 206,999 | 210,435 | 215,093 | 219,757 | 224,443 |
| **Total, Transmission Services - Operating Expense** | **512,844** | **537,702** | **547,167** | **561,507** | **574,820** |

## Transmission Services – Operating Expense

### Overview

This activity provides for the transmission system services of engineering, operations, and maintenance for Bonneville's electric transmission system, and the associated power system control and communication facilities. Primary strategies of this program are: 1) maintain the safety and reliability of the transmission system; 2) increase the focus on meeting customers' needs; 3) optimize the transmission system; 4) provide open and non-discriminatory transmission access; and 5) improve Bonneville's cost effectiveness. Consistent with the FY 2018 Budget Request, the FY 2019 Budget Request maintains the proposal that the Federal government be authorized to sell the transmission assets of Bonneville.

### Explanation of Changes

Bonneville's budget includes $512.8 million in FY 2019 for TS operating expense which is a 0.7 percent increase over the FY 2018 forecasted level. The increase reflects continuing operation and maintenance of Bonneville's transmission assets.

The FY 2019 budget increases the levels for Engineering (+$0.8 million), Operations (+$1.0 million), and Maintenance (+$1.6 million).

| Engineering ($K) | | |
|---|---|---|
| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
| 110,378 | 111,753 | 112,591 |

**Overview**

Continue efforts to identify best methods for improving system reliability and maintenance practices, and continue cost reduction efforts by identifying opportunities for low-cost reinforcement and voltage support of the existing transmission system.

Continued investments in Engineering include:

*Continuous Activity (all years)*

- Research and Development (R&D): Conduct research focused on technologies related to business challenges Bonneville faces including reliability, energy efficiency, and integration of renewable energy resources. Technologies of interest are identified in Bonneville's Technology Roadmaps. A portfolio of research is selected every year through Bonneville's Portfolio Decision Framework.

- System Development Planning and Analysis: Continue providing technical support and asset planning to deploy the Asset Management approach to sustain existing assets and expand the system to meet Agency objectives.

- Technical Support: Provide technical support activities, such as transmission system planning and studies to optimize portions of the system. Provide support for non-wires solutions studies and pilot projects.

- Capital-to-Expense Adjustments: Conduct annual analysis of Bonneville's outstanding capital work orders to assess whether they should be expensed. As obsolete inventory is identified and disposed of, it is expensed.

- Regulatory Fees: WECC dues and loop flow payments, Department of Commerce/National Telecommunications and Information Administration licensing costs for radio frequencies, DOE Radio Spectrum staff and contractor support, and NERC Critical Infrastructure Protection (CIP) compliance program costs. Includes membership in ColumbiaGrid, a transmission planning organization in the region.

- Reimbursable Transactions: Enter into written agreements with federal and non-federal entities that have work or services to be performed by Bonneville staff at the expense of the benefiting entities. The projects must be beneficial, under agreed upon criteria, to Bonneville operations and to the federal or non-federal entity involved or otherwise be aligned with or supportive of Bonneville's strategic objectives. Additionally, these activities generally contribute to more efficient or reliable construction of the federal transmission system or otherwise enhance electric service to the region.

- Leased and Other Costs: Includes leases, lease purchases, and other costs of financing transmission, delivery, and voltage support facilities when such arrangements are operationally feasible and cost effective to deliver power. Leases and lease purchases enable Bonneville to continue to invest in infrastructure to support a safe and reliable system for the transmission of power. Other costs included are the accrued interest costs associated with Large Generator Interconnection Agreements (LGIA).

| Operations ($K) | | |
|---|---|---|
| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
| 168,254 | 192,265 | 193,255 |

**Overview**

Substation Operations: Perform operations functions necessary to provide electric service to customers and to protect the federal investment in electric equipment and other facilities. Includes equipment adjustments, switching lines and equipment during emergencies or maintenance, isolating damaged equipment, restoring service to customers, inspecting equipment, and reading meters.

Power System Dispatching and Supporting Functions: Perform central dispatching, control, and monitoring of the electric operation of the federal transmission system. Also includes load, frequency, and voltage control of federal generating plants, and coordinating long- and short-term outages of system equipment. In addition, provides technical engineering support of dispatching function and provides all technical and systems support for Dittmer Control Center (DCC) and Munro Control Center (MCC).

Marketing and Sales: Provide management and direction of transmission rates, and provide business strategy in marketing of transmission and ancillary products and services of Transmission Services. Involve customers and constituents in the process of product and rate development. Maintain accurate and complete historical records of current and past legacy transmission agreements. Provide guidance for current and future transmission contract negotiations. Provide financial analysis of market strategies. Monitor and report on the financial health of Transmission Services. Support cost management by effective reporting and analysis of current expenditures. Ensure official budget submittals reflect current management financial strategies and adequately fund transmission programs.

Transmission Scheduling: Provide non-discriminatory, open access to the Bonneville transmission system consistent with Bonneville's Open Access Transmission Tariff (OATT). Schedule transmission capacity to eligible Bonneville customers, which include customers acquiring services under Use of Facilities (UFT), Formula Power Transmission (FPT), Integration of Resources (IR), and Part II or Part III of the OATT. Manage the reservations and scheduling of all transmission services associated with the OATT. Update practices, policies, and commercial systems to accommodate a large diversity of resources, including wind.

*Continuous Activity (all years):*

- Continue to operate within parameters of NERC and WECC.
- Continue support of increased compliance activities related to the reliability of the transmission system, including cyber security.
- Continue developing facilities, policies, procedures, and implementing systems to support integrating the diversity of resources into the transmission grid.
- Continue preparation for increased complexity of transmission scheduling, power system operations, and dispatching, including congestion management and outage scheduling.
- Continue developing the Dittmer Scheduling Center and Munro Scheduling Center facilities to support continuous real time scheduling operations from both facilities.
- Continue developing a long-term approach to optimize transmission availability through streamlined, cost-effective, and sustainable processes.
- Continue to address succession planning issues across key functions.
- Continue development and implementation of business systems and tools.

**Maintenance**
**($K)**

| FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate |
|---|---|---|
| 194,346 | 205,387 | 206,999 |

**Overview**

In all aspects of maintenance, Bonneville is continuing the use of Reliability Centered Maintenance (RCM) practices. The use of RCM practices is focused on improving system reliability, increasing availability, and meeting new and existing compliance regulations at lowest lifecycle costs. In addition Bonneville is deploying Asset Management to optimize maintain/replace decision making. Maintenance costs are expected to increase as Bonneville addresses the aging transmission system, meeting reliability standards, including vegetation management, and environmental constraints associated with construction, enhancement, and maintenance of the system. The Bonneville transmission system encompasses 15,238 circuit miles on over 11,860 right-of-way miles (many of these miles are through rugged, inaccessible terrain).

Continued investments in Maintenance include:

*Continuous Activity (all years)*

- Continue to improve performance to meet System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) targets.
- Continue refining processes and procedures for monitoring and tracking compliance activities related to the reliability of the transmission system.
- Continue to improve system availability performance through new maintenance procedures and work practices.
- Continue to develop and implement work practices and procedures for implementation of a new specialty crew using bare-hand live line practices for maintenance of high-voltage transmission lines.
- Continue increased emphasis on replacement of line hardware (life extension programs for insulators, connectors, dampers, and fiber optic cable hardware).
- Continue to prepare for the impact of an expected high attrition rate among Bonneville's aging workforce by recruiting apprentices and replacements for critical minimum crew size workload positions.
- Increase outage-scheduling planning and coordination to increase customer satisfaction and system availability.
- Maintain vegetation management levels to ensure system reliability.
- Continue access road work to provide reliable access to facilities and ensure environmental compliance.
- Continue improving environmental stewardship.

Transmission Line Maintenance: Maintain and repair 15,238 circuit miles of high voltage transmission lines, of which over 7,617 km (4,734 circuit miles) are 500 kV transmission extra-high voltage (EHV). Maintenance of EHV lines is two and one-half times more labor-intensive than maintenance of lower transmission voltages, although more efficient in transmission of power. This responsibility includes maintaining transmission rights-of-way to ensure system reliability, safety, and environmental compliance. Adopt work practices that improve system availability, reliability, and compliance.

Right-of-Way Maintenance: Maintain over 11,860 of Bonneville's right-of-way miles. This responsibility includes vegetation management, danger tree management, and access road maintenance to ensure system reliability, safety, and environmental compliance. Adopt procedures and processes that improve system availability, reliability, environmental compliance, and reliability compliance. Continue to deploy new technologies such as LiDAR (Light Detection and Ranging) to reliably and cost-effectively manage vegetation.

Substation Maintenance: Maintain and repair the transmission system power equipment located in Bonneville's 260 substations. Work includes inspections, diagnostic testing, and predictive and condition-based maintenance.

System Protection Maintenance: Maintain relaying metering and remedial action scheme equipment used to control and protect the electrical transmission system and to meter energy transfers for the purpose of revenue billing. Additionally,

field-engineering services provide technical advice and assure the correct operation of power system relaying and special control systems used to support interregional energy transmission capabilities.

Power System Control Maintenance: Test, repair, and provide field engineering support of Bonneville's highly complex equipment, communications, and control systems, including seven major microwave systems, fiber optic systems, and other critical communications and control equipment that support the power system.

Non-Electric Plant Maintenance: Maintain and manage Bonneville's non-electric facilities. Includes site, building, and building utility maintenance; custodial services; station utility; and other maintenance service activities, as well as facilities asset management on Bonneville-owned or Bonneville-leased non-electric facilities.

Maintenance Standards and Engineering: Establish, monitor, and update system maintenance standards, policies, and procedures, and review and update long-range plans for maintenance of the electric power transmission system.

**Activities, Milestones, and Explanation of Changes**

| FY 2018 Estimate | FY 2019 Estimate | Explanation of Changes<br>FY 2019 vs FY 2018 Estimate |
|---|---|---|
| **Transmission Services - Operating Expense**<br>**$509,405,000** | **$512,844,000** | **+$3,440,000/0.7%** |
| **Engineering $111,753,000**<br>Milestones:<br>• Continue efforts to identify best methods for improving system reliability and maintenance practices.<br>• Continue cost reduction efforts by identifying opportunities for low-cost reinforcement and voltage support of the existing transmission system. | **$112,591,000**<br>Milestones:<br>• Continue efforts to identify best methods for improving system reliability and maintenance practices.<br>• Continue cost reduction efforts by identifying opportunities for low-cost reinforcement and voltage support of the existing transmission system. | **+$838,000/+0.8%**<br>• The increase reflects emphasis on system reliability standards compliance and research and development. |
| **Operations $192,265,000**<br>Milestones:<br>• Continue to operate within parameters of NERC and WECC.<br>• Continue support of increased compliance activities related to the reliability of the transmission system including cyber security. | **$193,255,000**<br>Milestones:<br>• Continue to operate within parameters of NERC and WECC.<br>• Continue support of increased compliance activities related to the reliability of the transmission system including cyber security. | **+$989,000/+0.5%**<br>• The increase reflects continued emphasis on reliability compliance activities, resource integration activities, key strategic initiatives, security, and control center systems support. |
| **Maintenance $205,387,000**<br>Milestones:<br>• Continue to improve performance to meet System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) targets. | **$206,999,000**<br>Milestones:<br>• Continue to improve performance to meet System Average Interruption Frequency Index (SAIFI) and System Average Interruption Duration Index (SAIDI) targets. | **+$1,612,000/+0.8%**<br>• The increase reflects implementation of facilities asset management plans, continued implementation of live-line crew, NERC/WECC compliance activities related to land rights and vegetation management, continuing maintenance program activities, including system protection, right-of-way, line maintenance, and performance improvements. |

**Interest, Pension, and Post-Retirement Benefits Operating Expense Funding Schedule by Activity Funding ($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Interest, Pension, and Post-retirement Benefits** | | | | | |
| BPA Bond Interest (Net) | 146,381 | 155,425 | 166,605 | 11,180 | 7.2% |
| BPA Appropriation Interest | 8,628 | 1,659 | 1,518 | -141 | -8.5% |
| Corps of Engineers Appropriation Interest | 86,576 | 76,370 | 76,472 | 102 | 0.1% |
| Lower Snake River Comp Plan Interest | 16,572 | 225 | 206 | -19 | -8.5% |
| Bureau of Reclamation Appropriation Interest | 12,434 | 6,700 | 6,009 | -691 | -10.3% |
| Bond Premiums Paid/Discounts (not capitalized) | 0 | 0 | 556 | 556 | 0.0% |
| **Subtotal, Interest – Operating Expense** | **270,590** | **240,379** | **251,366** | **10,987** | **4.6%** |
| Additional Pension, and Post-Retirement Benefits | 27,026 | 29,908 | 31,152 | 1,245 | 4.2% |
| **Total, Interest, Pension, and Post-Retirement Benefits** | **297,617** | **270,287** | **282,519** | **12,232** | **4.5%** |

**Outyears ($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Interest, Pension, and Post-Retirement Benefits** | | | | | |
| BPA Bond Interest (Net) | 166,605 | 199,164 | 230,752 | 261,948 | 291,925 |
| BPA Appropriation Interest | 1,518 | 0 | 0 | 0 | 0 |
| Corps of Engineers Appropriation Interest | 76,472 | 78,755 | 80,081 | 81,606 | 78,384 |
| Lower Snake River Comp Plan Interest | 206 | 206 | 206 | 206 | 157 |
| Bureau of Reclamation Appropriation Interest | 6,009 | 5,173 | 3,911 | 2,624 | 1,942 |
| Bond Premiums Paid/Discounts (not capitalized) | 556 | 6,638 | 6,710 | 8,419 | 8,669 |
| **Subtotal, Interest – Operating Expense** | **251,366** | **289,935** | **321,660** | **354,802** | **381,077** |
| Additional Pension, and Post-Retirement Benefits | 31,152 | 39,754 | 41,398 | 43,451 | 45,356 |
| **Total, Interest, Pension, and Post-Retirement Benefits** | **282,519** | **329,690** | **363,058** | **398,253** | **426,432** |

**Interest, Pension and Post-Retirement Benefits**
**Operating Expense**

**Overview**

Interest expense provides for interest due on bonds issued to the U.S. Treasury and appropriations repayment responsibilities. The appropriation repayments relate to capital investment in FCRPS hydroelectric generating and transmission facilities of Bonneville, and the Corps and Reclamation. Investments were financed by Congressional appropriations and Bonneville borrowings from the U.S. Treasury. Bonneville repays these amounts through revenue raised in its power sales and transmission services revenues.

Since initially receiving U.S. Treasury borrowing authority in 1974 under the Transmission Act, all of Bonneville's U.S. Treasury borrowing has been at market rates. As of October 1, 1996, all of Bonneville's repayment obligations on FCRPS appropriated investment (Corps and Reclamation FCRPS investment and Bonneville investment financed with appropriations prior to the Transmission Act that were unpaid as of September 30, 1996) were restructured and assigned new current-market interest rates. The Bonneville Appropriations Refinancing Act of 1996 (Refinancing Act) called for re-setting (reducing) the unpaid principal of FCRPS appropriations and reassigning (increasing) interest rates. New principal amounts were established as of the beginning of FY 1997 at the present value of the principal and annual interest payments Bonneville would make to the U.S. Treasury for these obligations in the absence of the legislation, plus $100.0 million. The new principal amounts were assigned prevailing market interest rates as of October 1, 1996. Bonneville's outstanding appropriations repayment obligations at the end of FY 1996 were $6.6 billion with a weighted average interest rate of 3.4 percent. The refinancing reduced the principal amount to $4.1 billion with a weighted average interest rate of 7.1 percent. Implementation of the refinancing took place in 1997 after audited actual financial data were available. Pursuant to the legislation, Bonneville submitted its calculations and interest rate assignments implementing the Refinancing Act to the U.S. Treasury for its review and approval. The U.S. Treasury approved the implementation calculations in July 1997. The Refinancing Act also calls for all future FCRPS appropriations to be assigned prevailing U.S. Treasury yield curve interest rates. Bonneville's outstanding appropriations may be prepaid prior to their stated maturities.

Interest estimates are a function of costs of U.S. Treasury borrowing to Bonneville, repayment status of outstanding FCRPS investments, and projected additions to FCRPS plant in service. These estimates may change over time depending on forecasted market conditions. The interest cost estimates include the impact of Bonneville's appropriation refinancing legislation.

Federal employees associated with the operation of the FCRPS participate in either the Civil Service Retirement System or the Federal Employees Retirement System. Employees may also participate in the Federal Employees Health and Benefit Program and the Federal Employee Group Life Insurance Program. All such post-retirement systems and programs are sponsored by the Office of Personnel Management; therefore, Bonneville does not record any accumulated plan assets or liabilities related to the administration of such programs. Bonneville makes additional annual contributions to the General Fund of the U.S. Treasury (receipt account 892889) related to the Federal post-retirement benefit programs provided to employees associated with the operation of the FCRPS. These payments were begun with the FY 1998 Administration's budget which assumed Bonneville would prospectively cover the unfunded liability that accrues in fiscal years after FY 1997 of the Civil Service Retirement and Disability Fund (Disability Fund), the Employees Health Benefits Fund (Health Fund), and the Employees Life Insurance Fund (Insurance Fund) that it had not covered prior to FY 1998. Bonneville's additional annual contributions include amounts relating to pension and post-retirement benefits for Bonneville and the power-related portion of the Corps and Reclamation projects.

**Capital Transfers Funding**
**Schedule by Activity Funding**
**($K)**

| | FY 2017 Actuals | FY 2018 Estimate | FY 2019 Estimate | FY 2019 vs FY 2018 $ | FY 2019 vs FY 2018 % |
|---|---|---|---|---|---|
| **Capital Transfers** | | | | | |
| BPA Bond Amortization[1] | 0 | 90,100 | 370,213 | 280,113 | 310.9% |
| Reclamation Appropriation Amortization | 161,131 | 11,754 | 14,236 | 2,483 | 21.1% |
| BPA Appropriation Amortization | 112,071 | 1,956 | 21,053 | 19,097 | 976.4% |
| Corps Appropriation Amortization | 405,445 | 78,991 | 3,135 | -75,856 | -96.0% |
| Lower Snake River Comp Plan Amortization | 230,065 | 325 | 0 | -325 | -100.0% |
| **Total, Capital Transfers** | 908,712 | 183,126 | 408,637 | 225,511 | 123.1% |

**Outyears**
**($K)**

| | FY 2019 Estimate | FY 2020 Estimate | FY 2021 Estimate | FY 2022 Estimate | FY 2023 Estimate |
|---|---|---|---|---|---|
| **Capital Transfers** | | | | | |
| BPA Bond Amortization[1] | 370,213 | 296,890 | 329,659 | 275,909 | 347,634 |
| Reclamation Appropriation Amortization | 14,236 | 21,480 | 21,901 | 11,608 | 0 |
| BPA Appropriation Amortization | 21,053 | 0 | 0 | 0 | 0 |
| Corps Appropriation Amortization | 3,135 | 0 | 0 | 63,634 | 24,536 |
| Lower Snake River Comp Plan Amortization | 0 | 0 | 0 | 897 | 230 |
| **Total, Capital Transfers** | 408,637 | 318,370 | 351,560 | 352,048 | 372,400 |

**Overview**

This activity conveys funds to the U.S. Treasury for repayment of certain FCRPS costs not included in the Associated Project Costs budget. Since capital transfers are cash transactions, they are not considered budget obligations.

[1] Bonneville "Bond(s)" in this FY 2019 Budget refers to all bonds issued by Bonneville to and advances received from the U.S. Treasury. This reference is consistent with section 13(a) of the Transmission Act (P.L. 93-454), which defines Bonneville bonds as all bonds, notes, and other evidences of indebtedness issued and sold by Bonneville to the U.S. Treasury.

**Bonneville Power Administration**
**Performance Measures**

In accordance with the Government Performance and Results Act (GPRA) Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **BPA Hydropower Generation Efficiency Performance - Achieve 97.5% Heavy-Load-Hour Availability (HLHA) through efficient performance of Federal hydro-system processes and assets, including joint efforts of BPA, Army Corps of Engineers, and Bureau of Reclamation. HLHA is actual machine capacity available during heavy-load hours (0700-2200 Monday-Saturday), divided by planned available capacity during heavy-load hours.** | | |
| Target | 9 .5 percent | 9 .5 percent | 9 .5 percent |
| Result | Met - 99.9 | TBD | TBD |
| Endpoint Target | Maintain at least 97.5% Heavy-Load-Hour Availability | | |
| Performance Goal (Measure) | **BPA Repayment of Federal Power Investment to Keep Costs Low - Meet planned annual repayment of principal on Federal power investments to help keep costs low consistent with sound business principles.** | | |
| Target | 100 percent | 100 percent | 100 percent |
| Result | Met - 100 | TBD | TBD |
| Endpoint Target | Continue to meet planned annual repayment of principal | | |
| Comment | As a capital-intensive business, with constant requirements to maintain extensive generation and transmission system assets across the region, meeting BPA's planned federal annual repayment is vital to maintaining a high credit rating which enables access to lower cost non-federal capital to make needed system investments. | | |
| Performance Goal (Measure) | **BPA System Reliability Performance - NERC Rating - Attain average North American Electric Reliability Corporation (NERC) compliance ratings for NERC Control Performance Standard 1 (CPS1) of greater than or equal to 100 percent.** | | |
| Target | 100 percent | 100 percent | 100 percent |
| Result | Met - 151.3 | TBD | TBD |
| Endpoint Target | Continually ensure the reliability of the electrical grid by attaining a NERC CPS1 rating of equal to or greater than 100 percent each year. | | |
| Comment | CPS1 measures generation/load balance on one-minute intervals. | | |

*Additional Tables*

**BONNEVILLE POWER ADMINISTRATION**
**TOTAL OBLIGATIONS/OUTLAYS**
Current Services
(in millions of dollars)

| BP-1 SUMMARY[1/3/] | FISCAL YEAR 2017 | | 2018 | | 2019 | | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Oblig. | Oblig. | Oblig. |
| 1 Residential Exchange Program | 219 | 219 | 316 | 316 | 318 | 318 | 251 | 251 | 266 | 266 |
| 2 Power Services [2/] | 1,967 | 1,967 | 1,580 | 1,580 | 1,573 | 1,573 | 1,549 | 1,617 | 1,643 | 1,675 |
| 3 Transmission Services | 770 | 770 | 976 | 976 | 1,002 | 1,002 | 1,129 | 1,135 | 1,159 | 1,131 |
| 4 Conservation & Energy Efficiency | 150 | 150 | 165 | 165 | 165 | 165 | 173 | 173 | 175 | 171 |
| 5 Fish & Wildlife | 260 | 260 | 327 | 327 | 321 | 321 | 320 | 321 | 321 | 327 |
| 6 Interest/ Pension [4/] | 298 | 298 | 270 | 270 | 283 | 283 | 330 | 363 | 398 | 426 |
| 7 Associated Project Cost - Capital | 207 | 207 | 243 | 243 | 265 | 265 | 313 | 339 | 346 | 352 |
| 8 Capital Equipment | 11 | 11 | 27 | 27 | 27 | 27 | 3 | 14 | 7 | 9 |
| 9 Planning Council | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 13 | 13 |
| 10 Misc. Accounting Adjs. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 Projects Funded in Advance | 141 | 141 | 42 | 42 | 41 | 41 | 36 | 35 | 35 | 35 |
| 12 Capitalized Bond Premiums | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | | | | | | | | | | |
| 13 **TOTAL OBLIGATIONS/ OUTLAYS** [3/] | **4,034** | **4,034** | **3,959** | **3,959** | **4,009** | **4,009** | **4,119** | **4,261** | **4,365** | **4,407** |

**REVENUES AND REIMBURSEMENTS**

Current Services

(in millions of dollars)

FISCAL YEAR

| BP-1 SUMMARY | 2017 | | 2018 | | 2019 | | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Oblig. | Oblig. | Oblig. |
| 14 Revenues [5/] | 3,525 | 3,525 | 3,944 | 3,944 | 3,945 | 3,945 | 4,033 | 4,121 | 4,207 | 4,294 |
| 15 Project Funded in Advance | 141 | 141 | 42 | 42 | 41 | 41 | 36 | 35 | 35 | 35 |
| 16 **TOTAL** | **3,666** | **3,666** | **3,986** | **3,986** | **3,986** | **3,986** | **4,069** | **4,156** | **4,242** | **4,329** |
| **BUDGET AUTHORITY (NET)** [6/] | **429** | | **606** | | **419** | | **629** | **625** | **629** | **577** |
| 17 **OUTLAYS (NET)** [6/7/8] | | **383** | | **(27)** | | **23** | **49** | **105** | **123** | **79** |

**These notes are an integral part of this table.**

1/ This FY 2019 budget includes capital and expense estimates based on final spending proposals from Bonneville's 2016 IPR/ CIR and IPR 2 processes.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

2/ Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

3/ This budget has been prepared in accordance with PAYGO. Under PAYGO all Bonneville budget estimates are treated as mandatory and are not subject to the discretionary caps included in the Budget Control Act of 2011. These estimates support activities that are separate from discretionary activities and accounts. Thus, any changes to Bonneville estimates cannot be used to affect any other budget categories which have their own dollar caps. Because Bonneville's obligations are and will be incurred under pre-existing legislative authority, Bonneville is not subject to a "pay-as-you-go" test regarding its revision of current-law funding estimates.

4/ See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

5/ Revenues, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools, including upcoming rate adjustment mechanisms, a net revenue risk adjustment, debt service refinancing strategies and/or short-term financial tools to manage net revenues and cash. Some of these potential tools will reduce costs rather than generate revenue, causing the same Net Outlay result. Adjustments for depreciation and 4(h)(10)(C) credits of the Northwest Power Act are also assumed.

6/ Bonneville received $48.7 million of additional budget authority in FY 2007 to accommodate the work necessary to relocate the radio spectrum consistent with the Commercial Spectrum Enhancement Act (P.L. 108-494). In accordance with Federal law, Bonneville plans to return the forecasted unused balance of approximately $8.2 million to the U.S. Treasury as soon as the National Telecommunications Information Administration notifies the Federal Communications Commission that the DOE relocation effort is complete.

7/ Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses. Actual Net Outlays are volatile and are reported in Report on Budget Execution and Budgetary Resources (SF-133). Actual Net Outlays could differ from estimates due to changing market conditions, streamflow variability, continuing restructuring of the electric industry, and other reasons.

8/ FY 2017 Net Outlays are based on Bonneville's FY 2017 audited actuals. FYs 2018 and 2019 Net Outlays are calculated using Bonneville's revenue forecast from the BP-18 rate case. FYs 2020 and 2021 assume no growth in Offsetting Collections compared to FYs 2018 and 2019. FYs 2022 and 2023 assume a growth in Offsetting Collections based on standard inflation factors.

**EXPENSED OBLIGATIONS/OUTLAYS** [1,4/]
**Current Services**
(in millions of dollars)
**FISCAL YEAR**

| BP-2 | 2017 | | 2018 | | 2019 | | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Oblig. | Oblig. | Oblig. |
| 1 Residential Exchange Program | 219 | 219 | 316 | 316 | 318 | 318 | 251 | 251 | 266 | 266 |
| 2 Power Services [2/] | 1,967 | 1,967 | 1,580 | 1,580 | 1,573 | 1,573 | 1,549 | 1,617 | 1,643 | 1,675 |
| 3 Transmission Services | 473 | 473 | 509 | 509 | 513 | 513 | 538 | 547 | 562 | 575 |
| 4 Conservation & Energy Efficiency | 150 | 150 | 165 | 165 | 165 | 165 | 173 | 173 | 175 | 171 |
| 5 Fish & Wildlife | 255 | 255 | 277 | 277 | 277 | 277 | 282 | 287 | 292 | 298 |
| 6 Interest/ Pension [3/] | 298 | 298 | 270 | 270 | 283 | 283 | 330 | 363 | 398 | 426 |
| 7 Planning Council | 11 | 11 | 12 | 12 | 12 | 12 | 12 | 12 | 13 | 13 |
| 8 TOTAL EXPENSE | 3,371 | 3,371 | 3,128 | 3,128 | 3,141 | 3,141 | 3,135 | 3,250 | 3,349 | 3,423 |
| 9 Projects Funded in Advance | 141 | 141 | 42 | 42 | 41 | 41 | 36 | 35 | 35 | 35 |

**CAPITAL OBLIGATIONS/OUTLAYS [1/]**

Current Services

(in millions of dollars)

**FISCAL YEAR**

| BP-2 continued | 2017 | | 2018 | | 2019 | | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|---|---|
| | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Outlays | Oblig. | Oblig. | Oblig. | Oblig. |
| 10 Transmission Services | 297 | 297 | 466 | 466 | 489 | 489 | 591 | 588 | 598 | 556 |
| 11 Associated Project Cost | 207 | 207 | 243 | 243 | 265 | 265 | 313 | 339 | 346 | 352 |
| 12 Fish & Wildlife | 5 | 5 | 51 | 51 | 44 | 44 | 38 | 34 | 29 | 29 |
| 13 Capital Equipment | 11 | 11 | 27 | 27 | 27 | 27 | 3 | 14 | 7 | 9 |
| 14 Capitalized Bond Premiums | 0 | 0 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| 15 **TOTAL CAPITAL INVESTMENTS** | **521** | **521** | **788** | **788** | **827** | **827** | **948** | **976** | **981** | **949** |
| 16 **TREASURY BORROWING AUTHORITY TO** | | | | | | | | | | |
| 17 **FINANCE CAPITAL OBLIGATIONS [4/]** | **521** | | **788** | | **827** | | **948** | **976** | **981** | **949** |

**These notes are an integral part of this table.**

[1/] This FY 2019 budget includes capital and expense estimates based on final spending proposals from Bonneville's 2016 IPR/ CIR and IPR 2 processes.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

[2/] Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

[3/] See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

[4/] This budget has been prepared in accordance with PAYGO. Under PAYGO all Bonneville budget estimates are treated as mandatory and are not subject to the discretionary caps included in the Budget Control Act of 2011. These estimates support activities that are separate from discretionary activities and accounts. Thus, any changes to Bonneville estimates cannot be used to affect any other budget categories which have their own dollar caps. Because Bonneville's obligations are and will be incurred under pre-existing legislative authority, Bonneville is not subject to a "pay-as-you-go" test regarding its revision of current-law funding estimates.

BP-3

**CURRENT SERVICES**

(in millions of dollars)

| | **CAPITAL TRANSFERS** | **FISCAL YEAR** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Amortization: | **2017 Pymts** | **2018 Pymts** | **2019 Pymts** | **2020 Pymts** | **2021 Pymts** | **2022 Pymts** | **2023 Pymts** |
| 18 | BPA Bonds | 0 | 90 | 370 | 297 | 330 | 276 | 348 |
| 19 | Reclamation Appropriations | 161 | 12 | 14 | 21 | 22 | 12 | 0 |
| 20 | BPA Appropriations | 112 | 2 | 21 | 0 | 0 | 0 | 0 |
| 21 | Corps Appropriations | 405 | 79 | 3 | 0 | 0 | 64 | 25 |
| 22 | Lower Snake River Comp Plan Amortization | 230 | 0 | 0 | 0 | 0 | 1 | 0 |
| 23 | **TOTAL CAPITAL TRANSFERS** | **909** | **183** | **409** | **318** | **352** | **352** | **372** |
| 24 | **FULL-TIME EQUIVALENT (FTE)** | **2,891** | **3,000** | **3,000** | **3,000** | **3,000** | **3,000** | **3,000** |

**PROGRAM & FINANCING SUMMARY**

Current Services

(in millions of dollars)

Identification Code: 89-4045-0-3-271

| | | 2017 | 2018 | est. 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|
| Program by activities: | | | | | | | | |
| | Operating expenses: | | | | | | | |
| 0.01 | Power Services | 1,468 | 1,103 | 1,098 | 1,056 | 1,109 | 1,120 | 1,137 |
| 0.02 | Residential Exchange Program | 219 | 316 | 318 | 251 | 251 | 266 | 266 |
| | Associated Project Costs: | | | | | | | |
| 0.05 | Bureau of Reclamation | 148 | 165 | 163 | 171 | 176 | 182 | 187 |
| 0.06 | Corps of Engineers | 247 | 256 | 256 | 265 | 273 | 281 | 289 |
| 0.07 | Colville Settlement | 17 | 23 | 23 | 23 | 24 | 24 | 25 |
| 0.19 | U.S. Fish & Wildlife Service | 26 | 33 | 33 | 35 | 35 | 36 | 37 |
| 0.20 | Planning Council | 11 | 12 | 12 | 12 | 12 | 13 | 13 |
| 0.21 | Fish & Wildlife | 255 | 277 | 277 | 282 | 287 | 292 | 298 |
| 0.23 | Transmission Services | 473 | 509 | 513 | 538 | 547 | 562 | 575 |
| 0.24 | Conservation & Energy Efficiency | 150 | 165 | 165 | 173 | 173 | 175 | 171 |
| 0.25 | Interest | 272 | 240 | 251 | 290 | 322 | 355 | 381 |
| 0.26 | Pension and Health Benefits [1/] | 27 | 30 | 31 | 40 | 41 | 43 | 45 |
| 0.91 | **Total operating expenses [2/]** | **3,312** | **3,128** | **3,141** | **3,135** | **3,250** | **3,349** | **3,423** |
| | Capital investment: | | | | | | | |
| 1.01 | Power Services | 207 | 243 | 265 | 313 | 339 | 346 | 352 |
| 1.02 | Transmission Services | 297 | 466 | 489 | 591 | 588 | 598 | 556 |
| 1.04 | Fish & Wildlife | 5 | 51 | 44 | 38 | 34 | 29 | 29 |
| 1.05 | Capital Equipment | 11 | 27 | 27 | 3 | 14 | 7 | 9 |
| 1.06 | Capitalized Bond Premiums | 0 | 2 | 2 | 2 | 2 | 2 | 2 |
| 1.07 | **Total Capital Investment [3/]** | **521** | **788** | **827** | **948** | **976** | **981** | **949** |
| 2.01 | Projects Funded in Advanced | 141 | 42 | 41 | 36 | 35 | 35 | 35 |
| 10.00 | **Total obligations [4/]** | **3,974** | **3,959** | **4,009** | **4,119** | **4,261** | **4,365** | **4,407** |

**These notes are an integral part of this table.**

[1/] See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

[2/] Assumes expense obligations, not accrued expenses.

Power Services includes Fish & Wildlife, Residential Exchange Program, Planning Council, Conservation & Energy Efficiency and Associated Project Costs which have been shown separately for display purposes.

[3/] Assumes capital obligations, not capital expenditures.

[4/] This FY 2019 budget includes capital and expense estimates based on final spending proposals from Bonneville's 2016 IPR/ CIR and IPR 2 processes.

For purposes of this table, this FY 2019 budget reflects, for FY 2017, actual third party financing expense only for PFIA.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

Refer to 16 USC Chapters 12B, 12G, 12H, and Bonneville's other organic laws, including P.L. 100-371, Title III, Sec. 300, 102 Stat. 869, July 19, 1988, regarding Bonneville's ability to obligate funds.

**Program and Financing (continued)**
Current Services
(in millions of dollars)

| | | 2017 | 2018 | est. 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|---|
| Financing: | | | | | | | | |
| 1000 | Unobligated balance available, start of year. [5/] | 13 | 13 | 11 | 0 | 0 | 0 | 0 |
| 1050 | Unobligated balance available, end of year.[5/] | 13 | 11 | 10 | 0 | 0 | 0 | 0 |
| 1900 | **Budget authority (gross)** | **3,971** | **4,592** | **4,405** | **4,698** | **4,781** | **4,871** | **4,904** |
| Budget Authority: | | | | | | | | |
| 1400 | Permanent Authority: Authority to borrow from Treasury (indefinite) [6/] | 250 | 789 | 827 | 947 | 977 | 982 | 950 |
| 1800 | Spending authority from off-setting collections | 3,521 | 3,986 | 3,986 | 4,069 | 4,156 | 4,242 | 4,327 |
| 1825 | Portion applied to debt reduction | 0 | (183) | (408) | (318) | (352) | (353) | (373) |
| 1850 | **Spending authority from offsetting collections (adjusted)** | **776** | **3,803** | **3,578** | **3,751** | **3,804** | **3,889** | **3,954** |
| 900 | Total obligations | 3,973 | 3,959 | 4,009 | 4,119 | 4,261 | 4,365 | 4,407 |
| 4110 | Outlays (gross) | 3,973 | 3,959 | 4,009 | 4,119 | 4,261 | 4,365 | 4,407 |
| Adjustments to budget authority and outlays: | | | | | | | | |
| | Deductions for offsetting collections: | | | | | | | |
| 4120 | Federal funds | (73) | (90) | (90) | (90) | (90) | (90) | (90) |
| 4121 | Interest on Federal Securities | (8) | | | | | | |
| 4123 | Non-Federal sources | (3,444) | (3,896) | (3,896) | (3,979) | (4,066) | (4,152) | (4,237) |
| 4130 | Total, offsetting collections | (3,525) | (3,986) | (3,986) | (4,069) | (4,156) | (4,242) | (4,327) |
| 4160 | **Budget authority (net)** | **429** | **606** | **419** | **629** | **625** | **629** | **577** |
| 4170 | **Outlays (net) [7/8/]** | **383** | **(27)** | **23** | **49** | **105** | **123** | **79** |

**These notes are an integral part of this table.**

[5/] Reflects estimated cost for radio spectrum fund.

[6/] The Permanent Authority: Authority to borrow (indefinite) from the U.S. Treasury amounts reflect both Bonneville's capital program financing needs and either the use of, or creation of, deferred borrowing. Deferred borrowing is created when, as a cash and debt management decision, Bonneville uses cash from revenues to liquidate capital obligations in lieu of borrowing at that time from the U.S. Treasury. This temporary use of cash on hand instead of borrowed funds creates the ability in future years to borrow money, when fiscally prudent. The FY 1989 Energy and Water Development Appropriations Act (P.L. 100-371 0f 7/19/88) confirmed that Bonneville has authority to incur obligations in excess of U.S. Treasury borrowing authority and cash in the BPA fund.

[7/] Net Outlay estimates are based on current cost savings to date and anticipated cash management goals. They are expected to follow anticipated management decisions throughout the rate period that, along with actual market conditions, will impact revenues and expenses. Actual Net Outlays are volatile and are reported in Report on Budget Execution and Budgetary Resources (SF-133). Actual Net Outlays could differ from estimates due to changing market conditions, streamflow variability, continuing restructuring of the electric industry, and other reasons.

Revenues, included in the Net Outlay formulation, are calculated consistent with cash management goals and assume a combination of adjustments. Assumed adjustments include the use of a combination of tools, including upcoming rate adjustment mechanisms, a net revenue risk adjustment, debt service refinancing strategies and/or short-term financial tools to manage net revenues and cash. Some of these potential tools will reduce costs rather than generate revenue, causing the same Net Outlay result. Adjustments for depreciation and 4(h)(10)(C) credits of the Northwest Power Act are also assumed.

This budget has been prepared in accordance with PAYGO. Under PAYGO all Bonneville budget estimates are treated as mandatory and are not subject to the discretionary caps included in the Budget Control Act of 2011. These estimates support activities that are separate from discretionary activities and accounts. Thus, any changes to Bonneville estimates cannot be used to affect any other budget categories which have their own dollar caps. Because Bonneville's obligations are and will be incurred under pre-existing legislative authority, Bonneville is not subject to a "pay-as-you-go" test regarding its revision of current-law funding estimates.

[8/] FY 2017 Net Outlays are based on Bonneville's FY 2017 audited actuals. FYs 2018 and 2019 Net Outlays are calculated using Bonneville's revenue forecast from the BP-18 rate case. FYs 2020 and 2021 assume no growth in Offsetting Collections compared to FYs 2018 and 2019. FYs 2022 and 2023 assume a growth in Offsetting Collections based on standard inflation factors.

**BONNEVILLE POWER ADMINISTRATION**
**BPA STATUS of U.S. TREASURY BORROWING**
**CURRENT SERVICES**
(in millions of dollars)

BP-4A

Fiscal Year

| | 2017 | | | | 2018 | | | |
|---|---|---|---|---|---|---|---|---|
| | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing |
| **Start-of-Year: Total** | 3,573 | 3,031 | 4,472 | 4,758 | 4,094 | 3,552 | 4,993 | 5,009 |
| **Plus: Annual Increase** | | | | | | | | |
| Cum.-Annual Treasury Borrowing | 521 | 521 | 521 | 250 | 788 | 788 | 788 | 788 |
| Treasury Borrowing (Cash) | | | | | | | | |
| **Less:** | | | | | | | | |
| BPA Bond Amortization | 0 | 0 | 0 | 0 | 90 | 90 | 90 | 90 |
| **Net Increase/(Decrease):** | 521 | 521 | 521 | 250 | 698 | 698 | 698 | 698 |
| Cum.-End-of-Year: Total | 4,094 | 3,552 | 4,993 | 5,009 | 4,792 | 4,250 | 5,691 | 5,707 |
| **Total Remaining Treasury Borrowing Amount** | | | | 2,691 | | | | 1,993 |
| **Total Legislated Treasury Borrowing Amount** | | | | 7,700 | | | | 7,700 |

**These notes are an integral part of this table.**

In any given year, Bonneville may issue lower principal amount of bonds to the U.S. Treasury than forecast depending on net revenues, borrowing costs, and other cash management factors. In such cases, Bonneville accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2019 budget, Bonneville "bond(s)" refers to all bonds issued by Bonneville to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act, which defines Bonneville bonds as all bonds, notes, and other evidences of indebtednesses issued and sold by Bonneville to the U.S. Treasury.

As in the past, Bonneville may pursue future restructuring of total debt as opportunities arise.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

Bonneville reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2018-2023.

Cumulative advance amortization payments as of the end of FY 2017 are $5,130 million.

**BONNEVILLE POWER ADMINISTRATION**
**BPA STATUS of U.S. TREASURY BORROWING**
**CURRENT SERVICES**
(in millions of dollars)

BP-4B

| | 2019 | | | | 2020 | | | |
|---|---|---|---|---|---|---|---|---|
| | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing |
| **Start-of-Year: Total** | 4,804 | 4,262 | 5,703 | 5,757 | 5,261 | 4,719 | 6,160 | 6,214 |
| **Plus: Annual Increase** | | | | | | | | |
| Cum.-Annual Treasury Borrowing | 827 | 827 | 827 | 827 | 948 | 948 | 948 | 948 |
| Treasury Borrowing (Cash) | | | | | | | | |
| **Less:** | | | | | | | | |
| Total BPA Bond Amortization | 370 | 370 | 370 | 370 | 297 | 297 | 297 | 297 |
| **Net Increase/(Decrease):** | | | | | | | | |
| Total | 457 | 457 | 457 | 457 | 651 | 651 | 651 | 651 |
| Cum.-End-of-Year: Total | 5,261 | 4,719 | 6,160 | 6,214 | 5,912 | 5,370 | 6,811 | 6,865 |
| **Total Remaining Treasury Borrowing Amount** | | | | 1,486 | | | | 835 |
| **Total Legislated Treasury Borrowing Amount** | | | | 7,700 | | | | 7,700 |

**These notes are an integral part of this table.**

In any given year, Bonneville may issue lower principal amount of bonds to the U.S. Treasury than forecast depending on net revenues, borrowing costs, and other cash management factors. In such cases, Bonneville accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2019 budget, Bonneville "bond(s)" refers to all bonds issued by Bonneville to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act, which defines Bonneville bonds as all bonds, notes, and other evidences of indebtednesses issued and sold by Bonneville to the U.S. Treasury.

As in the past, Bonneville may pursue future restructuring of total debt as opportunities arise.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

Bonneville reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2018-2023.

Cumulative advance amortization payments as of the end of FY 2017 are $5,130 million.

**BONNEVILLE POWER ADMINISTRATION**
**BPA STATUS of U.S. TREASURY BORROWING**
**CURRENT SERVICES**
(in millions of dollars)

BP-4C Fiscal Year

| | 2021 | | | | 2022 | | | |
|---|---|---|---|---|---|---|---|---|
| | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing |
| **Start-of-Year: Total** | 5,912 | 5,370 | 6,811 | 6,865 | 6,558 | 6,016 | 7,457 | 7,511 |
| **Plus: Annual Increase** | | | | | | | | |
| Cum.-Annual Treasury Borrowing | 976 | 976 | 976 | 976 | 981 | 981 | 981 | 981 |
| Treasury Borrowing (Cash) | | | | | | | | |
| **Less:** | | | | | | | | |
| Total BPA Bond Amortization | 330 | 330 | 330 | 330 | 276 | 276 | 276 | 276 |
| **Net Increase/(Decrease):** | | | | | | | | |
| Total | 646 | 646 | 646 | 646 | 705 | 705 | 705 | 705 |
| Cum.-End-of-Year: Total | 6,558 | 6,016 | 7,457 | 7,511 | 7,263 | 6,721 | 8,162 | 8,216 |
| **Total Remaining Treasury Borrowing Amount** | | | | 189 | | | | (516) |
| **Total Legislated Treasury Borrowing Amount** | | | | 7,700 | | | | 7,700 |

**These notes are an integral part of this table.**

In any given year, Bonneville may issue lower principal amount of bonds to the U.S. Treasury than forecast depending on net revenues, borrowing costs, and other cash management factors. In such cases, Bonneville accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2019 budget, Bonneville "bond(s)" refers to all bonds issued by Bonneville to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act, which defines Bonneville bonds as all bonds, notes, and other evidences of indebtednesses issued and sold by Bonneville to the U.S. Treasury.

As in the past, Bonneville may pursue future restructuring of total debt as opportunities arise.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

Bonneville reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2018-2023.

Cumulative advance amortization payments as of the end of FY 2017 are $5,130 million.

**BONNEVILLE POWER ADMINISTRATION**
**BPA STATUS of U.S. TREASURY BORROWING**
**CURRENT SERVICES**
(in millions of dollars)

BP-4D

| | Fiscal Year 2023 | | | |
|---|---|---|---|---|
| | Net Capital Obs | Net Capital Obs Subject to BA | Net Capital Expend. | Bonds Out-Standing |
| **Start-of-Year: Total** | 7,263 | 6,721 | 8,162 | 8,216 |
| **Plus: Annual Increase** | | | | |
| Cum.-Annual Treasury Borrowing | 951 | 951 | 951 | 951 |
| Treasury Borrowing (Cash) | | | | |
| **Less:** | | | | |
| Total BPA Bond Amortization | 348 | 348 | 348 | 348 |
| **Net Increase/(Decrease):** | | | | |
| Total | 603 | 603 | 603 | 603 |
| Cum.-End-of-Year: Total | 7,866 | 7,324 | 8,765 | 8,819 |
| **Total Remaining Treasury Borrowing Amount** | | | | (1,119) |
| **Total Legislated Treasury Borrowing Amount** | | | | 7,700 |

**These notes are an integral part of this table.**

In any given year, Bonneville may issue lower principal amount of bonds to the U.S. Treasury than forecast depending on net revenues, borrowing costs, and other cash management factors. In such cases, Bonneville accumulates a deferred borrowing balance that it accesses as necessary in the future.

Capital funding levels reflect external factors such as the significant changes affecting West Coast power and transmission markets, along with planned infrastructure investments designed to address the long-term needs of the region.

In this FY 2019 budget, Bonneville "bond(s)" refers to all bonds issued by Bonneville to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act, which defines Bonneville bonds as all bonds, notes, and other evidences of indebtednesses issued and sold by Bonneville to the U.S. Treasury.

As in the past, Bonneville may pursue future restructuring of total debt as opportunities arise.

Budget estimates included in this budget are subject to change due to rapidly changing economic and institutional conditions in the evolving electric utility industry.

Bonneville reserve financing of $15 million annually is assumed as part of TS capital-PFIA for FYs 2018-2023.

Cumulative advance amortization payments as of the end of FY 2017 are $5,130 million.

**BONNEVILLE POWER ADMINISTRATION**
**POTENTIAL THIRD PARTY FINANCING TRANSPARENCY**
(in millions of dollars)

**BP-5**

| | | Fiscal Year | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Transmission Services - Capital** | | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
| Main Grid | Requirements | 12 | 3 | 40 | 90 | 97 | 120 | 63 |
| Area & Customer Services | | 31 | 76 | 48 | 41 | 56 | 46 | 47 |
| Upgrades & Additions | | 45 | 76 | 72 | 51 | 52 | 51 | 46 |
| System Replacements | | 210 | 311 | 330 | 409 | 382 | 381 | 399 |
| Projects Funded in Advance | | 141 | 42 | 41 | 36 | 35 | 35 | 35 |
| Total, Transmission Services - Capital | | 438 | 508 | 530 | 627 | 622 | 632 | 591 |
| **Associated Project Costs - Capital** | | | | | | | | |
| Associated Project Costs | Requirements | 207 | 243 | 265 | 313 | 339 | 346 | 352 |
| Projects Funded in Advance[1/] | | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total, Associated Project Costs - Capital | | 207 | 243 | 265 | 313 | 339 | 346 | 352 |
| **Federal and Non-Federal Funding** | | | | | | | | |
| Projects Funded in Advance | Sources | 141 | 42 | 41 | 36 | 35 | 35 | 35 |
| U.S. Treasury Borrowing Authority | | 504 | 709 | 754 | 905 | 926 | 943 | 908 |
| **Scenario** | | | | | | | | |
| Projects Funded in Advance[1/] | Scenario | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Third Party Financing | | 150 | 117 | 122 | 148 | 147 | 149 | 139 |
| Alternate Treasury Borrowing Authority | | NA | 592 | 632 | 757 | 779 | 794 | 769 |

**These notes are an integral part of this table.**

1/ In this instance, Projects Funded in Advance represents prepayment of Power customers' bills reimbursed by future credits and third party non-federal financing for Conservation initiatives.

The table above shows both the potential use of U.S. Treasury borrowing authority for transmission capital projects based on this FY 2019 budget and the use adjusted for potential third-party financing to fund appropriate capital expenditures when feasible in lieu of U.S. Treasury borrowing. Estimates included in this FY 2019 budget are uncertain and may change due to revised capital investment plans, changing economic conditions, and an evolving financial market environment. The estimates of third-party financing included in the table show a reduction in the use of U.S. Treasury borrowing and do not reflect the actual notional third party financing commitment Bonneville may enter into in that particular year. The difference of reduction in use of U.S. Treasury borrowing and the actual notional third party financing commitment is primarily due to the difference in the timing of financing transactions between U.S. Treasury and third-party financing for capital projects with multi-year construction schedules.

Bonneville's Third Party Financing for Transmission Services consists primarily of lease-purchase agreements, which are capitalized obligations that enable Bonneville to acquire the use of transmission facilities over time. Bonneville also undertakes the construction and installation of facilities from funds that customers advance to Bonneville for construction of BPA-owned facilities that assist the customers in obtaining necessary transmission service from Bonneville. These customers receive monetary payment credits in bills for transmission services from Bonneville up to the amount of funds advanced to Bonneville, plus interest.

Bonneville's historical Third Party Financing amounts may vary over time due to re-assignment of certain lease-purchase agreements to Treasury Financing.

**Bonneville Status of U.S. Treasury Borrowing with Potential Third Party Financing & PFIA Scenario**

With the potential use of third party financing assumed in the scenario above, Bonneville's total remaining U.S. Treasury Borrowing Amount would be extended to the following amounts. See BP-4 BPA Status of Treasury Borrowing- Current Services.

| | Fiscal Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | **2017** | **2018** | **2019** | **2020** | **2021** | **2022** | **2023** |
| Start-of-Year: Total Bonds Outstanding | 4,758 | 5,009 | 5,590 | 5,925 | 6,428 | 6,927 | 7,483 |
| Plus: | | | | | | | |
| U.S. Treasury Borrowing (Cash) | 250 | 788 | 827 | 948 | 976 | 981 | 951 |
| Less: | | | | | | | |
| **Potential Third Party Financing & PFIA** | NA | 117 | 122 | 148 | 147 | 149 | 139 |
| BPA Bond Amortization | - | 90 | 370 | 297 | 330 | 276 | 348 |
| | | | | | | | |
| Net Increase/(Decrease) Bonds Outstanding: | 250 | 581 | 335 | 503 | 499 | 556 | 464 |
| Cum.-End-of-Year: Total | 5,009 | 5,590 | 5,925 | 6,428 | 6,927 | 7,483 | 7,947 |
| | | | | | | | |
| **Total Remaining U.S. Treasury Borrowing Amount** | 2,691 | 2,110 | 1,775 | 1,272 | 773 | 217 | (247) |
| Total Legislated U.S.Treasury Borrowing Amount | 7,700 | 7,700 | 7,700 | 7,700 | 7,700 | 7,700 | 7,700 |

## U.S. TREASURY PAYMENTS

(in millions of dollars)

| | | FISCAL YEAR | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| **A.** | **INTEREST ON BONDS & APPROPRIATIONS** | | | | | | | |
| | **Bonneville Bond Interest** | | | | | | | |
| 1 | Bonneville Bond Interest (net) | 113 | 155 | 167 | 199 | 231 | 262 | 292 |
| 2 | AFUDC [1/] | 33 | 33 | 33 | 34 | 35 | 36 | 35 |
| | **Appropriations Interest** | | | | | | | |
| 3 | Bonneville | 9 | 2 | 2 | 0 | 0 | 0 | 0 |
| 4 | Corps of Engineers [2/] | 87 | 76 | 76 | 79 | 80 | 82 | 78 |
| 5 | Lower Snake River Comp. Plan | 17 | 0 | 0 | 0 | 0 | 0 | 0 |
| 6 | Bureau of Reclamation [3/] | 12 | 7 | 6 | 5 | 4 | 3 | 2 |
| 7 | Bond Premiums paid/Discounts (not capitalized) | 0 | 0 | 1 | 7 | 7 | 8 | 9 |
| **8** | **Total Bond and Approp. Interest** | **271** | **273** | **284** | **324** | **357** | **391** | **416** |
| **B.** | **ASSOCIATED PROJECT COST** | | | | | | | |
| 9 | Bureau of Reclamation Irrigation Assistance | 51 | 27 | 57 | 24 | 15 | 16 | 13 |
| 10 | Bureau of Rec. O & M [4/] | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | Corps of Eng. O & M [4/] | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | L. Snake River Comp. Plan O & M [4/] | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **13** | **Total Assoc. Project Costs** | **51** | **27** | **57** | **24** | **15** | **16** | **13** |
| **C.** | **CAPITAL TRANSFERS** | | | | | | | |
| | **Amortization** | | | | | | | |
| 14 | Bonneville Bonds [6/] | 0 | 90 | 370 | 297 | 330 | 276 | 348 |
| 15 | Bureau of Reclamation Appropriations | 161 | 12 | 14 | 21 | 22 | 12 | 0 |
| 16 | Corps of Engineers Appropriations | 405 | 79 | 3 | 0 | 0 | 64 | 25 |
| 17 | Lower Snake River Comp. Plan | 230 | 0 | 0 | 0 | 0 | 1 | 0 |
| 18 | Bonneville Appropriations | 112 | 2 | 21 | 0 | 0 | 0 | 0 |
| **19** | **Total Capital Transfers** | **909** | **183** | **409** | **318** | **352** | **352** | **372** |
| **D.** | **OTHER PAYMENTS** | | | | | | | |
| 20 | Unfunded Post-Retirement Liability [5/] | 27 | 30 | 31 | 40 | 41 | 43 | 45 |
| **21** | **TOTAL TREASURY PAYMENTS** | **1,258** | **514** | **781** | **706** | **764** | **802** | **847** |

**These notes are an integral part of this table.**

1/ This interest cost is capitalized and included in BPA's Transmission System Development, System Replacements, and Associated Projects Capital programs. AFUDC is financed through the sale of bonds.

2/ Includes interest on construction funding for Corp of Engineers (Corps) fish bypass facilities at Corps dams in the Columbia River Basin, including Lower Monumental, Ice Harbor, and The Dalles.

3/ Includes payments paid by Reclamation to the U.S. Treasury on behalf of Bonneville.

4/ Costs for power O&M is funded directly by Bonneville as follows (in millions):

| FISCAL YEAR | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Bureau of Reclamation | 148 | 165 | 163 | 171 | 176 | 182 | 187 |
| Corps of Engineers | 247 | 256 | 256 | 265 | 273 | 281 | 289 |
| Subtotal Bureau and Corps | 395 | 421 | 419 | 436 | 449 | 462 | 476 |
| Lower Snake River Comp. Plan | 26 | 33 | 33 | 35 | 35 | 36 | 37 |
| Total | 421 | 454 | 452 | 470 | 484 | 498 | 513 |

5/ See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

6/ In this FY 2019 budget, Bonneville "bond(s)" refers to all bonds issued by Bonneville to and advances received from the U.S. Treasury. This reference is consistent with section 13 (a) of the Transmission Act, which defines Bonneville bonds as all bonds, notes, and other evidences of indebtednesses issued and sold by Bonneville to the U.S. Treasury.

Does not include Treasury bond premiums on refinanced Treasury bonds.

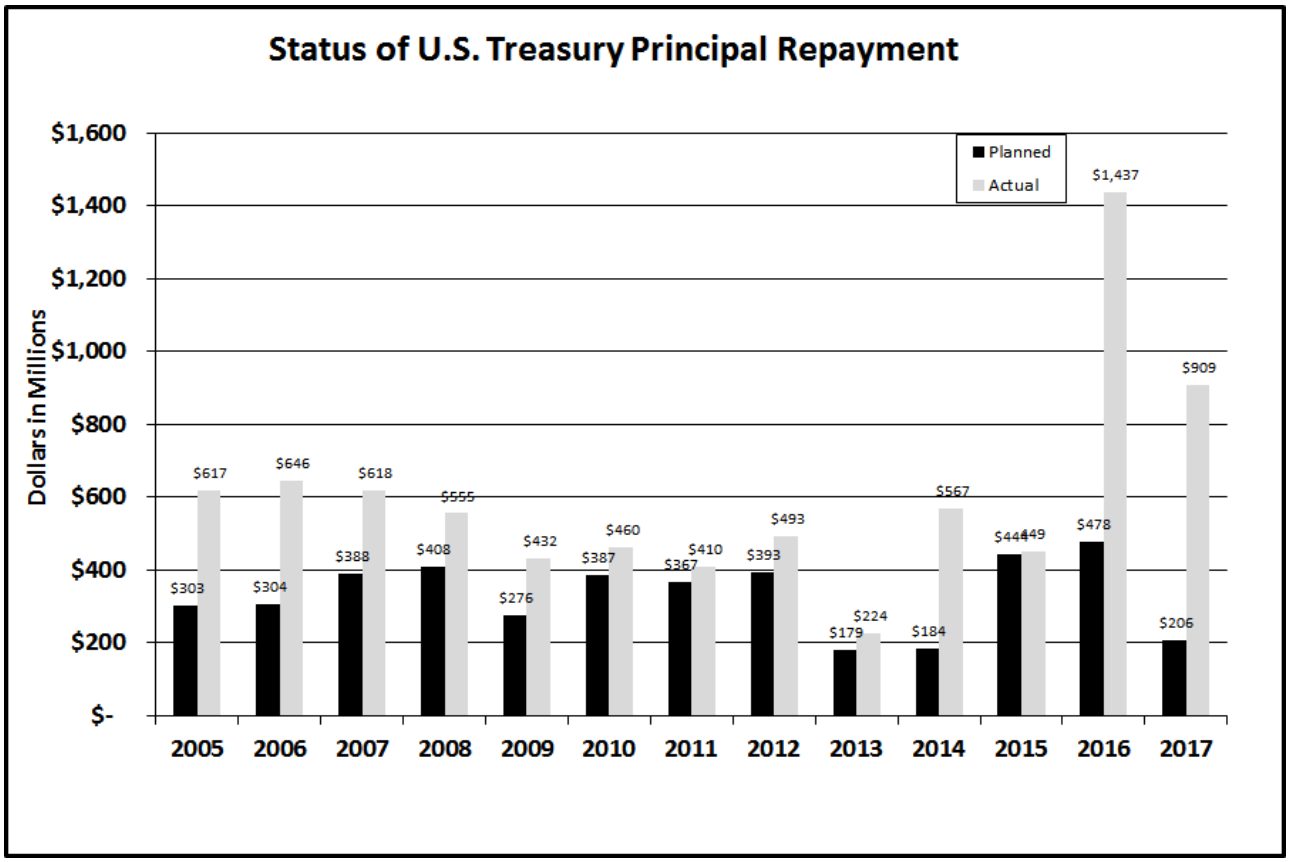



Chart Notes

[1/] This chart displays principal repayment only.

[2/] U.S. Treasury payment outyear estimates for planned amortization of principal are based on rate case estimates when available and are planned amortization for future rate case periods. These estimates may change due to revised capital investment plans, actual U.S. Treasury borrowing, and advanced amortization payments. Bonneville's aggregate FY 2017 U.S. Treasury payment was $1,258 million, composed of $909 million in principal repayment, which included $778 million in early retirement of higher interest rate U.S. Treasury debt, $271 million in interest, and $78 million for other costs.

[3/] FYs 2002-2012 payments include portions of future planned amortization amounts consistent with Bonneville's capital strategy plan and the Bonneville /Energy Northwest debt optimization program.

[4/] Advance amortization due to sale of transmission facilities includes $12.7 million in FY 2003, $5.3 million in FY 2006, $2.0 million in FY 2011, $0.4 million in FY 2013 and $0.4 million in FY 2014, and $0.6 million in FY 2017.

[5/] The cumulative amount of actual advance amortization payments as of the end of FY 2017 is $5,130 million.

[6/] FYs 2014-2018 include advance amortization under the Regional Cooperation Debt initiative with Energy Northwest (EN) under which EN extended maturities on Bonneville-backed debt which enabled the early amortization of higher cost appropriations.

**OBJECT CLASSIFICATION STATEMENT**

(in millions of dollars)

| | | ESTIMATES | | |
|---|---|---|---|---|
| | | **2017 act.** | **2018** | **2019** |
| 11.1 | Full-time permanent | 263 | 274 | 277 |
| 11.3 | Other than full-time permanent | - | - | - |
| 11.5 | Other personnel compensation | 61 | 64 | 64 |
| 11.9 | **Total personnel compensation** | **324** | **337** | **342** |
| 12.1 | Civilian personnel benefits | 119 | 124 | 125 |
| 13.0 | Benefits for former personnel | - | - | - |
| 21.0 | Travel and transportation of persons | 9 | 10 | 10 |
| 22.0 | Transportation of things | - | - | - |
| 23.1 | Rental payments to GSA | 1 | 1 | 1 |
| 23.2 | Rents, other | 0 | 0 | 0 |
| 23.3 | Communication, utilities & misc. charges | 9 | 9 | 9 |
| 25.1 | Consulting Services | 16 | 16 | 16 |
| 25.2 | Other Services | 2,423 | 2,346 | 2,376 |
| 25.5 | R & D Contracts | 13 | 11 | 11 |
| 26.0 | Supplies and materials | 52 | 54 | 54 |
| 31.0 | Equipment | 427 | 444 | 450 |
| 32.0 | Lands and structures | 249 | 259 | 263 |
| 41.0 | Grants, subsidies, contributions | 38 | 41 | 42 |
| 43.0 | Interest and dividends | 295 | 307 | 311 |
| 99.0 | **Total obligations** | **3,973** | **3,959** | **4,009** |

**Estimate of Receipts**
(in millions of dollars)

| | Fiscal Year | | | | | | |
|---|---|---|---|---|---|---|---|
| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
| Reclamation Interest | 12 | 7 | 6 | 5 | 4 | 3 | 2 |
| Reclamation Amortization | 161 | 12 | 14 | 21 | 22 | 12 | 0 |
| Reclamation O&M | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Reclamation Irrig. Assist. | 51 | 27 | 57 | 24 | 15 | 16 | 13 |
| Revenues Collected by Reclamation Distributed in Treasury Account (credit) | -13 | -7 | -7 | -7 | -7 | -7 | -7 |
| Colville Settlement (credit) | -5 | -5 | -5 | -5 | -5 | -5 | -5 |
| **Total 1/ Reclamation Fund** | **206** | **34** | **65** | **39** | **29** | **18** | **3** |
| Corps O&M | | | | | | | |
| CSRS | 27 | 30 | 31 | 40 | 41 | 43 | 45 |
| **Total 2/ Repayments on misc.costs** | **27** | **30** | **31** | **40** | **41** | **43** | **45** |

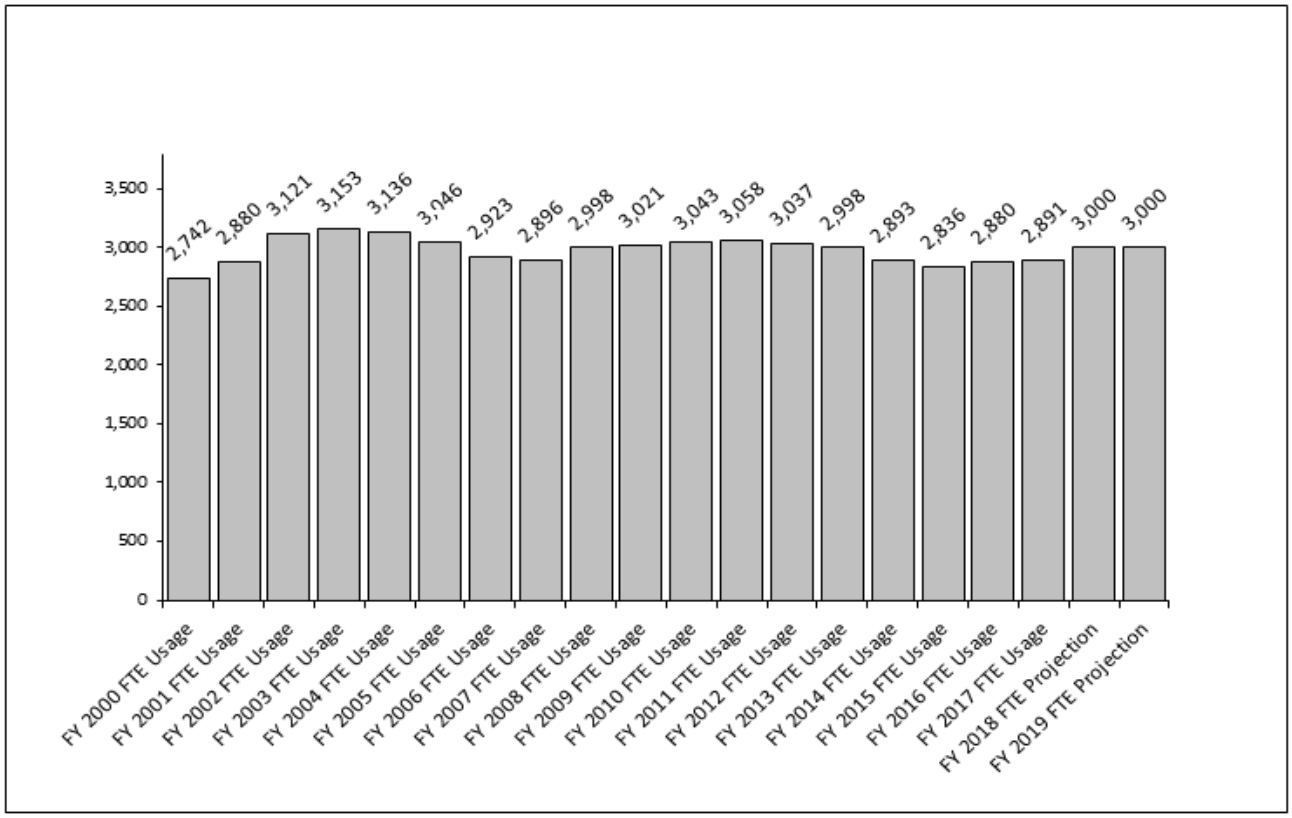
1/ Includes amortization of appropriations and irrigation assistance, and interest costs for Reclamation. The cost of power O&M for Reclamation is no longer included in Proprietary Receipts due to Direct Funding by Bonneville. Represents transfer to Account #895000.26

2/ The costs of power O&M for the Corps and Lower Snake River Comp. Plan are no longer included in Proprietary Receipts due to Direct Funding by Bonneville. Represents transfers to Account #892889, Repayments on misc. recoverable costs, not otherwise classified. Costs for power O&M is funded directly by Bonneville as follows (in millions)

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|---|
| Bureau of Reclamation | 148 | 165 | 163 | 171 | 176 | 182 | 187 |
| Corps of Engineers | 247 | 256 | 256 | 265 | 273 | 281 | 289 |
| Lower Snake River Comp. Plan | 26 | 33 | 33 | 35 | 35 | 36 | 37 |
| **Total** | **421** | **454** | **452** | **470** | **484** | **498** | **513** |

See Interest Expense, Pension and Post-retirement Benefits and Capital Transfers section of this budget for a complete discussion of these cost estimates.

**BONNEVILLE FTE**




Actual FTE data is consistent with DOE personnel reports.

FTE outyear data are estimates and may change. Bonneville is facing a dynamic and changing transmission marketplace and operations while, at the same time, many of its employees are eligible to retire in the near future. It is important that Bonneville continue to attract and retain skilled individuals to meet the growing demands of a competitive and rapidly changing industry. Accordingly, FTE estimates may need to be adjusted in the future.

## Total Cost of BPA Fish & Wildlife Actions

| COST ELEMENT | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **CAPITAL INVESTMENTS** [1] | | | | | | | | | | | |
| BPA FISH AND WILDLIFE | 35.2 | 25.5 | 27.4 | 40.0 | 90.2 | 57.5 | 52.1 | 37.4 | 21.4 | 16.0 | 5.4 |
| BPA SOFTWARE DEVELOPMENT COSTS | 1.0 | 1.3 | 0.6 | 1.2 | 0.8 | 0.4 | 0.0 | 0.1 | 1.4 | 1.2 | 1.4 |
| ASSOCIATED PROJECTS (FEDERAL HYDRO) | 60.4 | 37.3 | 135.7 | 56.4 | 103.0 | 114.5 | 103.6 | 101.7 | 81.4 | 34.1 | 58.9 |
| **TOTAL CAPITAL INVESTMENTS** | **96.6** | **64.2** | **163.7** | **97.6** | **193.9** | **172.3** | **155.7** | **139.2** | **104.1** | **51.4** | **65.6** |
| **PROGRAM EXPENSES** | | | | | | | | | | | |
| **BPA DIRECT FISH AND WILDLIFE PROGRAM** | 139.5 | 148.9 | 177.9 | 199.6 | 221.1 | 248.9 | 239.0 | 231.8 | 258.2 | 258.1 | 254.7 |
| **FISH & WILDLIFE SOFTWARE EXPENSE COSTS** | | | | | | | 0.2 | 0.3 | 0.1 | 0.0 | 0.0 |
| **SUPPLEMENTAL MITIGATION PROGRAM EXPENSES** [2] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **REIMBURSABLE/DIRECT-FUNDED PROJECTS** [3] | | | | | | | | | | | |
| O & M LOWER SNAKE RIVER HATCHERIES | 19.3 | 19.4 | 20.8 | 23.3 | 24.5 | 22.0 | 28.7 | 31.0 | 30.9 | 28.6 | 26.0 |
| O & M CORPS OF ENGINEERS | 32.9 | 34.4 | 34.3 | 36.5 | 40.3 | 41.1 | 39.2 | 47.8 | 46.4 | 48.2 | 47.5 |
| O & M BUREAU OF RECLAMATION | 3.9 | 4.3 | 4.5 | 5.2 | 5.0 | 5.3 | 5.6 | 6.6 | 2.6 | 6.0 | 7.0 |
| NW POWER AND CONSERVATION COUNCIL ALLOCATED @ 50% | 4.2 | 4.1 | 4.7 | 4.7 | 4.5 | 4.6 | 5.0 | 4.9 | 4.9 | 5.4 | 5.4 |
| SUBTOTAL (REIMB/DIRECT-FUNDED) | 60.3 | 62.2 | 64.3 | 69.7 | 74.3 | 73.0 | 78.5 | 90.3 | 84.9 | 88.2 | 85.9 |
| **TOTAL OPERATING EXPENSES** | **199.7** | **211.1** | **242.1** | **269.3** | **295.3** | **321.9** | **317.70** | **322.40** | **343.17** | **346.34** | **340.61** |
| **PROGRAM RELATED FIXED EXPENSES** [4] | | | | | | | | | | | |
| INTEREST EXPENSE | 76.0 | 76.9 | 78.7 | 80.5 | 79.2 | 80.6 | 89.1 | 83.4 | 89.2 | 85.6 | 58.6 |
| AMORTIZATION EXPENSE | 22.9 | 24.4 | 24.6 | 25.0 | 28.3 | 30.2 | 35.7 | 38.7 | 41.3 | 42.5 | 42.5 |
| DEPRECIATION EXPENSE | 14.0 | 14.9 | 16.7 | 18.0 | 19.6 | 20.7 | 18.6 | 19.2 | 20.1 | 20.1 | 20.3 |
| **TOTAL FIXED EXPENSES** | **112.9** | **116.2** | **120.0** | **123.5** | **127.2** | **131.5** | **143.4** | **141.3** | **150.6** | **148.2** | **121.4** |
| **GRAND TOTAL PROGRAM EXPENSES** | **312.7** | **327.3** | **362.1** | **392.8** | **422.5** | **453.4** | **461.1** | **463.7** | **493.7** | **494.6** | **462.0** |
| **FORGONE REVENUES AND POWER PURCHASES** | | | | | | | | | | | |
| **FOREGONE REVENUES** | 282.6 | 273.5 | 142.8 | 99.4 | 156.7 | 152.2 | 135.5 | 122.7 | 195.8 | 76.6 | 9.6 |
| **BPA POWER PURCH. FOR FISH ENHANCEMENT** | 120.7 | 274.9 | 240.3 | 310.1 | 70.7 | 38.5 | 85.8 | 196.2 | 67.5 | 50.3 | (20.5) |
| **TOTAL FOREGONE REVENUES AND POWER PURCHASES** | **403.3** | **548.5** | **383.1** | **409.5** | **227.4** | **190.7** | **221.3** | **318.9** | **263.3** | **126.9** | **(10.9)** |
| **TOTAL PROGRAM EXPENSES, FOREGONE REVENUES, & POWER PURCHASES** | **716.0** | **875.8** | **745.3** | **802.3** | **649.9** | **644.1** | **682.4** | **782.6** | **757.0** | **621.5** | **451.1** |
| **CREDITS** | | | | | | | | | | | |
| 4(h)(10)(C) | (66.1) | (100.5) | (99.5) | (122.8) | (85.3) | (77.0) | (84.1) | (103.9) | (77.7) | (72.6) | (53.7) |
| FISH COST CONTINGENCY FUND | - | - | - | - | - | - | - | - | - | - | - |
| **TOTAL CREDITS** | **(66.1)** | **(100.5)** | **(99.5)** | **(122.8)** | **(85.3)** | **(77.0)** | **(84.1)** | **(103.9)** | **(77.7)** | **(72.6)** | **(53.7)** |

**This information has been made publicly available by BPA on 3/25/2008. The figures shown are consistent with audited actuals that contain Agency approved financial information, except for forgone revenues and power purchases which are estimates and do not contain Agency approved financial information**

1/ Capital Investments include both BPA's direct Fish and Wildlife Program capital investments, funded by BPA's Treasury borrowing, and "Associated Projects", which include capital investments at Corps of Engineers' and Bureau of Reclamation projects, funded by appropriations and repaid by BPA. The negative amount in FY 1997 reflects a decision to reverse "plant-in-service" investment that was never actually placed into service. The annual expenses associated with these investments are included in "Program-Related Fixed Expenses", below.

2/ Includes High Priority and Action Plan Expenses and other supplemental programs.

3/ "Reimbursable/Direct-Funded Projects" includes the portion of costs BPA pays to or on behalf of other entities that is determined to be for fish and wildlife purposes.

4/ "Fixed Expenses" include depreciation, amortization and interest on investments on the Corps of Engineers' projects, and amortization and interest on the investments associated with BPA's direct Fish and Wildlife Program.

# Fossil Energy Research and Development

# Fossil Energy Research and Development

**Fossil Energy Research and Development**

**Table of Contents**

**Fossil Energy Research and Development**
**Proposed Appropriation Language**

*For Department of Energy expenses necessary in carrying out fossil energy research and development activities, under the authority of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition of interest, including defeasible and equitable interests in any real property or any facility or for plant or facility acquisition or expansion, and for conducting inquiries, technological investigations and research concerning the extraction, processing, use, and disposal of mineral substances without objectionable social and environmental costs (30 U.S.C. 3, 1602, and 1603), $502,070,000, to remain available until expended: Provided, That of such amount $61,070,000 shall be available until September 30, 2020, for program direction.*

Note.—A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115–56). The amounts included for 2018 reflect the annualized level provided by the continuing resolution.

**Public Law Authorizations**

CCS and Power Systems:

- Public Law 95-91.

Natural Gas Technologies:

- Public Law 91-91, "Department of Energy Organization Act", 1977
- Public Law 109-58, "Energy Policy Act of 2005".

Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies:

- Public Law 95-91, "Department of Energy Organization Act", 1977
- Public Law 109-58, "Energy Policy Act of 2005".

NETL Infrastructure and Operations/Plant and Capital Equipment (formerly Plant and Capital Equipment):

- Public Law 95-91, "Department of Energy Organization Act", 1977
- Public Law 108-153, "21st Century Nanotechnology Research and Development Act 2003"
- Public Law 109-58, "Energy Policy Act of 2005".
- Public Law 110-69, "America COMPETES Act of 2007"
- Public Law 110-140, "Energy Independence and Security Act 2007"
- Public Law 111-358, "America COMPETES Act of 2010"

NETL Infrastructure and Operations /Environmental Restoration (formerly Environmental Restoration):

- Public Law 95-91, "Department of Energy Organization Act", 1977
- Public Law 108-153, "21st Century Nanotechnology Research and Development Act 2003"
- Public Law 109-58, "Energy Policy Act of 2005".
- Public Law 110-69, "America COMPETES Act of 2007"
- Public Law 111-358, "America COMPETES Act of 2010"

Special Recruitment Programs:

- Public Law 95-91, "Department of Energy Organization Act", 1977
- Public Law 108-153, "21st Century Nanotechnology Research and Development Act 2003"
- Public Law 109-58, "Energy Policy Act of 2005".
- Public Law 110-69, "America COMPETES Act of 2007"
- Public Law 111-358, "America COMPETES Act of 2010"

**Fossil Energy Research and Development (FER&D)**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR[1] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|
| 421,154 | 425,093 | 502,070 | 80,916 |

**Overview**

The Fossil Energy Research and Development (FER&D) program advances transformative science and innovative technologies that enable the reliable, efficient, affordable, and environmentally sound use of fossil fuels. Fossil energy sources constitute over 77% of the country's total energy use,[2] and are critical to the nation's security, economic prosperity, and growth. FER&D conducts R&D on advanced Carbon Capture Utilization and Storage (CCUS) technologies, advanced fossil energy systems, and crosscutting fossil energy research. 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.

The Office of Fossil Energy invests in research and development (R&D) as part of the Department of Energy's (DOE) broad portfolio approach to addressing our Nation's energy and environmental challenges. This Budget Request focuses DOE resources toward early-stage R&D and reflects an increased reliance on the private sector to fund later-stage research, development, and commercialization of energy technologies. It emphasizes energy technologies best positioned to support American energy independence and domestic job-growth in the near- to mid-term.

FER&D early-stage research focuses on technology challenges that present a significant degree of scientific or technical uncertainty across a relatively long period, making it unlikely that industry will invest significant R&D on their own. Industry typically focuses on near term (2-4 years) investments in marginal improvements to operational performance, while FER&D early-stage R&D focuses on longer-range (5-15 years) transformational technologies, materials, and processes. Thus, this request maintains the most critical core capabilities and infrastructure at DOE National Laboratories related to advanced fossil energy technologies.

The FER&D Budget Request is informed by guiding principles of energy dominance, security, strong domestic energy production, and advancing clean coal technologies. 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. Maintaining U.S global economic competiveness with the best energy technologies and affordable energy prices is essential to strengthen and grow our economy, create new jobs, and enhance our national security. Developing advanced, clean, high-efficiency technologies underpins our national economy and creates new products for export.

**Highlights and Major Changes in the 2019 Budget Request**

The FY 2019 FER&D Budget Request focuses resources on impactful early-stage research and development that enables domestic energy production and enhances energy security and independence. After initial investment by FER&D, these technologies will then be poised for further advancement, development, and/or scale-up by industry. These investments will drive innovation to support economic growth and provide affordable, reliable, and environmentally sustainable energy. The Office of Fossil Energy will also continue the Department's initiative on streamlining the program to become more accountable and efficient, examining organizational efficiencies at both headquarters and NETL.

The proposed restructure of Advanced Energy Systems (AES) within FER&D improves the alignment of the budget structure to the research focus areas, repositioning the Department to more effectively enable industry to commercialize and deploy advanced technologies necessary to support a secure and reliable power grid. FER&D will support early-stage research in advanced technologies (in materials, sensors, and processes , etc.) to expand the knowledge-base upon which industry can

[1] A full-year 2018 appropriation was not enacted at the time the budget was prepared; therefore, the budget assumes operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. These amounts are shown only at the Congressional control level and above, below that level, a dash (—) is shown.
[2] https://www.eia.gov/todayinenergy/detail.php?id=26912

improve the efficiency, flexibility, and resilience of the existing fleet of coal fired power plants. The restructure also focuses funding on early-stage research that enables the next generation of high efficiency, and low emission coal fired power plants that can directly compete with other sources of electricity in the market and provide low cost reliable power 24/7.

For comparability, all discussions of funding changes that follow assume the FY 2019 proposed budget structure. Funding crosswalks in the Budget Structure Crosswalks chapter of this narrative provide details of the proposed changes.

**Advanced Coal Energy Systems & CCUS ($343.3M)**
Descriptions of major funding and programmatic changes and highlights within the Advanced Coal Energy Systems & CCUS program for FY 2019 are as follows:

**Advanced Energy Systems (AES):**

The FY 2019 Budget provides $175 million to enhance the mission of the Advanced Energy Systems (AES) subprogram 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 six activities:

- Advanced Combustion/Gasification Sysytems activities will focus on oxygen carriers, modular gasification systems, and materials development to enable low-cost syngas production from coal.
- Advanced Turbines activities will focus on turbine component technologies that withstand the high temperatures and aggressive environments predicted for high-hydrogen content syngas combustion, including advanced materials, ceramics, and coatings.
- Solid Oxide Fuel Cells (SOFC) activities will focus on SOFC component materials, performance and integration to enable efficient, cost-effective electricity generation from coal or natural gas with near-zero atmospheric emissions and minimal water use for both distributed generation and central power generation applications.
- Advanced Sensors and Controls activities will focus on low-cost and reliable multi-sensing technologies capable of reading temperature, pressure and gas species that could be capable of providing real-time measurements critical to the operation, optimization, reliability and efficiency of the next-generation of power systems.
- Power Generation Efficiency activities will focus on enhancing existing unit performance through development of energy cycles, monitoring equipment, dynamic data analysis, and advanced process controls. The activity will fund competitively awarded early-stage research in areas such as fluid dynamics, and fuel preparation that can subsequently be developed further by industry for deployment at existing units. Funding will focus on improving plant efficiency through topping cycles, recovery of low grade waste heat, improvements in water usage, lower parasitic losses and the development of advanced instrumentation and artificial intelligence control systems based on dynamic data analysis.
- Advanced Energy Materials activities will focus on fundamental materials design through qualification of functional materials that support the next generation of advanced power generation. New computational techniques will continue to be developed to design materials needed for advanced combustion, fuel cells, turbines and gasification systems. This computational work decreases the time and cost to develop the new materials and is projected to lead to classes of improved high performance materials.

**Crosscutting Research:**

The FY 2019 Budget provides $53.3 million to support R&D that bridges basic and applied research by targeting concepts with the greatest potential for transformational breakthroughs. As such, the program focuses on advancing early-stage research in areas such materials, rare earth recovery from coal and coal byproducts, fluid dynamics, and fuel preparation characteristics (i.e., coal particle sizing and drying). 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: The proposed Critical Materials initiative will enable DOE to continue developing technologies with the goal of enabling additional domestic supplies of Rare Earth Elements (REE), reducing environmental impact of coal REE production, and delivering technologies that can be manufactured within the United States. DOE has accomplished

much in this area, including the evaluation of pilot-scale processing options and the nature and distribution of REE in U.S. coal deposits.

- Water Management R&D supports sustainability and improved water efficiency focusing on treatment and use of non-traditional water in fossil energy systems. FY 2019 activities include increased efficiency in heat exchangers and cooling systems to reduce the need for water for cooling in thermoelectric power plants. R&D efforts will be coordinated with other offices throughout DOE in support of DOE's Energy-Water Nexus to maximize the value of this research across DOE programs.
- Modeling, Symulation, and Analysis activities include potential environmental impacts (e.g., on water quality, air emissions, solid waste disposal, climate change) of fossil fuel use and large-scale deployment of different generations of CCS technologies. This activity supports program strategic planning by identifying major challenges, technologies, and advanced concepts that have the potential to improve the efficiency, cost, and/or environmental performance of fossil energy systems integrated with CCUS.
- University Training and Research 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, and at the same time providing support for expanding the research capabilities and education of the next generation of scientists and engineers. The Historically Black Colleges and Universities (HBCU) and Other Minority Institutions (OMI) education and training program awards research grants to qualifying universities and institutions, with project results being used to further DOE's commitment to fossil energy research.

**Carbon Capture, Utilization and Storage ($40M):**

The CCUS subprogram is focused on early-stage research and development on post-combustion and pre-combustion $CO_2$ capture, novel compression technologies for new and existing fossil fuel-fired power plants, and $CO_2$ utilization technologies to convert $CO_2$ to valuable products and commodities. Specific efforts will focus on the following activities:

- Carbon Capture: The Budget provides $20 million to focus on lab research and bench-scale development of transformational carbon capture technologies such as advanced membranes and metal organic frameworks (MOF) that can significantly reduce the cost of capture from fossil fuel-fired power plants and industrial facilities. In FY 2019, the Carbon Capture subprogram will focus on early-stage R&D on transformational gas separation technologies that can significantly reduce the cost of $CO_2$ capture targeting a Cost of Electricity (COE) at least 30% less than state of the art (~$30/tonne). These transformational technologies will be designed to adapt to the operational demands of advanced power systems and adjust to the increasing need for fossil fuel power plants to, at times, be load-following/demand responsive electricity generators. The Subprogram supports capture from sources in addition to coal, mindful that early-stage R&D successes can be shared across a number of sectors across generation modalities. In addition to post-combustion capture, the subprogram also supports pre-combustion bench- and lab-scale R&D that focuses on $CO_2$ separation from syngas. While the Carbon Capture subprogram has previously focused on 1st generation separation technology demonstrations and 2nd generation pilots, these large, more mature efforts are no longer central to the R&D portfolio. In FY 2019, the program discontinues funding for large-scale demonstrations, pilot projects and similar projects addressing technology scale-up as industry is capable of advancing these technologies to commercial deployment.
- Carbon Utilization: The Budget provides $9 million to focus on early-stage $CO_2$ 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 ($CO_2$ and methane) to higher value products such as nutraceuticals, bio plastics, and animal feed.
- Carbon Storage: The Budget provides $11 million to focus on early-stage research focusing on carbon utilization and adaptive reservoir management of carbon storage systems. Proposed activities in FY 2019 include early-stage research focused on adaptive reservoir management with an emphasis on reducing the risk of induced seismicity. This will include developing tools and methods for improved monitoring, detection, mapping and simulation of fractures and faults, as well as microseismic data analysis and interpretation, to increasing our ability to monitor and manage induced seismicity and the stress state of the subsurface at field and basin-scales. This work will be coordinated with similar research funded by the Geothermal Technologies Program in the Office of Energy Efficiency and Renewable

Energy and implemented through a targeted competitive funding solicitation to leverage existing work with the DOE National Laboratories.

NETL Coal R&D: The request of $50 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 FE R&D programs, including salaries and benefits, travel, personal protective equipment, and other employee costs.

**Natural Gas Technologies ($5.5 million):**

- 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.
- The Natural Gas Infrastructure Research and Development subprogram will focus on early-stage, foundational research on materials, coatings and sensors to improve the operational efficiency and safety of natural gas supply and delivery infrastructure, which is needed to support the increased reliance on gas as both a domestic energy source and a vital export market. The federal government will continue to have a significant role in addressing areas of public interest and concern, to include pipeline safety and reliability, resource stewardship, and infrastructure security.

**Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies ($14 million):**

- The Request will continue early-stage R&D in the current field laboratories in the Marcellus and Utica basins in the eastern United States. R&D at these field sites addresses fluid flow and physio-chemical interactions in unconventional reservoirs, with a focus on improving the technical understanding of fracturing dynamics that can contribute to game-changing increases in recovery factor from the typical single-digit range. Success would also decrease the footprint of shale development and lower water use.

- The Program will also analyze data to gain knowledge about the detailed causal factors for induced seismicity, an operational risk that pertains to both large volume water and $CO_2$ injection into critically stressed subsurface environments. The program will address areas of public interest to include reducing the impacts from development and improving the amount of resource recovered per well by conducting research to understand the precise factors that will allow improved injection practices including real-time, dynamic management and manipulation of the subsurface environment, and reduced risk to critical national infrastructure.

**National Energy Technology Laboratory ($109 million for NETL; and an additional $30.3 million for HQ Program Direction and Special Recruitment):**

- The Office of Fossil Energy is committed to supporting the National Energy Technology Laboratory's (NETL) capabilities and competitiveness. NETL, whose primary funding source is the Office of Fossil Energy, is the only federally owned and operated laboratory in the DOE National Laboratory system.

- NETL Infrastructure: The Request of $38.0 million supports the fixed costs of maintaining NETL's lab footprint three geographic locations: Morgantown, WV; Pittsburgh, PA; and Albany, OR. These sites include more than 240 acres of land, including 112 buildings with over 1,000,000 square feet of space, supporting more than 1,200 Federal and contractor employees.

- NETL Research and Operations: The Request of $40.0 million 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: The request of $61.3 million ($30.1 million for headquarters, $31 million for NETL, and $0.2M 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. These staff are 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. Funding to advance FER&D workforce reshaping is also included.

**Cybersecurity:** DOE is engaged in two categories of cyber-related activities: protecting the DOE enterprise from a range of cyber threats that can adversely impact mission capabilities and improving cybersecurity in the electric power subsector and the oil and natural gas subsector. The Cybersecurity Crosscut supports central coordination of the strategic and operational aspects of cybersecurity and facilitates cooperative efforts such as the Joint Cybersecurity Coordination Center (JC3) for incident response and the implementation of Department-wide Identity, Credentials, and Access Management (ICAM).

**FY 2019 Crosscuts**
**($K)**

| | **Cybersecurity** |
|---|---|
| NETL Infrastructure and Operations | 3,183 |
| Program Direction | 884 |
| **Total, Crosscuts** | **4,067** |

## Fossil Energy Research and DevelopmentFunding by Congressional Control ($K) (Comparable)

| | FY 2017 Enacted | FY 2018 Annualized CR[1] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Advanced Coal Energy Systems and CCUS** | | | | |
| Advanced Energy Systems | 116,650 | --- | 175,000 | +58,350 |
| Cross-cutting | 48,850 | --- | 53,300 | +4,450 |
| Carbon Capture, Utilization and Storage | 196,300 | --- | 40,000 | -156,300 |
| STEP (Supercritical CO2) | 24,000 | --- | 25,000 | +1,000 |
| Transformational Coal Pilots (formerly Fossil Proviso)[2] | 50,000 | --- | 0 | -50,000 |
| NETL Coal Research and Development | 38,000 | --- | 50,000 | +12,000 |
| **Subtotal, Advanced Coal Energy Systems and CCUS** | **473,800** | **470,581** | **343,300** | **-130,500** |
| **Natural Gas Technologies** | **43,000** | **42,708** | **5,500** | **-37,500** |
| **Unconventional Fossil Energy Technologies from Petroleum - Oil Technologies** | **21,000** | **20,857** | **14,000** | **-7,000** |
| **Program Direction** | **60,000** | **59,593** | **61,070** | **+1,070** |
| **Special Recruitment Programs** | **700** | **695** | **200** | **-500** |
| **NETL Infrastructure** | **40,500** | **40,226** | **38,000** | **-2,500** |
| **NETL Research and Operations** | **43,000** | **42,708** | **40,000** | **-3,000** |
| **Subtotal, Fossil Energy Research & Development** | **682,000** | **677,368** | **502,070** | **-179,930** |
| Use of Prior Year Balances | -14,000 | -13,905 | 0 | +14,000 |
| Rescission of Prior Year Balances | -246,846 | -238,370 | 0 | +246,846 |
| **Total, Fossil Energy Research & Development** | **421,154** | **425,093** | **502,070** | **+80,916** |
| **Federal FTEs** | **638** | **615** | **591** | **-47** |

[1] *A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

[2] In prior years, Transformational Coal Pilots was called Fossil Proviso and was separate from other funding. This causes the comparable subtotals to be different than the non comparable subtotals.

**Fossil Energy Research and Development**
**Funding by Congressional Control**
**($K) (Non-Comparable)**

| | FY 2017 Enacted | FY 2018 Annualized CR[3] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Coal** | | | | |
| **CCS AND POWER SYSTEMS** | | | | |
| Carbon Capture | 101,000 | 100,314 | --- | -101,000 |
| Carbon Storage | 95,300 | 94,653 | --- | -95,300 |
| Advanced Energy Systems | 105,000 | 104,287 | --- | -105,000 |
| Cross-cutting Research | 45,500 | 45,190 | --- | -45,500 |
| Supercritical Transformational Electric Power | 24,000 | 23,837 | --- | -24,000 |
| NETL Coal Research and Development | 53,000 | 52,640 | --- | -53,000 |
| **Total, CCS and Power Systems** | **423,800** | **420,921** | **---** | **-423,800** |
| **Natural Gas Technologies** | **43,000** | **42,708** | **---** | **-43,000** |
| **Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies** | **21,000** | **20,857** | **---** | **-21,000** |
| **Program Direction** | **60,000** | **59,593** | **---** | **-60,000** |
| **Special Recruitment Program** | **700** | **695** | **---** | **-700** |
| **NETL Infrastructure** | **40,500** | **40,226** | **---** | **-40,500** |
| **NETL Research and Operations** | **43,000** | **42,708** | **---** | **-43,000** |
| **Subtotal, Fossil Energy Research & Development** | **632,000** | **627,708** | **---** | **-682,000** |
| Fossil Fuel Proviso | 50,000 | 49,660 | **---** | **+14,000** |
| Use of Prior Year Balances | -14,000 | -13,905 | **---** | **+14,000** |
| Rescission of Prior Year Balances | -246,846 | -238,370 | **---** | **+246,846** |
| **Total, Fossil Energy Research & Development** | **421,154** | **425,093** | **---** | **-421,154** |
| **Federal FTEs** | **638** | **615** | | |
| | | | | |
| Advanced Energy Systems | --- | --- | 175,000 | +175,000 |
| Cross-cutting | --- | --- | 53,300 | +53,300 |
| Carbon Capture, Utilization and Storage | --- | --- | 40,000 | +40,000 |
| STEP (Supercritical CO2) | --- | --- | 25,000 | +25,000 |
| Transformational Coal Pilots | --- | --- | 0 | 0 |
| NETL Coal Research and Development | --- | --- | 50,000 | +50,000 |
| **Total, Advanced Coal Energy Systems and CCUS** | | | **343,300** | **+343,300** |
| **Natural Gas Technologies** | --- | --- | **5,500** | **+5,500** |
| **Unconventional Fossil Energy Technologies from Petroleum - Oil Technologies** | --- | --- | **14,000** | **+14,000** |
| **Program Direction** | --- | --- | **61,070** | **+61,070** |
| **Special Recruitment Programs** | **---** | **---** | **200** | **+200** |
| **NETL Infrastructure** | **---** | **---** | **38,000** | **+38,000** |
| **NETL Research and Operations** | **---** | **---** | **40,000** | **+40,000** |
| **Subtotal, Fossil Energy Research & Development** | | | **502,070** | **+502,070** |
| Use of Prior Year Balances | **---** | **---** | **0** | **0** |
| Rescission of Prior Year Balances | **---** | **---** | **0** | **+0** |
| **Total, Fossil Energy Research & Development** | **---** | **---** | **502,070** | **+502,070** |
| **Federal FTEs** | | | **591** | **-47** |

SBIR/STTR:

- FY 2017 Transferred: SBIR $12,964; STTR: $1,823
- FY 2018 CR Annualized: SBIR $12,876; STTR: $1,811
- FY 2019 Request: SBIR $8,773; STTR: $1,234

[3] *A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Budget Structure Crosswalk FY 2017 Enacted**
**Proposed FY 2019 Budget Structure**
**($K)**

| | Advanced Coal Energy Systems & CCUS | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Advanced Energy Systems | | | | | | | |
| | Advanced Systems | | | | Advanced Materials | | | |
| **Current Budget Structure (FY17$)** | **Advanced Combustion/ Gasification Systems** | **Advanced Turbines** | **Solid Oxide Fuel Cells** | **Advanced Sensors & Controls and other Novel Concepts** | **Advanced Coal Processing** | **Power Generation Efficiency** | **Advanced Energy Materials** | **Total, Advanced Energy Systems** |
| ***Advanced Energy Systems*** | | | | | | | | |
| *Advanced Combustion Systems* | 30,000 | — | — | — | — | — | — | 30,000 |
| *Gasification/Combustion Systems* | 25,000 | — | — | — | — | — | — | 25,000 |
| *Advanced Turbines* | — | 19,000 | — | — | — | — | — | 19,000 |
| *Coal and Coal Biomass to Liquids* | 1,000 | — | — | — | — | — | — | 1,000 |
| *Solid Oxide Fuel Cells* | — | — | 30,000 | — | — | — | — | 30,000 |
| ***Cross Cutting Research*** | | | | | | | | |
| *Sensors and Controls* | — | — | — | 3,650 | — | — | — | 3,650 |
| *Crosscutting Materials R&D* | — | — | — | — | — | — | 1,000 | 1,000 |
| *Advanced Ultra Supercritical Materials R&D* | — | — | — | — | — | — | 7,000 | 7,000 |
| | **56,000** | **19,000** | **30,000** | **3,650** | | | **8,000** | **116,650** |

**Budget Structure Crosswalk FY 2017 Enacted**
**Proposed FY 2019 Budget Structure**
**($K)**

| Current Budget Structure (FY17$) | Advanced Coal Energy Systems & CCUS | | | | |
|---|---|---|---|---|---|
| | Crosscutting Research | | | | |
| | Water Management R&D | Modeling, Simulation & Analysis | Critical Minerals | University Training & Research | Total, Cross-cutting |
| **Cross Cutting Research** | | | | | |
| *Water Management R&D* | 9,800 | — | — | — | 9,800 |
| ***Coal Utilization Science*** | | | | | |
| *Computational System Dynamics* | — | 10,000 | — | — | 10,000 |
| *Focus Area for Computational Energy Science* | — | 10,000 | — | — | 10,000 |
| ***Energy Analyses*** | | | | | |
| *Environmental Activities* | — | 400 | — | — | 400 |
| *Technical and Economic Analyses* | — | 450 | — | — | 450 |
| ***International Activities*** | — | — | — | — | 800 |
| ***University Training and Research*** | | | | | |
| *University Coal Research* | — | — | — | 1,400 | 1,400 |
| *HBCUs, Education, and Training* | — | — | — | 1,000 | 1,000 |
| ***NETL Coal Research and Development*** | | | | | |
| *Feasibility of Recovering REEs* | — | — | 15,000 | — | 15,000 |
| | **9,800** | **20,850** | **15,000** | **2,400** | **48,850** |

**Budget Structure Crosswalk FY 2017 Enacted**
**Proposed FY 2019 Budget Structure**
**($K)**

| | Advanced Coal Energy Systems & CCUS | | | | | |
|---|---|---|---|---|---|---|
| | Carbon Capture, Utilization & Storage | | | | | |
| | Carbon Utilization | Carbon Capture | | Carbon Storage | | |
| **Current Budget Structure (FY17$)** | **Carbon Use and Reuse** | **Post-Combustion Capture Systems** | **Pre-Combustion Capture Systems** | **Storage Infrastructure** | **Advanced Storage R&D** | **Total, CCUS** |
| ***Carbon Capture*** | | | | | | |
| *Post-Combustion Capture Systems* | — | 86,000 | — | — | — | 86,000 |
| *Pre-Combustion Capture Systems* | — | — | 15,000 | — | — | 15,000 |
| ***Carbon Storage*** | | | | | | |
| *Storage Infrastructure* | — | — | — | 45,300 | — | 45,300 |
| *Advanced Storage R&D* | — | — | — | — | 28,000 | 28,000 |
| *Carbon Use and Reuse* | 10,000 | — | — | — | — | 10,000 |
| *Sub-disciplinary Storage R&D* | — | — | — | — | 12,000 | 12,000 |
| | **10,000** | **86,000** | **15,000** | **45,300** | **40,000** | **196,300** |

**Budget Structure Crosswalk FY 2017 Enacted**
**Proposed FY 2019 Budget Structure**
**($K)**

| Current Budget Structure (FY17$) | (Other FER&D) | | | | |
|---|---|---|---|---|---|
| | **STEP** | **Coal & Carbon Materials Hub** | **Transformational Coal Pilots** | **NETL Coal R&D** | **Total (Other FER&D)** |
| ***STEP (Supercritical CO2)*** | 24,000 | — | — | — | 24,000 |
| ***Transformational Coal Pilots*** | — | — | 50,000 | — | 50,000 |
| ***NETL Coal Research and Development*** | | | | | |
| *NETL Coal R&D (Other)* | — | — | — | 38,000 | 38,000 |
| | **24,000** | **0** | **50,000** | **38,000** | **112,000** |

**Fossil Energy**

**FERD - Natural Gas Technologies**

**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Natural gas infrastructure research – Increase the modeled efficiency of natural gas infrastructure as demonstrated by a modeled decrease in fugitive methane emissions by 50%.** | | |
| Target | N/A | 0% modeled reduction of fugitive methane emissions | 5% modeled reduction of fugitive methane emissions |
| Result | N/A | TBD | TBD |
| Endpoint Target | By the end of FY 2022, develop technologies that will reduce modeled fugitive methane emissions from natural gas transmission and distribution infrastructure by 50% to a level of 13.4 MMT $CO_2$ from the current level of 26.7 MMT $CO_2$, as identified in the EPA's Greenhouse Gas Inventory. | | |

**FERD - Unconventional FE Technologies**

**Performance Measures**

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Unconventional FE technologies – Improve modeled unconventional resource recovery to 12%.** | | |
| Target | N/A | 10% modeled recovery efficiency | 11% modeled recovery efficiency |
| Result | 10% recovery efficiency | TBD | TBD |
| Endpoint Target | By the end of FY 2022, develop technologies and production methods for unconventional resources to improve modeled recovery efficiency to 12% from the current recovery efficiency level of 10%. | | |

## FERD - Coal

## Performance Measures

In accordance with the GPRA Modernization Act of 2010, the Department sets targets for, and tracks progress toward, achieving performance goals for each program.

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **CCS Demonstrations - Initiate operation of CCS demonstration projects - Initiating operation of CCS demonstration projects will help to establish that carbon capture, compression of CO2 and injection, combined with long term monitoring, verification, accounting, and assessment (MVAA), can be performed at commercial scale at both power plants and industrial sites while continuing to maintain reliable plant operations.** | | |
| Target | 4 CCS projects initiated operation | N/A | N/A Measure ended in FY 2017 |
| Result | Not Met - 3 | N/A | TBD |
| Endpoint Target | Operations initiated at a minimum of four commercial CCS demonstrations including the Clean Coal Power Initiative (CCPI) and the Industrial CCS Demonstration projects (funded by both annual appropriations and the American Recovery and Reinvestment Act). Two of the four demonstrations to initiate operations by end of FY 2017 will be CCPI projects and two will be ICCS projects. This goal will be completed in FY 2017 and will no longer will be tracked in FY 2018 and beyond since this no longer aligns with the program's efforts focused on early stage R&D. | | |
| Performance Goal (Measure) | **Carbon Capture and Advanced Energy Systems - Achieving the target signifies that the Carbon Capture & Advanced Energy Systems programs are continuing to make progress in meeting the goal of developing cost-effective, reliable carbon capture technologies for pre-combustion, post-combustion, natural gas carbon capture and advanced combustion capture applications.** | | |
| Target | 47 $ per tonne CO2 captured | N/A | N/A |
| Result | Met - 46.6 | N/A | N/A |
| Endpoint Target | Advanced Energy Systems with CO2 capture at no more than $40 per tonne of CO2 captured ready for demonstration by 2020 and less than $40 per tonne of CO2 captured ready for demonstration by 2030. | | |
| Performance Goal (Measure) | **Carbon Storage - Inject CO2 in large-volume field test sites to demonstrate the formations' capacity to permanently and safely store carbon dioxide.** | | |
| Target | 8 MMTs injected (since 2009) | N/A | N/A |
| Result | Exceeded - 14 | N/A | N/A |
| Endpoint Target | Inject 9.0 million metric tons of CO2 between January 2009 and 2020 in large-volume field test sites representing different storage classes to demonstrate and monitor for the formations' capacity to permanently and safely store carbon dioxide. A long-term goal is to ensure the cost-effective ability to measure and account for the injected CO2 to ensure 99 percent storage permanence in all storage types while minimizing the environmental footprint of carbon storage activities. This program goal is no longer relevant as the program has shifted to early-stage R&D and the RCSP will be terminated starting in 2018. | | |

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| Performance Goal (Measure) | **Cost of Energy and CO2 Capture from Advanced Power Systems - Develop cost-effective, efficient, and reliable CO2 separation technologies and energy conversion technologies that inherently capture CO2, for both new and existing coal-fired power plants.** | | |
| Target | N/A | Identify material properties to meet transformational goals | Synthesize and develop process models for at least two technology types (e.g., metal organic frameworks and non-binding organic liquid solvents) that show potential to meet the 2030 target of a 30% reduction in COE ($30/tonne of CO2 captured). |
| Result | N/A | TBD | TBD |
| Endpoint Target | By 2030, R&D technologies are available to support a new coal-fired power plant with CO2 capture with a cost of electricity at least 30% lower than a supercritical PC with CO2 capture, or approximately $30 per tonne of CO2 captured. By 2030, for retrofitting an existing coal-fired power plant with CO2 capture, capture technologies are available to reduce the cost of capture by 30% (actual cost of capture varies for each unit). (Baseline: NETL Cost and Performance Baseline Series; 2012 Capture Technology) | | |
| Comment | Typical laboratory and bench-scale R&D projects are conducted in 2-3 year time periods, after which point, systems analyses are conducted to validate current progress against target, and status of the technology in relation to the DOE program goals. Progress against the target will be updated accordingly during that period. | | |

| | | | |
|---|---|---|---|
| Performance Goal (Measure) | **Power Plant Efficiency Improvements (Existing Plants) -** Increase the average modeled efficiency (heat rate) of existing coal based power plants. | | |
| Target | N/A | 31 % | 31% |
| Result | 31% | TBD | TBD |
| Endpoint Target | By the end of FY 2022, improve the average modeled efficiency (heat rate) of a typical plant in the existing fleet by 5 percent from the 2017 baseline of 31 percent (i.e., to 32.5%) | | |
| Comment | The original FY 2018 performance goal was to complete the Efficiency Improvement Roadmap to 2030. Typical laboratory and bench-scale R&D projects are conducted in 2-3 year time periods, after which point, systems analyses are conducted to validate current | | |

| | FY 2017 | FY 2018 | FY 2019 |
|---|---|---|---|
| | progress against target, and status of the technology in relation to the DOE program goals. Progress against the target will be updated accordingly during that period. | | |
| Performance Goal (Measure) | **Power Plant Efficiency Improvements (New Plants) -** Increase the average modeled efficiency (heat rate) of new coal based power plants. | | |
| Target | N/A | 38 % | 38% |
| Result | N/A | TBD | TBD |
| Endpoint Target | By the end of FY 2023, improve the average modeled efficiency (heat rate) of an advanced or new coal plant by 5 percent from the 2017 baseline of 38 percent (i.e., to 40%). | | |
| Comment | The original FY 2018 target was to complete the Efficiency Improvement Roadmap to 2030. Typical laboratory and bench-scale R&D projects are conducted in 2-3 year time periods, after which point, systems analyses are conducted to validate current progress against target, and status of the technology in relation to the DOE program goals. Progress against the target will be updated accordingly during that period. | | |

## Advanced Coal Energy Systems & CCUS

**Overview**

The Advanced Coal Energy Systems & CCUS supports secure, affordable, low-emission fossil energy through early-stage research into technologies that can be further developed and scaled by industry to improve the cost competitiveness and performance of both new and existing plants. The current coal power generation fleet is faced with degrading performance as equipment ages. Government-supported early-stage research and development in areas such as materials, fluid dynamics, and a new generation of plant controls can lead to new knowledge that industry can use to develop technologies that can improve efficiency and performance in components that can replace these aging systems.

The FY 2019 Budget proposes a restructure of the Advanced Energy Systems (AES), Crosscutting Research, and Carbon Capture and Storage programs within the FER&D Program. This restructure improves the alignment of the budget structure to the research focus areas, repositioning the Department to more effectively enable industry to commercialize and deploy advanced technologies necessary to support a secure and reliable power grid. FER&D will support early-stage research in materials, sensors, and processes to expand the knowledge base upon which industry can improve the efficiency, flexibility, and resilience of the existing fleet of coal fired power plants. The restructure also focuses funding on early-stage research that enables the next generation of high efficiency and low emission coal fired power plants that can directly compete with other sources of electricity in the market and provide low cost reliable power 24/7.

The Advanced Coal Energy Systems and CCUS program will continue to support early-stage transformational R&D in coal gasification, advanced turbines, solid oxide fuel cells, CCUS, advanced materials for high efficiency/low emissions energy systems, advanced sensors and modeling, and water management. In addition, the Budget launches a new Critical Materials initiative, building on the R&D breakthroughs achieved by FE and advancing US technologies in Rare Earth Elements (REE).

For comparability, all discussions of funding changes that follow assume the FY 2019 proposed budget structure. Funding crosswalks in the Budget Structure Crosswalks chapter of this narrative provide details of the proposed changes.

**Highlights of the FY 2019 Budget Request**

The Advanced Coal Energy Systems & CCUS program will pursue the following major activities in FY 2019:

Advanced Energy Systems

The mission of the Advanced Energy Systems (AES) subprogram is 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 six activities: 1) Advanced Combustion/Gasification Systems, 2) Advanced Turbines, 3) Solid Oxide Fuel Cells, 4) Advanced Sensors and Controls, 5) Power Generation Efficiency, and 6) Advanced Energy Materials. While the primary focus is on coal-based power systems, improvements to these technologies will result in spillover benefits that can reduce the cost of converting other carbon-based fuels, such as natural gas, biomass, or petroleum coke into power and other useful products in an environmentally-acceptable manner. By the end of 2022, the AES subprogram would develop economically viable technologies ready for demonstration by the private sector that, if deployed, would improve the average heat rate (i.e., efficiency) of a typical plant in the existing (2018) fleet by 5 percent.

Crosscutting Research

The Crosscutting Research subprogram supports innovative early-stage R&D for improving reliability, availability, efficiency, and environmental performance of advanced fossil-based power systems. The program bridges basic and applied research by targeting concepts with the greatest potential for transformational breakthroughs. As such, the program focuses on advancing early-stage research in areas such materials, rare earth recovery from coal and coal byproducts, fluid dynamics, and fuel preparation characteristics (i.e., coal particle sizing and drying). 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. Crosscutting Research is focused on four activities and associated sub-activities: 1) Critical Minerals; 2) Water Management R&D; 3) Modeling, Simulation and Analysis; and 4) University Training and Research (e.g., funding for: University Coal Research, and Historically Black Colleges and Universities and other Minority-Serving Institutions, and the University Turbine Systems Research.

Carbon Capture, Utilization and Storage

The Carbon Capture subprogram is focused on early-stage research and development on post-combustion and pre-combustion CO2 capture, novel compression technologies for new and existing fossil fuel-fired power plants and CO2 utilization technologies to convert CO2to valuable products and commodities. Significant improvements are required to reduce parasitic energy load, and lower capital costs that can support the market potential for large quantities of CO2 for economic utilization in Enhanced Oil Recovery (EOR) operations and conversion to high-value products. Low cost CO2 can strengthen U.S. energy security by enabling the production of up to 60 billion barrels of stranded oil that is uneconomic with current recovery practices and current market prices for CO2. The Carbon Utilization subprogram focuses on using captured/concentrated CO2 and/or carbon-containing substances, or directly using CO2 from flue gas or mixed gas streams, and converting it into valuable products. Critical challenges identified in the utilization focus area include the cost-effective use of CO2 and other carbon-containing substances as a feedstock for chemical synthesis, or its integration into pre-existing products. The Carbon Storage subprogram is focused on development of technologies for the safe and permanent geologic storage of captured CO2. The subprogram is focused on early-stage R&D in five primary storage types—saline formations, oil and natural gas reservoirs, un-mineable coal seams, basalts, and organic shales—and in geologic reservoirs across eleven different geologic storage depositional classes. Coupled simulation tools, characterization methods, and monitoring technologies developed and validated through the Carbon Storage subprogram will improve storage efficiency, reduce overall cost, decrease subsurface uncertainties, and identify ways to ensure that operations are safe, economically viable, and environmentally benign.

**Fossil Energy Research and Development**
**Funding by Congressional Control**
**(Comparable)**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[1] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Advanced Coal Energy Systems & CCUS** | | | | |
| **Advanced Energy Systems** | | | | |
| **Advanced Systems** | | | | |
| Advanced Combustion/Gasification Systems | 56,000 | 55,620 | 65,000 | +9,000 |
| Advanced Turbines | 19,000 | 18,871 | 20,000 | +1,000 |
| Solid Oxide Fuel Cells | 30,000 | 29,796 | 3,000 | -27,000 |
| Advanced Sensors and Controls and other Novel Concepts | 3,650 | 3,625 | 15,000 | +11,350 |
| **Subtotal Advanced Systems** | **108,650** | **107,912** | **103,000** | **-5,650** |
| **Advanced Materials** | | | | |
| Advanced Coal Processing | 0 | 0 | 10,000 | +10,000 |
| Power Generation Efficiency | 0 | 0 | 37,000 | +37,000 |
| Advanced Energy Materials | 8,000 | 7,946 | 25,000 | +17,000 |
| **Subtotal Advanced Materials** | **8,000** | **7,946** | **72,000** | **+64,000** |
| **Total Advanced Energy Systems** | **116,650** | **115,858** | **175,000** | **+58,350** |
| | | | | |
| **Cross-cutting** | | | | |
| **Water Management R&D** | **9,800** | **9,733** | **10,000** | **+200** |
| **Modeling, Simulation & Analysis** | **20,850** | **20,708** | **8,000** | **-12,850** |
| **Critical Minerals** | | | | |
| Feasibility of Recovering REEs | 15,000 | 14,898 | 15,000 | 0 |
| Critical Materials | 0 | 0 | 15,000 | +15,000 |
| **Subtotal Critical Minerals** | **15,000** | **14,898** | **30,000** | **+15,000** |
| **University Training and Research** | **2,400** | **2,384** | **5,300** | **+2,900** |
| **International Activities** | **800** | **795** | **0** | **-800** |
| **Total Cross-cutting** | **48,850** | **48,518** | **53,300** | **+4,450** |

[1] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

| | FY 2017 Enacted | FY 2018 Annualized CR[1] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Carbon Capture, Utilization and Storage** | | | | |
| **Carbon Capture** | | | | |
| Post-Combustion Capture Systems | 86,000 | 85,416 | 17,000 | -69,000 |
| Pre-Combustion Capture Systems | 15,000 | 14,898 | 3,000 | -12,000 |
| **Subtotal Carbon Capture** | **101,000** | **100,314** | **20,000** | **-81,000** |
| **Carbon Utilization** | | | | |
| Carbon Use and Reuse | 10,000 | 9,932 | 9,000 | -1,000 |
| **Subtotal Carbon Utilization** | **10,000** | **9,932** | **9,000** | **-1,000** |
| **Carbon Storage** | | | | |
| Storage Infrastructure | 45,300 | 44,992 | 2,000 | -43,300 |
| Advanced Storage R&D | 40,000 | 39,728 | 9,000 | -31,000 |
| **Subtotal Carbon Storage** | **85,300** | **84,720** | **11,000** | **-74,300** |
| **Total Carbon Capture, Utilization and Storage** | **196,300** | **194,967** | **40,000** | **-156,300** |
| | | | | |
| **STEP (Supercritical CO2)** | **24,000** | **23,837** | **25,000** | **+1,000** |
| **Transformational Coal Pilots** | **50,000** | **49,660** | **0** | **-50,000** |
| **NETL Coal Research and Development** | **38,000** | **37,742** | **50,000** | **+12,000** |
| **Total, Advanced Coal Energy Systems & CCUS** | **473,800** | **470,582** | **343,300** | **-130,500** |

**Fossil Energy Research and Development**
**Funding by Congressional Control**
**($K) (Non-Comparable)**

| | FY 2017 Enacted | FY 2018 Annualized CR[2] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Coal** | | | | |
| **CCS and Power Systems** | | | | |
| **Carbon Capture** | | | | |
| Post-Combustion Capture Systems | 86,000 | 85,416 | --- | -86,000 |
| Pre-Combustion Capture Systems | 15,000 | 14,898 | --- | -15,000 |
| **Subtotal Carbon Capture** | **101,000** | **100,314** | --- | **-101,000** |
| **Carbon Storage** | | | | |
| Storage Field Management | 45,300 | 44,992 | --- | -45,300 |
| Advanced Storage R&D | 28,000 | 27,810 | --- | -28,000 |
| Carbon Use and Reuse | 10,000 | 9,932 | --- | -10,000 |
| Sub-disciplinary Storage R&D | 12,000 | 11,919 | --- | -12,000 |
| **Subtotal Carbon Storage** | **95,300** | **94,653** | --- | **-95,300** |
| **Advanced Energy Systems** | | | | |
| Advanced Combustion Systems | 30,000 | 29,797 | --- | -30,000 |
| Gasification Systems | 25,000 | 24,830 | --- | -25,000 |
| Advanced Turbines | 19,000 | 18,871 | --- | -19,000 |
| Coal and Coal Biomass to Liquids | 1,000 | 993 | --- | -1,000 |
| Solid Oxide Fuel Cells | 30,000 | 29,796 | --- | -30,000 |
| **Subtotal Advanced Energy Systems** | **105,000** | **104,287** | --- | **-105,000** |
| **Cross-cutting** | | | | |
| **Plant Optimization Technologies** | | | | |
| Sensors, Controls and Other Novel Concepts | 3,650 | 3,625 | --- | -3,650 |
| Crosscutting Materials R&D | 1,000 | 993 | --- | -1,000 |
| Advanced Ultrasupercritical Materials R&D | 7,000 | 6,952 | --- | -7,000 |
| Water Management R&D | 9,800 | 9,734 | --- | -9,800 |
| **Subtotal Plant Optimization Technologies** | **21,450** | **21,304** | --- | **-21,450** |
| | | | | |
| **Coal Utilization Science** | | | | |
| Computational System Dynamics | 10,000 | 9,932 | --- | -10,000 |
| Focus Area for Computational Energy Science | 10,000 | 9,932 | --- | -10,000 |

[2] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

| | FY 2017 Enacted | FY 2018 Annualized CR[2] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Subtotal Coal Utilization Science** | **20,000** | **19,864** | --- | **-20,000** |
| **Energy Analyses** | | | | |
| Environmental Activities | 400 | 397 | --- | -400 |
| Technical and Economic Analysis | 450 | 447 | --- | -450 |
| **Subtotal Energy Analyses** | **850** | **844** | --- | **-850** |
| **University Training and Research** | | | | |
| University Coal Research | 1,400 | 1,390 | --- | -1,400 |
| HBCU's, Education, and Training | 1,000 | 993 | --- | -1,000 |
| **Subtotal University Training and Research** | **2,400** | **2,383** | --- | **-2,400** |
| **International Activities** | | | | |
| Coal Technology Export | 300 | 298 | --- | -300 |
| International Program Support | 500 | 497 | --- | -500 |
| **Subtotal International Activities** | **800** | **795** | --- | **-800** |
| **Total Cross-cutting** | **45,500** | **45,190** | --- | **-45,500** |
| **NETL Coal Research and Development** | | | | |
| Feasibility of Recovering Rare Earth Elements | 15,000 | 14,898 | --- | -15,000 |
| NETL Coal R&D | 38,000 | 37,742 | --- | -38,000 |
| **Subtotal NETL Coal Research and Development** | **53,000** | **52,640** | **---** | **-53,000** |
| **Supercritical Transformational Electric Power** | **24,000** | **23,837** | **---** | **-24,000** |
| **Transformational Coal Pilots** | **50,000** | **49,660** | **---** | **-50,000** |
| **Total CCS and Power Systems** | **473,800** | **470,581** | **---** | **-423,800** |
| | | | | |
| **Advanced Coal Energy Systems & CCUS** | | | | |
| **Advanced Energy Systems** | | | | |
| **Advanced Systems** | | | | |
| Advanced Combustion/Gasification Systems | --- | --- | 65,000 | +65,000 |
| Advanced Turbines | --- | --- | 20,000 | +20,000 |
| Solid Oxide Fuel Cells | --- | --- | 3,000 | +3,000 |
| Advanced Sensors and Controls and other Novel Concepts | --- | --- | 15,000 | +15,000 |
| **Subtotal Advanced Systems** | **---** | **---** | **103,000** | **+103,000** |
| **Advanced Materials** | | | | |
| Advanced Coal Processing | --- | --- | 10,000 | +10,000 |
| Power Generation Efficiency | --- | --- | 37,000 | +37,000 |
| Advanced Energy Materials | --- | --- | 25,000 | +25,000 |
| **Subtotal Advanced Materials** | **---** | **---** | **72,000** | **+72,000** |
| **Total Advanced Energy Systems** | **---** | **---** | **175,000** | **+175,000** |
| | | | | |
| **Cross-cutting** | | | | |

| | FY 2017 Enacted | FY 2018 Annualized CR[2] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Water Management R&D** | **---** | **---** | **10,000** | **+10,000** |
| **Modeling, Simulation & Analysis** | **---** | **---** | **8,000** | **+8,000** |
| **Critical Minerals** | | | | |
| Feasibility of Recovering REEs | --- | --- | 15,000 | +15,000 |
| Critical Materials | --- | --- | 15,000 | +15,000 |
| **Subtotal Critical Minerals** | **---** | **---** | **30,000** | **+30,000** |
| **University Training and Research** | **---** | **---** | **5,300** | **+5,300** |
| **Total Cross-cutting** | **---** | **---** | **53,300** | **+53,300** |
| | | | | |
| **Carbon Capture, Utilization and Storage** | | | | |
| **Carbon Capture** | | | | |
| Post-Combustion Capture Systems | --- | --- | 17,000 | +17,000 |
| Pre-Combustion Capture Systems | --- | --- | 3,000 | +3,000 |
| **Subtotal Carbon Capture** | **---** | **---** | **20,000** | **+20,000** |
| **Carbon Utilization** | | | | |
| Carbon Use and Reuse | --- | --- | 9,000 | +9,000 |
| **Subtotal Carbon Utilization** | **---** | **---** | **9,000** | **+9,000** |
| **Carbon Storage** | | | | |
| Storage Infrastructure | --- | --- | 2,000 | +2,000 |
| Advanced Storage R&D | --- | --- | 9,000 | +9,000 |
| **Subtotal Carbon Storage** | **---** | **---** | **11,000** | **+11,000** |
| **Total Carbon Capture, Utilization and Storage** | **---** | **---** | **40,000** | **+40,000** |
| **STEP (Supercritical CO2)** | **---** | **---** | **25,000** | **+25,000** |
| **NETL Coal Research and Development** | **---** | **---** | **50,000** | **+50,000** |
| **Total, Advanced Coal Energy Systems & CCUS** | **---** | **---** | **343,300** | **+343,300** |

SBIR/STTR:

- FY 2017 Transferred: SBIR $11,038; STTR: $1,552
- FY 2018 CR Annualized: SBIR $10,963; STTR: $1,542
- FY 2019 Request: SBIR $8,186; STTR: $1,151

**Advanced Coal Energy Systems and CCUS**
**Explanation of Major Changes**
**($K)**

| | **FY 2019 Request vs FY 2017 Enacted** |
|---|---|
| **Advanced Energy Systems:** The increase in funding will support early-stage R&D to increase the availability, efficiency, and reliability of fossil energy power systems while maintaining environmental standards through early-stage R&D. Advanced Combustion/Gasification Systems will focus on a modular system design to develop new materials and computational modeling that can be adapted by industry to design smaller, more reliable and efficient facilities that will increase deployment opportunities. Advanced Turbine funding will support early-stage R&D to provide new knowledge on turbine component technologies that withstand the high temperatures and aggressive environments (1300°F, 3600psi steam turbine) predicted for high-hydrogen content syngas combustion, including advanced materials, ceramics, and coatings. Solid Oxide Fuel Cell funding decreases from FY 2017 enacted level; however, funding will support existing early-stage R&D with universities and National Laboratories to reduce cost and improve stack reliability. Proposed Advanced Sensors and Controls and Other Novel Concepts activities in FY 2019 will continue R&D on transformational sensing, process control, and novel control architectures that enable model-based, real-time control of plant systems and components to help improve power plant integrity. Advanced Materials activities include High Performance Computing for Materials (HPC4Mat), development of a national coal database to provide detailed technical information on the impact of coal properties and composition on the performance and emissions of power generation facilities, and R&D specifically focused on enhancing existing unit performance through development of advanced materials, energy cycles, monitoring equipment, dynamic data analysis, and advanced process controls. | **+58,350** |
| **Crosscutting**: In FY 2019, one of the major focuses of Crosscutting Research will be the launch of a new a Critical Materials Initiative to build on previous research related to Rare Earth Elements (REE) association with coal and coal byproducts. FE has been advancing technology development activities to improve the economic recoverability of REE from coal and coal byproducts. Planned R&D includes expanded geologic characterizations; expanded knowledge of the presence, form and distribution of REEs in coal basins; and early-stage research of new advanced separation and concentration processes to emable industry to develop and deploy technologies that can recover REE from coal and coal byproducts at commercially competitive rates. FY 2019 funding would also support Water Management R&D on innovative cooling geometries and materials that offer potential increases in overall plant efficiencies. Systems studies in this area continue improve understanding of the complex water issues facing today's coal fleet as it relates to energy production. Early-stage, emerging treatment technologies that may be able to assist treating or monitoring plant waste streams will also be explored. Modeling, Simulation and Analysis includes potential environmental impacts (e.g., on water quality, air emissions, solid waste disposal, climate change) of fossil fuel use and large-scale deployment of different generations of Advanced Coal Energy Systems and CCUS technologies. This activity supports program strategic planning by identifying major challenges, technologies, and advanced concepts that have the potential to improve the efficiency, cost, and/or environmental performance of fossil energy systems integrated with CCUS. The University Training Research activity will continue its support of university research supporting the applied R&D programs across the Coal office. | **+4,450** |

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Carbon Capture, Utilization and Storage:** In FY 2019, the Carbon Capture subprogram will focus on early-stage R&D on transformational gas separation technologies that can significantly reduce the cost of $CO_2$ capture and utilization. Transformational capture systems are a set of disruptive technologies that can significantly reduce the cost of capture, targeting a Cost of Electricity (COE) at least 30% less than state of the art (~$30/tonne). The decrease in funding reflects a reprioritized focus on transformational carbon capture technologies at the early R&D stages of development. Previously funded later-stage efforts such as 2nd generation technology development including small- and large-scale pilot tests at the National Carbon Capture Center (NCCC) will be left to industry to continue to develop, adopt, and commercialize. Carbon Utilization will focus on early-stage $CO_2$ utilization technologies that develop additional markets for fossil energy resources. Areas of research include, but are not limited to, new 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 ($CO_2$ and methane) to higher value products such as nutraceuticals, bio plastics, and animal feed. The decrease in funding for Carbon Storage reflects a reprioritized focus on early-stage advanced storage research targeting adaptive reservoir management. Early-stage research will focus on technologies that will have significant impact on the program goals to ensure storage containment and reduced risk. | **-156,300** |
| **STEP (Supercritical CO2):** The STEP activity line was created within Advanced Coal Energy Systems (formerly CCS and Power Systems) by FY 2015 Enacted appropriations. FY 2019 funding will support, through competitively awarded funding opportunity announcements, advances in the next generation of lower cost, higher performance recuperators, as well as next generation turbine components such as seals, bearings and rotors needed tom improve efficiency, reduce cost, and increase durability. | **+1,000** |
| **Transformational Coal Pilots:** No funding is requested in FY 2019 due to the subprogram's refocusing on early-stage R&D. FY 2017 and FY 2018 funding will be used Award up to 4 full front end engineering and design (FEED) studies that will proceed into down select of 2 large pilots. | **-50,000** |
| **NETL Coal R&D:** A requested increase will be used to invest in and expand enduring Fossil Energy core competencies enabling a collaborative innovative ecosystem to discover and mature advanced energy technologies along the entire value chain. Focused national laboratory-academia-industry partnerships will be used to increase the rate of discovery and development of technologies that will promote the administration's priorities. | **+12,000** |
| **Total, Advanced Coal Energy Systems & CCUS** | **-130,500** |

**Advanced Coal Energy Systems & CCUS**
**Advanced Energy Systems**

**Description**

Coal plays a critical role in powering the Nation's electricity demand, especially as baseload power plants. However, existing coal generation assets are faced with evolving market dynamics that favor the operational flexibility of generation assets. Early-stage research and development (R&D) opportunities exist to generate knowledge upon which industry can deploy advanced technologies that can significantly improve plant performance and allow these units to match the changing grid operations. Research and development (R&D) in areas such as materials, fluid dynamics, fuel properties and preparation characteristics, and a new generation of plant controls can lead to new components and systems that can help improve the efficiency and reliability of coal-fired power plants significantly, allowing these assets to continue to provide baseload power and load following grid services.

The mission of the Advanced Energy Systems (AES) subprogram is 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 six activities: 1) Advanced Combustion/Gasification Systems, 2) Advanced Turbines, 3) Solid Oxide Fuel Cells, 4) Advanced Sensors and Controls, 5) Power Generation Efficiency, and 6) Advanced Energy Materials. While the primary focus is on coal-based power systems, improvements to these technologies will result in spillover benefits that can reduce the cost of converting other carbon-based fuels, such as natural gas, biomass, or petroleum coke into power and other useful products in an environmentally-acceptable manner. By the end of 2022, the AES subprogram would develop economically viable technologies ready for demonstration by the private sector that, if deployed, would improve the average heat rate (i.e., efficiency) of a typical plant in the existing (2018) fleet by 5 percent. The proposed restructure of Advanced Energy Systems (AES) within FER&D improves the alignment of the budget structure to the research focus areas, repositioning the Department to more effectively enable industry to commercialize and deploy advanced technologies necessary to support a secure and reliable power grid. FER&D will support early-stage research in advanced technologies (in materials, sensors, and processes, etc.) to expand the knowledge necessary to improve the efficiency, flexibility, and resilience of the existing fleet of coal fired power plants. The restructure also focuses funding on early-stage research that enables the next generation of high efficiency, and low emission coal fired power plants that can directly compete with other sources of electricity in the market and provide low cost reliable power 24/7. A crosswalk of the proposed restructure is included in the Fossil Energy R&D Overview section.

**Advanced Coal Energy Systems & CCUS – Explanation of Budget Structure Changes**

- Advanced Combustion/Gasification Systems combines Advanced Combustion Systems, Gasification/Combustion Systems, Coal and Coal Biomass to Liquids (all activities were previously in AES)
- Advanced Turbines remains the same
- Solid Oxide Fuel Cells remains the same
- Coal Beneficiation will be renamed Advanced Coal Processing
- Transformative Power Generation was a new initiative proposed in AES in FY 2018, to be renamed Power Generation Efficiency in FY 2019
- Sensors and Controls and other Novel Concepts will move from Cross Cutting Research and be renamed Advanced Sensors and Controls and other Novel Concepts
- Crosscutting Materials R&D and Advanced Ultra Supercritical Materials R&D will move from Cross Cutting Research and be renamed Advanced Energy Materials
- Crosscutting Materials R&D and Advanced Ultra Supercritical Materials R&D will move from Crosscutting Research
- Supercritical CO2 (STEP) remains the same
- Transformational Coal Pilots remains the same
- NETL Coal R&D remains the same; however, the subprogram Feasibility of Recovering Rare Earth Elements moves from NETL Coal Research and Development to Crosscutting and will be renamed Critical Minerals

Advanced Combustion/Gasification Systems

Coal gasification is a technical process that combines oxygen, steam, and coal in a gasifier to produce syngas, a mixture of hydrogen and carbon monoxide through a series of chemical reaction under high temperature and pressure. The syngas can be further converted to hydrogen and $CO_2$ over a catalyst in a water-gas shift reactor for efficient electricity generation. Syngas can also be used to produce ammonia, fertilizer, liquid fuels, or other high-value chemicals.

Currently, all commercially established coal gasification-based power plants use Integrated Gasification Combined Cycle (IGCC) technology. Although IGCC is one of the cleanest and most efficient technologies to convert coal to electricity, the technology involves a complex set of systems tailored for utility-scale electricity generation from a large, centralized power plant. A consequence of tailoring the IGCC technology in this fashion is that technology adopters are required to invest many years of design and construction activity as well as billions of dollars of capital costs. In response, the Gasification Systems Program is seeking modularization, which would result in technology solutions that can be implemented quickly and with lower total capital investment.

In FY 2019, this activity will pursue early-stage, high risk R&D on oxygen carriers, modular gasification systems, and materials development to enable low-cost syngas production from coal. This activity focuses on reduction of the cost and environmental impact of coal conversion to syngas for the purpose of electricity generation. However, it should be noted that there are significant spillover benefits to potential applications of the technology for the purpose of producing hydrogen, chemicals, and other liquid fuels from the coal-derived syngas.

The early-stage R&D on modular system design will focus on the development of new materials and computational modeling that can be adapted by industry to design smaller, more reliable and efficient reactors to increase deployment opportunities. Specifically, modular systems could overcome siting, operating, and logistical constraints that inhibit the deployment of large scale plants. They could require lower capital investment and be strategically located close to resources and/or the markets for their products. In addition, funding will support competitively selected projects from a Funding Opportunity Announcement to develop early-stage R&D pre-FEED studies for several advanced combustion technologies.

Advanced Turbines

In FY 2019, this activity will focus on early-stage R&D to provide new knowledge on turbine component technologies that withstand the high temperatures and aggressive environments predicted for high-hydrogen content syngas combustion, including advanced materials, ceramics, and coatings. Turbine R&D activity will focus on continuing bench-scale projects with the DOE National Laboratories. These activities will include research on key turbine system components that, with additional development by industry, could be capable of achieving a 4-5 percentage point efficiency increase relative to existing combined cycle turbines. Specifically, research will focus on rig pilot testing of materials and components, reducing the risk of scale-up for use in commercial scale machines, including combustor components, rotating parts, and cooling systems. With additional development by industry, these technologies could reduce inter-stage leakage via improved sealing designs, optimize airfoil heat flux with reduced cooling flows, improve material architectures for higher temperature operation, and result in superior airfoils for more efficient expansion with higher throughput. In addition, projects selected through a competitive solicitation will support early stage R&D to enable development of a 1300°F, 3600psi steam turbine.

Solid Oxide Fuel Cells

This activity focuses on early-stage R&D to enable efficient, cost-effective SOFC electricity generation from coal or natural gas with near-zero atmospheric emissions of $CO_2$ and air pollutants, as well as minimal water use in both distributed generation and central power generation applications. FY 2019 activities will continue existing early-stage R&D with universities and National Laboratories to reduce cost and improve stack reliability focusing primarily on accelerating the development of new materials and components that can withstand variable operating conditions and strengthen these assets for grid reliability.

Advanced Sensors and Controls and other ovel Concepts

This activity, formerly funded under Crosscutting Research, focuses on early-stage R&D on low-cost and reliable multi-sensing technologies capable of reading temperature, pressure and gas species that, with additional investment by industry, could be capable of providing real-time measurements critical to the operation, optimization, reliability and efficiency of the next-generation of power systems. Advanced Sensors and Controls and other Novel Concepts will enable industry to shift from the current time-based preventive maintenance schedules to one focused on condition-based maintenance with improved operability and overall plant economics. Advanced sensors can also be used to monitor and identify transients associated with a cyber-attack, providing increased reliability and grid stability.

Proposed activities in FY 2019 will continue R&D on transformational sensing, process control, and novel control architectures that enable model-based, real-time control of plant systems and components to help improve power plant integrity. This area explores opportunities to improve ramp rates of power plants through improved instrumentation and control. As coal plants transition from primarily baseload operation to increasingly load-following operation, the ramp rates associated with cyclic start-ups/shut-downs introduce operational complexities for which existing plants were not originally engineered. Novel instrumentation that can withstand harsh environments has the ability to replace inferred process conditions with actual measurements which can facilitate faster/safer response times. The FY 2019 Budget also continues early-stage R&D in constructing complex components with the potential to improve plant performance (e.g. embedded sensing capability), use of dynamic data analysis, and distributed intelligence and control. In addition, funding will support competitively selected projects to develop and validate sensors capable of shifting power plants from preventive maintenance to condition based maintenance.

Advanced Energy Materials

This activity encompasses the spectrum of fundamental materials design through qualification of functional materials that support the next generation of advanced power generation. New computational techniques will continue to be developed to design materials needed for advanced combustion, fuel cells, turbines and gasification systems. This computational work decreases the time and cost to develop the new materials and is projected to lead to classes of improved high performance materials.

Proposed activities in FY 2019 include High Performance Computing for Materials (HPC4Mat), an initiative that brings together the materials expertise and computation power of the National Laboratories to work with Industry to solve critical materials problem that could not be solved without the HPC. In addition, the construction and building of the extreme environment ComTest, a component testing facility for advanced materials and parts to be used in boilers for advanced supercritical power plants, will begin to quantify and qualify high temperature materials. Existing R&D with DOE National Laboratories, academia and industry on development of new computational techniques to design extreme environment materials will continue. This field is on the threshold of important breakthroughs, building on emerging advances across many fields of science and technology. For example, planned activities include development of validated, science-based predictive tools that accurately describe a component's performance at service conditions. Models will also consider the impacts of multi-material interfaces on overall component performance, including the material's chemical and structural integrity. In addition, advanced characterization tools and rapid test and characterization methodologies will be developed to validate model predictions and to reduce uncertainty. Investments in this activity will also develop digital data repositories by material class that can be networked and are machine discoverable and accessible to allow algorithms to crawl the broad sets of data and identify unique trends or correlations. Issues relating to open-source and/or open-access standards, data privacy, intellectual property integrity, cyber secure integrity and experimental integrity for datasets both within and between materials and applications need to be addressed to ensure utility and public value from the resulting research. Methods will be developed to analyze the large volume of data generated during the manufacture and testing of materials components and to incorporate that learning to improve the predictive capability of simulations that are developed, as well as to reduce uncertainty. Further, this activity will advance early-stage R&D for extreme environments. Specifically, early-stage research and development will be focused on advanced materials and component testing in laboratory environment.

Advanced Coal Processing

This new activity proposes to develop a national coal database, drawing on data and expertise at the DOE National Laboratories and academia to provide detailed technical information on the impact of coal properties and composition on

the performance and emissions of power generation facilities. The research will focus on synthesizing available coal combustion phenomena data and their impact on plant efficiency and reliability into a common database. The results will centralize detailed information on U.S.-produced coal and help users understand the impacts of its use in a wide variety of applications. The activity combines basic chemistry and combustion science along with basic and fundamental research on thermo-physical properties, materials interactions, and heat transfer.

The activity will also support early-stage development of technologies that reduce the moisture content of high-moisture U.S. coals, which could ultimately be used by industry to improve overall power plant efficiency and reduce the cost of power generation from coal. R&D in this area will produce a higher quality coal through pre-processing that will result in advanced efficiency and reduced emissions. In FY 2019, the activities will include early-stage R&D focused on improved coal combustion and reduce specific power consumption (electrode improvements).

Power Generation Efficiency

The existing coal power generating fleet plays a critical role providing reliable on-demand power generation required for power grid stability, and it is important that these existing units can continue to operate in an efficient and reliable manner. FER&D is initiating this new activity in FY 2019 and prioritizing funding for it because there are opportunities to improve the efficiencies and reliability of existing plants through focus on transformational, early-stage, high risk research and development. DOE has a key role in early-stage energy research and development focused on the important tasks of investing in technology development that generates public benefits using the competitive market forces and addressing the market's inherent limits to respond to public needs. Expertise and equipment such as computational modeling, high performance computing (HPC), super computers, materials development, testing and manufacturing, etc. exist at a number of DOE National Laboratories that are not available elsewhere and which can generate vital insights on performance upgrades to existing pulverized coal plants, circulating fluidized bed plants, and repowering of coal-fired generating assets with high efficiency supercritical cycles. DOE has a role to play in early-stage high risk technologies development that would otherwise emerge far more slowly, if at all by the private sector.

This new activity proposes R&D specifically focused on enhancing existing unit performance through development of advanced materials, energy cycles, monitoring equipment, dynamic data analysis, and advanced process controls. The activity will fund competitively awarded early-stage research in areas such as materials, fluid dynamics, fuel preparation, and instrumentation and control systems that can subsequently be developed further by industry for deployment at existing units. Funding will focus on improving plant efficiency through topping cycles, advanced materials, recovery of low grade waste heat, improvements in water usage, lower parasitic losses and the development of advanced sensors, instrumentation, and artificial intelligence control systems based on dynamic data analysis. Transformational research opportunities include building a new knowledge base regarding fuel interactions with plant components such as pulverizers, refractory, steam raising and superheat/reheat surfaces, economizers, and air heaters. Artificial intelligence systems and other technologies will also be advanced to improve predictive maintenance required to optimize economic and environmental performance and maximize plant reliability. In addition, funding will support competitively selected projects focused on early-stage R&D of novel fluids for bottom and topping cycles.

**Advanced Coal Energy Systems & CCUS**
**Advanced Energy Systems**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Advanced Energy Systems: $116,650,000** | **$175,000,000** | **+$58,350,000** |
| **Advanced Combustion/Gasification Systems: $56,000,000** | **$65,000,000** | **+$9,000,000** |
| • Funding supports continued testing of advanced oxygen production technology, multiphase reacting flow model development applicable to commercial gasification systems, and refractory development activities. | • FY 2019 request will focus on development of low cost oxygen carriers to improve performance and durability and component development for gasification deployment with low disruptive costs.<br>• Continue the development of new materials and computational modeling that can be adapted by industry to design smaller, more reliable and efficient reactors. Issue a new funding opportunity announcement and competitively select gasification and chemical looping projects focused on advancement of technologies for modularity. | • Eliminate funding for the CERC Advanced Combustion Technology Program.<br>• Release a FOA to perform early stage R&D for pre-FEED studies focusing on process intensification to advance REMS and modular gasification system. |
| **Advanced Turbines $19,000,000** | **$20,000,000** | **+$1,000,000** |

| | | |
|---|---|---|
| • Current finding will be used to advance component technologies for high pressure ratio and high temperature turbine technologies.<br>• Continues NETL in-house activities on pressure gain combustion. | • FY 2019 request will be used to advance component technologies for high pressure ratio and high temperature turbine technologies.<br>• Continues NETL in-house activities on pressure gain combustion.<br>• Issue a new funding opportunity announcement and competitively select R&D activities that would lead to performance improvements in steam based power cycles applicable to coal fueled boilers. | • Initiate early stage R&D on a 1300F 3600psi steam turbine. |
| **Solid Oxide Fuel Cells $30,000,000** | **$3,000,000** | **-$27,000,000** |
| Funding accelerates the commercialization of SOFC technology while retaining the program's long term focus on efficient, cost- effective SOFC electricity that minimizes water consumption in central power generation applications and produces a pure, CO2 exhaust stream to reduce the costs of carbon capture and storage. | • FY 2019 request will focus on acceleration of SOFC materials development with academia and/or National Laboratories. | • The decrease in funding reflects a reprioritized focus on early-stage research and development |
| **Advanced Sensors & Controls and Other Novel Concepts** | | |
| **$3,650,000** | **$15,000,000** | **+$11,350,000** |
| • Early stage R&D (TRL 2-3) on new sensors capable of taking measurements in the high temperature, high pressure, and/or corrosive environments of a power system or underground injection system.<br>• Continues R&D on transformational research in process control and optimization centered on self-organizing information networks and distributed intelligence.<br>• Explores other novel concepts such as additive manufacturing toward construction of complex components (e.g. turbine blades) with embedded sensing capability. | • Continues early stage R&D (TRL 2-3) of novel sensor concepts beneficial to coal-based generating assets. Measurements of interest include high temperature pH, harsh environment temperature/pressure/strain, and in-situ gas composition.<br>• Advanced monitoring and diagnostics, including control | • Focus is on intelligent sensor networks to unify sensor and control architecture to enable real-time process control.<br>• R&D focused on improving ramp rates of existing coal-fired plants now faced with operating under cyclic peaking conditions R&D dedicated to expanding application of Condition-Based Maintenance within the coal fleet, marking a departure from |

| | | |
|---|---|---|
| | optimization, to improve efficiency and reliability of plants.<br>• Issue a new funding opportunity announcement and competitively select sensor technology projects focused on additive manufacturing of embedded sensor technologies into components. | traditional time-based preventative maintenance schedules<br>• Initiate testing and qualification of sensor networks. |
| **Advanced Materials $8,000,000** | **$72,000,000** | **+$64,000,000** |
| • Extreme environment materials development and testing will focus on early-stage technology development of advanced materials for extreme environments.<br>• Development of digital data repositories by material class that can be networked and are machine discoverable and accessible for algorithms to crawl the broad sets of data and identify unique trends or correlations.<br>• Develop models to increase the temperature of ferric alloys by 50°C. | • Materials research to maximize steam pressures and temperatures for new power cycles.<br>• Early-stage research on the incorporation of advanced power generation cycles that can be further developed and scaled up by industry to increase plant efficiency or lead to the repowering of existing coal power generation assets.<br>• Continue the development of models to increase the temperature of ferric alloys by 50°C. | • Funding of the HPC4Material projects with National Laboratories and Industry to address critical material issues.<br>• Funding for the AUSC component test (ComTest) facility<br>• Funding for National Lab academia for early-stage R&D on extreme environment materials<br>• Early-stage development of technologies that reduce the moisture content of high-moisture U.S. coals |

**Advanced Coal Energy Systems & CCUS**
**Crosscutting Research**

**Description**

Coal continues to play—and is forecasted to do so for the foreseeable future—a critical role in powering the Nation's electricity generation.[1] Aging coal generation assets are currently faced with decreased performance due to the state of the equipment and transient operating conditions—a challenge exacerbated by the current economic pressures on the coal sector. To address the challenges of an aging coal fleet, opportunities exist to explore early-stage technologies that could be further advanced by industry and ultimately integrated into plant designs and used to repower or retrofit existing facilities with new components, resulting in significant improvements to existing plant performance.

Fossil Energy Research and Development's Crosscutting Research subprogram supports innovative early-stage R&D for improving reliability, availability, efficiency, and environmental performance of advanced fossil-based power systems. The program bridges basic and applied research by targeting concepts with the greatest potential for transformational breakthroughs. As such, the program focuses on advancing early-stage research in areas such materials, fluid dynamics and fuel preparation characteristics (i.e., coal particle sizing and drying). 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. Research is focused on four activities and associated sub-activities: 1) Critical Minerals; 2) Water Management R&D; 3) Modeling, Simulation and Analysis; and 4) University Training and Research (e.g., funding for: University Coal Research, and Historically Black Colleges and Universities and other Minority-Serving Institutions, and the University Turbine Systems Research.

**Crosscutting Research – Explanation of Budget Structure Changes**

- Sensors and Controls will move to Advanced Coal Energy Systems and be renamed Advanced Sensors and Controls
- Crosscutting Materials R&D and Advanced Ultra Supercritical Materials R&D will move to Advanced Energy Systems and be renamed Advanced Energy Materials
- Water Management R&D remains the same
- Modeling, Simulation and Analysis combines Coal Utilization Science and its subprograms: Computational System Dynamics and Focus Area for Computational Energy Science; and Energy Analyses and its subprograms: Environmental Activities and Technical and Economic Analyses
- International Activities are transferred to the DOE Office of International Affairs
- University Training and Research combines the subprograms University Coal Research and HBCUs, Education and Training, and the University Turbine Systems Research.

**Critical Minerals**

The development of a domestic supply of Rare Earth Elements (REE) that is economically competitive will help fuel our nation's economic growth; secure our energy independence by reducing our reliance on foreign REE sources; and increase our national security. FE has so far generated over a thousand rock analyses from materials in 14 states. Appalachia is an area that contains some of highest concentrations of REE found in coal throughout the domestic U.S. characterization work is also underway, using industry and academic mineral processing and hydrometallurgy laboratory facilities. Among the results are the first indications of ion-exchangeable REE-containing clays present within coal seams. FE also have several projects to evaluate pilot-scale processing options, and recently announced three selections for the development of small scale production facilities. Small, production facilities of this type can provide a beginning toward bringing REE production back onshore and demonstrate the technical feasibility of producing REEs from coal by-products. Larger scale adaptation and the proposed Critical Materials initiative can help attract REE-based manufacturing of products such as magnets back

[1] U.S. Energy Information Administration, *Annual Energy Outlook 2017 with projections to 2050*, p. 69, www.eia.gov/aeo

onshore and possibly to coal country. New technologies resulting from this initiative include new processes to concentrate and extract REEs from coal and separate the REEs into salable products. As part of this program, these new technologies, developed by industry and academia, are being tested at small scale facilities to determine their usefulness in producing REEs from coal-based resources.

The program has five key focus areas:

1. Resource Sampling and Characterization – Characterize physical and chemical properties to identify the optimal coal and coal by-product resources for REEs
2. Separation Technology Development – Develop REE separation and extraction capabilities from coal-based resources that are economically feasible and environmentally friendly
3. REE Sensor Development – Create portable sensors to identify promising REE coal-based resources at field sites and determine the concentrations of REEs within flow streams during the separation process
4. Process and Systems Modeling – Develop models to use as virtual test platforms to optimize process separation designs
5. Techno-Economic Analysis – To evaluate the international REE market and assess the economics of commercial production of REEs.

**Water Management R&D**

This sub-activity supports reduced freshwater usage and improved water efficiency in thermoelectric plants, focusing on the treatment and use of non-traditional waters, including power plant generated waste streams, and improving cooling processes of a plant.

Proposed activities in FY 2019 will focus on new early-stage R&D on innovative cooling geometries and materials that offer potential increases in overall plant efficiencies. Systems studies in this area continue improve understanding of the complex water issues facing today's coal fleet as it relates to energy production. Early-stage, emerging treatment technologies that may be able to assist treating or monitoring plant waste streams will also be explored. This includes efforts to improve water intensity, heat utilization, and heat transfer of plant processes. It also seeks to develop enhanced water recovery options for applications within plants, thereby reducing water demands and reducing quantity of plant waste streams. An innovative condenser technologies pilot will be funded, improvement from which will have the ability to increase overall plant efficiencies. In addition, novel and new condenser modeling, design and testing will be conducted.

**Modeling, Simulation and Analysis**

Analysis includes potential environmental and regulatory impacts (e.g., on water quality, air emissions, solid waste disposal, climate change) of fossil fuel use and large-scale deployment of different generations of Advanced Coal Energy Systems and CCUS technologies. This activity supports program strategic planning by identifying major challenges, technologies, and advanced concepts that have the potential to improve the efficiency, cost, and/or environmental performance of fossil energy systems integrated with CCUS. This activity will support additional studies for HQ to address power plant novel designs and efficiency improvements and techno-ecomomic evaluations.

*Computational System Dynamics:* The Computational Systems Dynamics element develops immersive, interactive visualization technology as well as data communication optimization methods to improve the design and operation of advanced power systems with CCUS. This element builds computer-aided design tools for the Advanced Energy Systems activity so that novel concepts can be explored and analysis can be conducted on pre-commercial systems. Furthermore, these tools will be used to optimize data handling and exploit information technology in the design of advanced energy systems with carbon capture.

Proposed activities in FY 2019 will continue support of the Institute for the Design of Advanced Energy Systems [IDAES] and efforts to use process systems engineering tools and approaches in the conceptual design and process intensification of innovative systems. This element also will apply computational capabilities to development code for use in the identification of extreme environment materials, i.e. materials able to withstand the conditions associated with advanced power concepts.

*Computational Energy Science:* The Computational Energy Science element introduces first principle and physics based modeling of phenomenon for complex energy conversion and carbon capture processes. The element further supports tools and techniques to transform these computationally intensive models into reduced order and fast user enabled models for the purposes of study, development, and validation.

Proposed activities in FY 2019 will include multi-scale, multi-physics simulation capabilities that couple fluid flow, heat and mass transfer, and complex chemical reactions for optimizing the design and operation of heat engines, combustors, gasifiers, chemical reactors, and other unit processes in advanced power generation systems. This element further supports tools and techniques to transform computationally intensive models into reduced order and fast user enabled models for the purposes of study, development, and validation. As a part of this effort, maintenance of and updates to NETL's Multiphase Flow with Interphase eXchanges [MFIX] code will be realized. This element will also support computational efforts to process operational data from plants using Advanced Pattern Recognition to try to identify advance indicators of component failures that operators could use to reduce unexpected forced outages in plants.

Technical and Economic Analysis
Power plant systems analysis, techno-economic analysis and other studies supportive of power generation and emission management as directed by the Director of the Office of Advanced Fossil Technology Systems.

**University Training and Research**

*University Coal Research*: This sub-activity provides small-scale grants to colleges and universities to support early-stage research consistent with the goals of the CCS and Power Systems program. This sub-activity provides a two-fold benefit: conducting directed energy research in a cost-effective environment, and expanding the research capabilities and education of the next generation of scientists and engineers. Proposed FY 2019 research will include power generation concepts specifically focused on computational based R&D; advanced high performance materials; novel sensing and control concepts; advanced power cycle concepts that supports; combustion, aerodynamics, heat transfer, materials, technology development for supercritical steam and carbon dioxide based power cycles, and chemical looping and pulse combustion. Additional funding will support awards for multiple universities under a FY19 FOA.

*Historically Black Colleges and Universities (HBCU) and other Minority-Serving Institutions (MSI):* This sub-activity provides small-scale grant to qualifying universities and institutions. The sub-activity targets education programs that conduct research related to improving efficiencies and reliabilities of advanced energy systems. This is an area consistent with the goals of the Crosscutting Research subprogram. Key FY 2019 research areas include advanced power generation with; computationally based initiatives; advanced high performance materials; novel sensing and control concepts; and advanced power cycle concepts. Grants awarded under this program are intended to maintain and upgrade the educational, training and research capabilities of HBCUs/OMIs in the fields of science and technology, with project results being used to further DOE's commitment to fossil energy research.

*University Turbine Systems Research (UTSR):* This sub-activity provide the continued support to the turbines program to university to improve the efficiencies of gas, steam and sCO2 turbines and components. Key FY 2019 research areas include research will focus on reducing the risk of scale-up for use in commercial scale machines, including combustor components, rotating parts, and cooling systems.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Crosscutting Research $48,850,000** | **$53,300,000** | **+$4,450,000** |
| **Critical Minerals $15,000,000** | **$30,000,000** | **+$15,000,000** |
| • Not requested in FY 2017 | • Develop technologies that can be economically deployed, enabling additional domestic supplies of Rare Earth Elements (REE)<br>• Reduce the environmental impact of coal and REE production through advances in REE production from coal and coal by-products<br>• Deliver advanced technologies that can be developed and manufactured within the United States.<br>• Stand up a new Critical Materials initiative<br>• Invest in National Labs and Achidemia to inviestiagae early stage transformational concentration and separation technologies | • Funding for the feasibility of recovering Rare Earth Elements remains consistent with FY17 enacted<br>• The Critical Materials Initiative is a new activity |
| **Water Management R&D $9,800,000** | **$10,000,000** | **+$200,000** |
| • Early-stage R&D on innovative multi-stage filtration technologies including membrane-based, evaporative, chemical, electrochemical and biological systems for both effluent from the plant and water treatment and reuse within the plant.<br>• Early-stage development of highly efficient heat exchangers and other transformational cooling systems. | • R&D to improve water efficiency, heat utilization, and heat transfer of plant processes with the goal of reducing overall water usage of power plant<br>• Explore novel treatment and monitoring techniques of plant effluents in order to assist with environmental regulations<br>• Develop enhanced water recovery options for applications within plants, thereby reducing water demands and reducing quantity of plant waste streams | • Eliminate funding for the CERC Water Program. Initiate early stage R&D on condensers design and testing. |
| **Modeling, Simulation and Analysis $20,850,000** | **$8,000,000** | **-$12,850,000** |
| • Implements the next generation of enabling computational formats for domain specific solution sets, enhancing both speed and capabilities.<br>• Uses fundamental models to reduce risk of employing novel concepts by developing a framework for uncertainty quantification and model hierarchy.<br>Select and award grants for 1-2 research projects focused on | • Continue maintenance of NETL's multiphase computational fluid dynamics (CFD) code, MFIX.<br>• Continue National Lab- and University-based support of IDAES consortium. | • Decelerate code development for the identification of extreme environment materials<br>• Decrease efforts to analyze plant operational data to identify common patterns preceding unexpected plant outages.Provide techno-economic and systems studies to for efficiency |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| developing concepts related to advanced power, restricted to only HBCU/MSI applicants. | | improments of new and existing plants. |
| **University Training and Research $2,400,000** | **$5,300,000** | **+$2,900,000** |
| • Select and award up to 6 -10 university-based research projects focused on developing concepts related to advanced power.<br>• Reflects a move of the University Turbine System Research activity to this line to better align university research programs. | • Select and award grants for university-based research projects focused on developing concepts related to advanced power systems, open to all university-based applicants. | • The increase reflects an additional 3-4 awards to university-based applicants |
| **International Activities $800,000** | **$0** | **-$800,000** |
| • Organize the 2017 CLSF Ministerial conference and coordinate international activities within the Office of Fossil Energy that fall under the Office of the Deputy Assistant Secretary for Clean Coal and Carbon Management. | • Activities transfer to the DOE Office of International Affairs. | • Reduction in the FER&D account is a result of transferring activities to the Office of International Affairs |

**Advanced Coal Energy Systems & CCUS**
**Carbon Capture, Utilization & Storage**

**Description**

The FY 2019 budget restructure proposes decoupling Advanced Energy Systems, Crosscutting, and other R&D programs from the Carbon Capture, Utilization and Storage (CCUS) program. FE continues to recognize opportunities to capture and utilize $CO_2$ generated from power generation and other industrial processes for enhanced oil recovery in both conventional and unconventional oil bearing formations.

**Carbon Capture and Storage – Explanation of Budget Structure Changes**

- Carbon Capture, and Storage will be renamed Carbon Capture, Utilization and Storage
- The Carbon Capture and Carbon Storage Control Points will become one Control Point and be renamed Carbon Capture, Utilization and Storage
- Carbon Use and Reuse remains the same and is moved to Carbon Utilization
- Post-Combustion Capture Systems remains the same
- Pre-Combustion Capture Systems remains the same
- Storage Infrastructure remains the same
- Advanced Storage R&D combines Advanced Storage R&D and Sub-Disciplinary Storage R&D

The CCUS program has three major subprograms: Carbon Capture, Carbon Utilization, and Carbon Storage.

**Carbon Capture**

Despite changes in U.S. electricity generation in recent years, coal is forecasted[1] to play a critical role in powering the Nation's electricity demand. Over the decades, power plants have made significant progress in reducing emissions of sulfur dioxide, nitrogen oxide, particulate matter, and mercury—and advancements in carbon capture technologies can put the United States within closer reach of cost-competitive, low emission power generation. The Carbon Capture subprogram supports Administration interests including clean coal technologies, reviving America's coal industry, and domestic energy production. FE continues to recognize opportunities to capture and utilize $CO_2$ generated from power generation and other industrial processes for enhanced oil recovery in both conventional and unconventional oil bearing formations.

Carbon capture from fossil fuel-fired generation is a technology solution for mitigating $CO_2$ emissions, and for concentrating $CO_2$ for high-value applications such as enhanced oil recovery (EOR). Research and development (R&D) that reduces the cost of carbon capture technologies can be applied to both the existing fleet of fossil fuel-fired power plants and new advanced generation power systems. These transformational carbon capture technologies have the potential to support the coal and natural gas sector while advancing U.S. leadership in low-emission generation technology innovation. Many of the same $CO_2$ capture technologies can be adapted by industry and applied to other industrial sources and natural gas fired power plants to address unique challenges such as differences in pollution control systems, oxygen content, and $CO_2$ concentrations, which will demand modifications to both the materials and systems configurations.

[1] U.S. Energy Information Administration, *Annual Energy Outlook 2017 with projections to 2050*, p. 69, www.eia.gov/aeo

The Carbon Capture subprogram is focused on early-stage research and development on post-combustion and pre-combustion $CO_2$ capture, novel compression technologies for new and existing fossil fuel-fired power plants and $CO_2$ utilization technologies to convert $CO_2$ to valuable products and commodities. Significant improvements are required to reduce parasitic energy load, and lower capital costs that can support the market potential for large quantities of $CO_2$ for economic utilization in EOR operations and conversion to high-value products. Low cost $CO_2$ can strengthen U.S. energy security by enabling the production of up to 60 billion barrels of stranded oil that would otherwise be uneconomic with current recovery practices.[2] Next generation EOR technology could increase recoverable domestic oil to over 130 billion barrels if "next generation" EOR techniques and transformational low cost $CO_2$ are available. [3] There is not enough low cost $CO_2$ available from natural sources or natural gas processing facilities to facilitate this recovery to occur. Transformational, low cost $CO_2$ capture could be adopted by industry through R&D conducted in this subprogram and will enable this important domestic energy resource to be recovered by allowing economic recovery of $CO_2$ from power plants and other industrial sources.

In FY 2019, the Carbon Capture subprogram will focus on early-stage R&D on transformational gas separation technologies that can significantly reduce the cost of $CO_2$ capture and utilization. Transformational capture systems are a set of disruptive technologies that can significantly reduce the cost of capture, targeting a Cost of Electricity (COE) at least 30% less than state of the art (~$30/tonne). These transformational technologies will be designed to adapt to the operational demands of advanced power systems and adjust to the increasing need for fossil fuel power plants to at times be load-following/demand responsive electricity generators.

The subprogram has completed its efforts in 1st generation technology through successful demonstration projects. The proposed FY 2019 activities represent a purposeful shift away from later-stage R&D such as development 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. The program will also investigate approaches to utilize CO2 and optimize capture process.

Post-Combustion Capture Systems

The Post-Combustion Capture Systems activity will focus on early-stage R&D on transformational technologies that separate $CO_2$ after the fuel is combusted, at both new and existing fossil fuel-fired power plants, and can achieve a 30% reduction in COE compared to a facility operating with current state of the art amine systems. Critical R&D milestones have been achieved since 2008 in laboratory through pilot-scale testing of 2nd generation $CO_2$ capture approaches through multiple small-scale (0.5-1 MWe) slipstream tests; it is expected that industry will now continue the development, adoption, and commercialization of these technologies.

Proposed activities in FY 2019 will continue to focus on the early-stage R&D that will lead to discovery of novel $CO_2$ separation technologies such as non-aqueous solvents, membranes, advanced sorbents, and cryogenic processes. This will be achieved through the use of advanced computational tools for rational material discovery, design of advanced capture systems components, and synthesis of these materials with characterization of their physical properties. A competitive funding solicitation, complemented with existing laboratory R&D will expand efforts on early-stage research with DOE national laboratories, academia, and industry research organizations.

Pre-Combustion Capture Systems

The Pre-Combustion Capture Systems activity will focus on generating knowledge that enables industry to develop transformational technologies for pre-combustion capture that achieve a 30% reduction in the COE relative to state of the art capture technologies. Technologies for pre-combustion capture complement research that is

[2] ARI. (2011). Improving Domestic Energy Security and Lowering CO2 Emissions with "Next Generation" CO2-Enhanced Oil Recovery (CO2-EOR).
[3] Ibid

ongoing in creating new fundamental knowledge of advanced gasification systems, and could be applied to other industrial processes in the chemical industry. Lowering the cost of $CO_2$ separation from pre-combustion systems is a critical step toward enabling industry to develop and commercialize technologies that open markets for the use of this captured $CO_2$ for EOR and conversion to higher value products or enabling long term storage.

Requested FY 2019 funds will continue to support discovery of new gas separation materials and laboratory- and bench-scale tests of transformational technologies such as advanced solvents, sorbents, and membranes, including process intensification efforts that combine two or more technology concepts. Funding will support both existing early-stage R&D projects and new technology approaches through a competitive funding solicitation.

**Carbon Utilization**

Carbon utilization is the conversion of carbon-containing feedstocks to some other high-value product, or the direct utilization of these materials for some economic benefit. CO2 is one such feedstock that can be converted into other products or used directly. There are a number of methods available to utilize $CO_2$, such as from increasing the yield of depleted oil fields, to using $CO_2$ as a working fluid or as a chemical feedstock, and for carbonation of beverages. Some methods are already commercially available while others are in the very early stages of R&D.

The Carbon Utilization subprogram focuses on using captured/concentrated $CO_2$ and/or carbon-containing substances, or directly using $CO_2$ from flue gas or mixed gas streams, and converting it into valuable products. Critical challenges identified in the utilization focus area include the cost-effective use of $CO_2$ and other carbon-containing substances as a feedstock for chemical synthesis, or its integration into pre-existing products. The efficiency of reaction conversion, amount of $CO_2$ stored in a product and energy use of these utilization processes also represent a critical challenge that FE is uniquely positioned to address.

Research activities are aimed at developing technologies, systems, and strategies to advance novel mineralization, biological, physical and chemical pathways toward the production of value-added products. Products include goods such as cement, concrete, building products, chemicals, fuel, plastics, bioplastics, nutraceuticals, animal feed; as well as services such as cooling and energy storage. Research activities seek to develop innovative approaches that enable competitive process substitution leading to saleable products in existing markets, and that enable introduction of carbon-derived products to new markets.

<u>Carbon Use and Reuse</u>

The Carbon Use and Reuse activity focuses on developing technologies for beneficial use of $CO_2$ other than through EOR. Beneficial uses include the conversion of $CO_2$ to higher-value products such as chemicals, plastics, building materials, curing for cement, and the integration of carbon utilization technologies with fossil fuel power plants, such as biological conversion systems (i.e., algae). The primary objective of carbon use and reuse technology development is to lower the near-term cost of CCUS through the creation of value-added products from the conversion of $CO_2$.

In FY 2019 this subprogram activity area will focus on early-stage $CO_2$ utilization technologies that develop additional markets for fossil energy resources. Areas of research include, but are not limited to, new 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 ($CO_2$ and methane) to higher value products such as nutraceuticals, bio plastics, and animal feed. Specific focus on catalysts made from low- cost materials, using nano-manufacturing and rational design, will be pursued to lower the energy penalty and capital cost of the conversion process. This work will be implemented though a targeted competitive funding solicitation and also existing work with the DOE National Laboratories.

**Carbon Storage**

The Carbon Storage subprogram is focused on development of technologies for the safe and permanent geologic storage of captured $CO_2$. Federal government sponsored research and development in this area is critical to validating and increasing confidence in the safety, economically feasibility, and permanence of $CO_2$ injection and storage. This area of research is in the national interest as it has long-term economic and environmental benefits for the U.S. and industry. Further advancements in this area will help ensure that industry has sound information to economically and safely assess and monitor long-term storage of $CO_2$, ensuring the viability of geologic carbon storage as an effective technology solution that can be implemented on a large-scale.

Captured $CO_2$ can be stored in deep saline formations and/or injected for enhanced oil recovery (EOR) operations. For example, over 60 billion barrels of known U.S. oil reserves exist that could be produced with EOR if large quantities of low cost $CO_2$ were available. The production of additional tens of billions of barrels could be enabled by advancements in $CO_2$ storage technologies that optimize pore space utilization and could optimize retention of the $CO_2$ in the subsurface.[4]

The subprogram is focused on early-stage R&D in five primary storage types—saline formations, oil and natural gas reservoirs, unmineable coal seams, basalts, and organic shales—and in geologic reservoirs across eleven different geologic storage depositional classes. Coupled simulation tools, characterization methods, and monitoring technologies developed and validated through the Carbon Storage subprogram will improve storage efficiency, reduce overall cost, decrease subsurface uncertainties, and identify ways to ensure that operations are safe, economically viable, and environmentally benign.

Storage Infrastructure

The Storage Infrastructure activity is focused on early-stage R&D to identify on and offshore geologic storage resources across various depositional environments; evaluate mitigation strategies associated with future injection projects that have existing wellbores, faults, and fractures; and assess features that affect the probability and mitigation of local and regional seismic events from changes in the state of stress during injection.

Existing field projects have conducted regional and site-specific characterization and validation; simulation and risk assessment; and applied monitoring, verification, accounting, and assessment technologies (MVAA) to various onshore storage reservoirs, including both EOR and saline. These projects have been successful in improving our understanding of $CO_2$ injection, fluid flow and pressure migration, and geochemical impacts from $CO_2$ injection. They have also aided development of cost-effective monitoring technologies in all storage types.

Early-stage R&D projects to understand the potential for future storage reservoirs in offshore oil, gas, and saline bearing formations were initiated in FY 2017. Regional offshore characterization activities are focused on identifying regional opportunities for carbon capture, utilization, and storage (CCUS), $CO_2$ sources, and priority opportunities for field sites.

Due to the reprioritization across this subprogram, funding will focus on supporting early-stage characterization research with the aim to leverage existing field sites where possible. Existing field projects such as the Brine Extraction Storage Tests and Regional Carbon Sequestration Partnerships or large scale field characterization activities through CarbonSAFE, are being phased out to completion.

[4] ARI. (2011). Improving Domestic Energy Security and Lowering $CO_2$ Emissions with "Next Generation" $CO_2$-Enhanced Oil Recovery ($CO_2$-EOR).

Advanced Storage R&D

The Advanced Storage R&D activity is focused on developing and validating storage monitoring, simulation and risk assessment technologies, and advanced wellbore technologies to detect and mitigate wellbore issues from both short and long term exposure of $CO_2$. These advanced technologies have the potential to safely, permanently, and cost effectively manage the injection and associated storage of $CO_2$ in geologic reservoirs in both onshore and offshore project settings.

Reprioritization across the subprogram has shifted emphasis to early-stage research focused on technologies that will have significant impact on the program goals to ensure permanent storage and reduced risk. Adaptive reservoir management is an early-stage R&D area in which substantial gains can be made toward achieving program goals.

Proposed activities in FY 2019 include early-stage research focused on adaptive reservoir management with emphasis on reducing the risks of carbon storage in the subsurface. This will include developing tools and methods for improved monitoring, detection, mapping and simulation of fractures and faults, as well as microseismic data analysis and interpretation, to increasing our ability to monitor and manage the stress state of the subsurface at field and basin-scales. These work elements may include uncertainty quantification to aid in the development of risk management strategies. This work will be implemented through existing projects or a targeted competitive funding solicitation.

The Sub-Disciplinary Storage R&D activity, which centered primarily on assessment and validation of subsurface coupled system models and the ability to quantify risks, will be discontinued as a budget line. For FY19 support for the National Risk Assessment Partnership (NRAP) and development of the Energy Data Exchange (EDX) system will continue to be supported under the Advanced Storage R&D budget line.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| ***Carbon Capture, Utilization & Storage: $196,300,000*** | ***$40,000,000*** | ***-$156,300,000*** |
| **Carbon Capture: $101,000,000** | **$20,000,000** | **-$81,000,000** |
| Post-Combustion Capture Systems: $86,000,000 | $17,000,000 | -$69,000,000 |
| Funding will be used to support the Discovery of Carbon Capture Substances and Systems (DOCCSS) initiative focused on the use of computational chemistry and rational design of novel $CO_2$ separation materials, rapid synthesis and testing, and manufacturing to accelerate the discovery of transformational capture materials and systems. A new FOA will be issued to select projects that represent a partnership between industry and academia to develop these transformational $CO_2$ capture processes. | Funding will provide additional support for the four laboratories awarded for the DOCCSS initiative and focused on the use of computational chemistry and rational design of novel $CO_2$ separation materials, rapid synthesis and testing, and advanced manufacturing to accelerate the discovery of transformational capture materials and systems. A new FOA will be issued to select projects that represent a partnership between industry and academia to develop these transformational $CO_2$ capture processes. | The decrease in funding reflects a reprioritized focus on transformational carbon capture technologies at the early R&D stages of development. Previously funded later-stage efforts such as 2nd generation technology development including small- and large-scale pilot tests at the National Carbon Capture Center (NCCC) will be left to industry to continue to develop, adopt, and commercialize. |
| Pre-Combustion Capture Systems: $15,000,000 | $3,000,000 | -$12,000,000 |
| Advanced computational materials discovery, laboratory scale and bench scale slipstream research and development for pre-combustion capture technologies will continue. | Issue a FOA to select a limited number of projects focused on the discovery of new pre-combustion capture processes. | The decrease in funding reflects a reprioritized focus on early-stage research and development. No funding is requested for the NCCC as the pre-combustion test facility is being decommissioned in 2018. |
| **Carbon Utilization: $10,000,000** | **$9,000,000** | **-$1,000,000** |
| Carbon Use and Reuse: $10,000,000 | $9,000,000 | -$1,000,000 |
| Early-stage research projects focused on catalysis of carbon wastes from coal will focus on catalytic materials made from low cost materials and nano-manufacturing to reduce capital and energy costs for conversion to useful products. | Early-stage research projects focused on catalysis of carbon wastes from coal will focus on catalytic materials made from low cost materials and nano-manufacturing to reduce capital and energy costs for conversion to useful products. | The decrease in funding reflects a reprioritized focus on early-stage research throughout the coal R&D portfolio. |

| | | |
|---|---|---|
| **FY 2017 Enacted** | **FY 2019 Request** | **Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted** |
| **Carbon Storage $85,300,000** | **$11,000,000** | **-$74,300,000** |
| Storage Infrastructure $45,300,000 | $2,000,000 | -$43,300,000 |
| In FY 2017 Storage Infrastructure will be renamed Storage Field Management to better reflect that this subprogram validates technologies and best practices in the field for the characterization, injection, post-injection monitoring, reservoir and operations management related to geologic storage.<br>Funding will support up to two site characterization projects (>50 million metric tons) to conduct characterization, design, simulations, and monitoring to reduce risk and increase certainty in obtaining and meeting Class VI regulatory requirements.<br>Phase II of the Brine Extraction Storage Test (BEST) field validation, examining engineering strategies/approaches for managing formation pressure, predicting and monitoring the differential pressure plume movement in the subsurface, and validating differential pressure plume predictions, will be supported.<br>Collaboration with international sites (e.g., Shell Quest; METI Tomakomai) will be supported to increase knowledge sharing and enhance domestic technology development. | • Focus on characterization and modeling of opportunities for geologic storage in on- and/or offshore resources.<br>• All field projects including BEST, RCSP field sites, and international collaboration activities will be phased out of the program and evaluated to gather knowledge gained and transfer to industry. | The decrease in funding reflects a reprioritized focus on early-stage technologies and close-out of later-stage R&D projects. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| Advanced Storage R&D (merged with Sub-Disciplinary Storage R&D) $40,000,000 | $9,000,000 | -$31,000,000 |
| Funding will support early-stage research on plume behavior, pressure front, stresses, geomechanical deformation, simulations and reservoir performance and storage efficiency for associated storage in hydrocarbon bearing and saline field projects; as well as mechanical and flow properties for reservoirs, seals, and fracture networks on various reservoirs.<br>Funding will support early-stage research tools for improved mapping and characterization of fractures and faults; and develop novel tools for quantification of plume volume in subsurface.<br>Funding will support early stage research on technologies that can detect and mitigate wellbore issues from both short and long term exposure of $CO_2$.<br>(*From Sub-Disciplinary Storage R&D*) Research focused on storage assessment and model validation for long-term and system-wide modeling including uncertainty quantification; integration of monitoring within risk assessment models; development of capabilities to test risk assessment and monitoring capabilities; studies on conformance; and evaluation of mitigation options will be supported.<br>(*From Sub-Disciplinary Storage R&D*) Expansion of EDX from a NETL-centric resource to an Office of Fossil Energy-wide intramural and extramural resource in support of subsurface science R&D will be supported. | • Funding will support existing or new early-stage research focused on adaptive reservoir management to include wellbore integrity, simulations and reservoir performance and storage efficiency for associated storage in hydrocarbon bearing and saline field projects, plume behavior, pressure front, stresses, geomechanical deformation, mechanical and flow properties for reservoirs, seals, and fracture networks on various reservoirs, and tools for improved subsurface characterization including improved mapping of fractures and faults.<br>• NRAP Research focused on storage assessment and model validation for long-term and system-wide modeling including uncertainty quantification; integration of monitoring within risk assessment models; development of capabilities to test risk assessment and monitoring capabilities; studies on conformance; and evaluation of mitigation options will be supported.<br>• Expansion of EDX from a NETL-centric resource to an Office of Fossil Energy-wide intramural and extramural resource in support of subsurface science R&D will be supported. | The decrease in funding reflects a reprioritized focus on early-stage technologies. Program supported research will focus on high priority technologies with the greatest impact on program goals to ensure safe, affordable, and secure storage containment. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| Sub-Disciplinary Storage R&D: N/A | | This budget line will be discontinued. Any future activities associated with Sub-Disciplinary Storage R&D will be include in Advanced Storage R&D. |
| Carbon Use and Reuse: N/A | | Moved to a separate budget line under Carbon Utilization in the FY 2019 proposed restructure. |

**Overview**

**Description**

The STEP activity line was created within Advanced Coal Energy Systems (formerly CCS and Power Systems) by FY 2015 Enacted appropriations.

The Supercritical Transformational Electric Power Generation (STEP) program is focused on R&D to advance higher efficiency and lower cost technologies that advance use of $sCO_2$ power cycles, enabling greater operational efficiency. FY 2019 funding will support, through competitively awarded funding opportunity announcements, advances in the next generation of lower cost, higher performance recuperators, as well as next generation turbine components such as seals, bearings and rotors needed tom improve efficiency, reduce cost, and increase durability.

No funding is requested for the STEP 10MW pilot. Unobligated balances from prior years will be used to fund a rescoped simple cycle pilot using supercritical CO2 as the fluid but with only one compressor and recuperator to reduce cost and obtain valuable system integration data.

## Supercritical Transformational Electric Power (STEP)

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Supercritical Transformational Electric Power (STEP) $24,000,000** | **$25,000,000** | **+$1,000,000** |
| • Continue construction of the 10 MWe Supercritical Transformational Electric Power (STEP) pilot scale facility. | • Announce FOAs to support advances in the next generation of lower cost, higher performance recuperators as well as the next generation turbine components such as seals, bearings, and rotors needed to improve efficiency, reduce cost, and increase durability of power systems that use supercritical $CO_2$ as a working fluid. | • Funding is requested for FOAs rather than pilot facility construction. |

## Advanced Coal Energy Systems
## Transformational Coal Pilots

### Overview

The Consolidated Appropriations Act of 2017 provided $50 million "*to remain available until expended, shall be for the transformational coal technologies pilot program described in the explanatory statement described in section 4 (in the matter preceding division A of this consolidated Act).*" (H.R. 244) The funding is to support a new solicitation for two large-scale pilots which focus on transformational coal technologies that represent a new way to convert energy to enable a step change in performance, efficiency, and the cost of electricity compared to today's technologies. Such technologies include thermodynamic improvements in energy conversion and heat transfer, such as pressurized oxygen combustion and chemical looping, and improvements in carbon capture systems technology. In making the awards for large-scale pilots, the Department should prioritize entities that have previously received funding for these technologies at the lab and bench scale.

The solicitation was announced by the Department in August of 2017, with successful applications scheduled to be announced in early CY 2018.

### Description

No funding is requested in FY 2019 due to the subprogram's refocusing on early-stage R&D. FY 2017 and FY 2018 funding will be used Award up to 4 full front end engineering and design (FEED) studies that will proceed into down select of 2 large pilots.

### Transformational Coal Pilots

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Transformational Coal Pilots $50,000** | **$0** | **-$50,000** |
| • The solicitation was announced by the Department in August of 2017, with successful applications scheduled to be announced in early CY 2018. | • No funding is requested. | • The subprogram is refocusing on early-stage R&D and other program priorities. |

## NETL Coal Research and Development

### Description

The National Energy Technology Laboratory (NETL) is an integral part of the U.S. Department of Energy (DOE) national laboratory system. There are 17 laboratories in the DOE laboratory system; NETL is unique in that it is the only government owned, government operated laboratory. NETL supports the DOE mission to advance the energy security of the United States, as well as Administration interests in domestic energy production, clean coal technologies, and reviving America's coal industry.

The Research and Development subprogram funds all NETL in-house research efforts. Specifically, Research and Development funding supports salaries and benefits, travel, personal protective equipment and other employee costs for the NETL staff of scientists and engineers who conduct in-house research activities for Fossil Energy Research and Development (FER&D) programs. Funding also is included for research-specific equipment maintenance agreements and software licenses and mission-critical laboratory equipment refresh. This subprogram supports research capabilities in the areas of computational engineering, material engineering and manufacturing, and geological and environmental systems. NETL in-house research supports program-specific activities in the areas of carbon capture, carbon storage, advanced energy systems, and cross-cutting research. This program also funds costs related to collaboration with universities, other national labs, state and local governments, and industry, as well as strategic energy analysis and research data management.

### Highlights of the FY 2019 Budget Request

The NETL Coal Research & Development request is $12.0M higher than the FY 2017 Enacted level. The requested increase will be used to invest in and expand enduring Fossil Energy core competencies enabling a collaborative innovative ecosystem to discover and mature advanced energy technologies along the entire value chain. Focused national laboratory-academia-industry partnerships will be used to increase the rate of discovery and development of technologies that will promote the Administration's priorities.

Enduring NETL core competencies include Materials Engineering & Manufacturing, Geological & Environmental Systems, Energy Conversion Engineering, Systems Engineering & Analysis, and Computational Science & Engineering. In FY 2019, NETL will adapt the Energy Materials Network national laboratory-based consortia model pioneered by the Office of Energy Efficiency and Renewable Energy to facilitate industry access to NETL and partnering laboratories' capabilities, tools, and expertise to accelerate the materials development cycle. The XMat consortium will be led by NETL and leverage high-throughput/combinatorial techniques, advanced computing, and advanced manufacturing capabilities throughout the National Laboratories to identify and design materials for applications in extreme environments such as those experienced in advanced fossil energy systems and the subsurface.

**NETL Coal Research and Development Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **NETL Coal Research and Development** | | | | |
| NETL Coal Research and Development | 38,000 | 37,742 | 50,000 | +12,000 |
| Federal FTEs | 165 | 165 | 165 | - |

**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **NETL Coal Research & Development:** A requested increase of $12,000,000 from the FY 2017 Enacted funding level will be used to invest in and expand enduring Fossil Energy core competencies enabling a collaborative innovative ecosystem to discover and mature advanced energy technologies along the entire value chain. Focused national laboratory-academia-industry partnerships will be used to increase the rate of discovery and development of technologies that will promote the Administration's priorities. | **+12,000** |
| **Total, NETL Coal Research & Development** | **+12,000** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **NETL Coal Research and Development $38,000,000** | **$50,000,000** | **+$12,000,000** |
| • Research and Development funding supports salaries and benefits, travel, personal protective equipment and other employee costs for the NETL staff of scientists and engineers who conduct in-house research activities for Fossil Energy Research and Development (FER&D) programs. Funding also is included for research-specific equipment maintenance agreements and software licenses and mission-critical laboratory equipment refresh.<br>• Funding also provides for contractor costs targeted toward collaboration, strategic energy analysis and research data management areas. | • Research and Development funding supports salaries and benefits, travel, personal protective equipment and other employee costs for the NETL staff of scientists and engineers who conduct in-house research activities for Fossil Energy Research and Development (FER&D) programs. Funding also is included for research-specific equipment maintenance agreements and software licenses and mission-critical laboratory equipment refresh.<br>• Funding also provides for costs targeted toward collaboration, strategic energy analysis and research data management areas. | • The requested increase will be used to invest in and expand enduring Fossil Energy core competencies enabling a collaborative innovative ecosystem to discover and mature advanced energy technologies along the entire value chain. Focused national laboratory-academia-industry partnerships will be used to increase the rate of discovery and development of technologies that will promote the Administration's priorities. |

**Natural Gas Technologies**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 43,000 | 42,708 | 5,500 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

Natural gas sourced from shales has the potential to significantly increase America's security of energy supply and lower prices for consumers. Along with oil and natural gas liquids, natural gas from shales is the foundation of America's newly emergent global energy dominance. Although shale gas has been produced in the United States for many decades, domestic reserves were relatively modest. As recently as 2006, the Energy Information Administration was projecting significant imports of natural gas to meet domestic demand. It has only been over the last decade that new horizontal drilling and hydraulic fracturing technologies have facilitated increased economic production. It is important to note that the "shale revolution" had its early start in technology R&D and field tests conducted by the DOE, leading to subsequent adoption and advancement by industry.

The Natural Gas Technologies Program addresses critical and emergent issues pertaining to the safe and sustainable production and transmission of domestic natural gas. Specifically, the Program's mission is to conduct early-stage R&D that supports the prudent development, distribution and storage of natural gas resources. The Program comprises two subprograms: Natural Gas Infrastructure Research and Development (new in FY 2019), and Gas Hydrates. Given the importance of natural gas in our energy system, it is critical to ensure the safety and reliability of related infrastructure to protect energy access. To that end, the new Natural Gas Infrastructure Research and Development subprogram will support early-stage R&D focused on innovative sensors and materials that enable industry to detect and reduce waste and improve the reliability and operational efficiency of natural gas transmission, distribution, and storage facilities. Specifically, the subprogram will conduct research in electrochemical point sensors for quantification of corrosion rates and environmental monitoring (e.g. pH), as well as distributed optical sensors for measuring temperature, pressure, natural gas composition, vibration and strain.

While shale gas has been discovered in sufficient quantities to now support and warrant U.S. liquefied natural gas (LNG) exports, the most plentiful supplies of natural gas throughout the world may in fact be the methane molecules trapped in ice-like structures called hydrates. The Gas Hydrates subprogram supports unique early-stage research to evaluate the occurrence, nature, and behavior of the potentially enormous naturally-occurring gas hydrate resources within the United States, with particular focus on the Arctic and Gulf of Mexico regions.

**Highlights of the FY 2019 Budget Request**

The Natural Gas Technologies Program will pursue the following major activities in FY 2019:

- Evaluate the occurrence, nature, and behavior of naturally occurring gas hydrates. The subprogram will assess the fundamental physio-chemical properties of hydrate bearing sediments for this potentially vast resource. In FY 2019, the subprogram intends to translate potential hydrate resources into latent energy assets via numerical simulations and pore scale visualization of hydrate bearing sediments. The subprogram will analyze materials obtained through field investigations conducted in the Gulf of Mexico to confirm the nature and regional context of gas hydrate deposits.
- Proposes a Natural Gas Infrastructure Research and Development (R&D) subprogram to support energy security and economic growth. The subprogram will focus efforts on early-stage research that will provide knowledge that can help industry to improve U.S. natural gas infrastructure. The FY 2019 request will fund early-stage technologies in targeted areas such as advanced materials and sensor research and development. When these technologies are further developed and deployed by industry they will improve the operational efficiency of natural gas transmission, distribution, and storage facilities.
- Proposes closeout and termination of the Environmentally Prudent Development subprogram.
- Proposes closeout and termination of the Emissions Mitigation and Quantification subprogram.

**Natural Gas Technologies Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Natural Gas Technologies** | | | | |
| **Gas Hydrates** | **19,800** | **19,666** | **3,500** | **-16,300** |
| **Emissions Mitigation from Midstream Infrastructure** | **7,000** | **6,952** | **0** | **-7,000** |
| **Emissions Quantification from Natural Gas Infrastructure** | **4,000** | **3,973** | **0** | **-4,000** |
| **Environmentally Prudent Development** | **12,200** | **12,117** | **0** | **-12,200** |
| **Natural Gas Infrastructure Research** | **0** | **0** | **2,000** | **+2,000** |
| **Total, Natural Gas Technologies** | **43,000** | **42,708** | **5,500** | **-37,500** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

SBIR/STTR:

- FY 2017 Transferred: SBIR $1,294: STTR: $182
- FY 2018 CR Annualized: SBIR $1,285: STTR: $181
- FY 2019 Request: SBIR $165: STTR: $23

**Natural Gas Technologies**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Natural Gas Technologies** | |
| **Gas Hydrates:** The decrease in funding is due to the termination of the planned field work in the Gulf of Mexico and Alaska, field flow testing, and development activities. | **-16,300** |
| **Emissions Mitigation from Midstream Infrastructure:** No funding is requested for the Emissions Mitigation from Midstream Infrastructure subprogram in FY 2019. | **-7,000** |
| **Emissions Quantification from Natural Gas Infrastructure:** No funding is requested for the Emissions Quantification from Natural Gas Infrastructure subprogram in FY 2019. | **-4,000** |
| **Environmentally Prudent Development:** No funding is requested for the Environmentally Prudent Development subprogram in FY 2019. | **-12,200** |
| **Natural Gas Infrastructure Research:** The increase in funding is for a new subprogram focused on improving the efficiency of midstream infrastructure. | **+2,000** |
| **Total, Natural Gas Technologies** | **-37,500** |

**Description**

Gas Hydrates

The Gas Hydrates subprogram will continue to evaluate the occurrence, nature, and behavior of naturally occurring gas hydrates. In order to take advantage of the immense, future potential energy supply from hydrates, the subprogram is leading efforts to characterize hydrate resources through early-stage research in several ways: numerical simulations, fundamental property characterization, and pore-scale visualization of hydrate-bearing sediments. This unique R&D will provide the foundation for industry investment in development and transformation of these resources to energy assets. Industry funding for research on developing gas hydrate energy resources and understanding associated environmental issues, even in collaboration with the federal government, remains limited due to the current abundant supply of economically recoverable natural gas resources, increasing industry concern about operational liabilities associated with deep-water scientific drilling using industry ships, and constraints within industry that prevent dedicating technical staff and other resources to long-range projects over near-term corporate profitability.

Subprogram activities funded in FY 2019 through competitively selected DOE National Lab R&D and existing projects will focus on characterization of laboratory-synthesized hydrate bearing sediments, which will provide critical input parameters for reservoir simulation of gas production. Numerical simulation efforts are designed to isolate and understand fundamental aspects of gas hydrate system behavior. This work will provide new insight into interactions between hydrate structure and matrix, and surrounding fluids and material. The subprogram intends to develop a comprehensive dataset for hydrate characterization and enhance understanding of hydrate behavior in natural settings.In FY 2019, the subprogram will also continue analyzing the results from field investigation work conducted during FY 2017 through existing projects under the FY 2016 funding opportunity announcement in the Gulf of Mexico to confirm the nature and regional context of gas hydrate deposits, and the physical properties and characteristics of gas hydrate-bearing sediments. This work will build on preliminary results gained from previously acquired seismic analysis, by analyzing and interpreting pressurized and unpressurized core samples and performing pressure perturbation experiments in the laboratory.

Natural Gas Infrastructure Research

The new Natural Gas Infrastructure Research subprogram is committed to generating new knowledge that industry can use to develop advanced, cost-effective technologies to improve operational reliability and reduce loss from natural gas transmission, distribution, and storage facilities. Priority areas for the subprogram include early-stage research in advanced materials for pipeline integrity and initiation of research on new passive sensor platforms. Development of magnetoelastic materials will allow for novel applications which are not feasible using other adaptive materials, while R&D in electrochemical materials will lead to the ability to quantify corrosion rates.

The subprogram will accelerate advances in materials science that, with additional scale up by industry, can enhance pipe integrity, reduce leaks, and improve the efficiency of midstream infrastructure operations. FER&D will specifically focus on early development of novel materials that can be utilized in liners and coatings. The subprogram will also support early-stage research through competitively selected DOE National Lab R&D on novel sensor technologies that can provide predictive analytics on pipeline corrosion rates via detection and monitoring of temperature, pressure, natural gas composition, vibration and strain. The proposed research entails topics and categories not addressed through efforts in other agencies, such as the Pipeline and Hazardous Materials Safety Administration, and that industry will not fund because the Federal and State gas pipeline operators and local utility distribution systems, which achieve a return on their investment through rate cases, are currently prohibited from including an R&D fee in customer rates and billing. Additionally, there is continuing reluctance within industry to dedicate technical assets and funds to projects with limited immediate discernible impact on profitability.

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Natural Gas Technologies $43,000,000** | **$5,500,000** | **-$37,500,000** |
| **Gas Hydrates $19,800,000** | **$3,500,000** | **-$16,300,000** |
| • Conduct early-stage research such as numerical simulations, fundamental property characterization, and pore-scale visualization of hydrate bearing sediments.<br>• Continue analyzing materials collected during FY 2017 in field investigations in the Gulf of Mexico to confirm the nature and regional context of gas hydrate deposits.<br>• Planning for field work in the Gulf of Mexico and North Slope of Alaska to improve understanding of hydrate characteristics and production potential.<br>• | • Conduct early-stage research such as numerical simulations, fundamental property characterization, and pore-scale visualization of hydrate bearing sediments.<br>• Continue analyzing materials collected during FY 2017 in field investigations in the Gulf of Mexico to confirm the nature and regional context of gas hydrate deposits. | • Decrease reflects the termination of field work in the Gulf of Mexico and DOE support for field tests in Alaska. |
| **Emissions Mitigation from Midstream Infrastructure $7,000,000** | **$0** | **-$7,000,000** |
| • Develop advanced, cost-effective technologies to detect and mitigate methane emissions from natural gas transmission, distribution, and storage facilities.<br>• Communicate results on methane emissions mitigation to stakeholders.<br>• Research projects focused on better quantifying methane emission from the natural gas value chain. | • No funding requested within the Natural Gas Technologies budget request. | • Decrease reflects the termination of the emissions mitigation subprogram. Research on improving midstream efficiency will be conducted under a new Natural Gas Infrastructure subprogram. |

| | | |
|---|---|---|
| **Emissions Quantification from Natural Gas Infrastructure** | | |
| **$4,000,000** | **$0** | **-$4,000,000** |
| • Advanced technologies to locate and measure methane emissions associated with the natural gas value chain. | • No funding requested within the Natural Gas Technologies budget request. | • Decrease reflects the termination of the emissions quantification subprogram. |
| **Environmentally Prudent Development $12,200,000** | **$0** | **-$12,200,000** |
| • Research to improve understanding of shale geology and fracture dynamics, as well as fluid flow and chemical interactions in unconventional reservoirs. | • No funding requested within the Natural Gas Technologies budget request. | • Decrease reflects the termination of the Environmentally Prudent Development Subprogram. Work on early-stage research on the development of the Nation's unconventional oil and gas resources will continue in the Unconventional Fossil Energy subprogram. |
| **Natural Gas Infrastructure Research $0** | **$2,000,000** | **+$2,000,000** |
| • No funding requested within the Natural Gas Technologies budget request. | • Funding will support research on advanced materials and sensors for midstream infrastructure. | • Early-stage research on advanced materials and sensors to increase efficiency in midstream infrastructure. |

**Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 21,000 | 20,857 | 14,000 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

The overall mission of the Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies Program is to provide information and generate knowledge that can be advanced by industry to enable sustainable and responsible development of domestic unconventional fossil energy resources. The prudent development of these natural resources supports the Nation's continued energy resilience and security.

Historically, most of the Nation's oil and natural gas has come from geologic formations that are termed "conventional": they have reservoir characteristics such as permeability and porosity, which typically make production and volumetric assessments relatively straightforward. With the advent of production from shales over the past decade, the United States has increasingly turned to "unconventional" reservoirs for domestic production. These "unconventional" reservoirs require complicated engineering measures, such as hydraulic fracturing, to improve reservoir access and enable production of oil and gas at commercially viable rates. The United States' unconventional oil and natural gas resources represent a fast-growing component of its energy portfolio.

Despite the dramatic success by industry in producing hydrocarbons from shales, there remain key technical and scientific questions that require early-stage R&D, and which are best addressed through targeted federal investment. At the target level the program will conduct both lab-based and field work on specific topics and challenges that, while of ultimate interest to industry, are early-stage and hence not able to yet attract industry investment. These include novel mechanisms for breaking rock to dramatically increase recovery factors, beyond the current industry standard of 7-10% of unconventional formations (conventional reservoirs have typical recovery factors of 25-40% of the original oil in place). It also includes better understanding of flow mechanisms and mechanics, and enhancing the ability to dynamically engineer the subsurface.

**Highlights of the FY 2019 Budget Request**

The Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies Program will pursue the following major activities in FY 2019:

- Fund on-going field laboratory research to improve understanding of shale geology and fracture dynamics, including projects selected under the FY 2017 funding opportunity announcement in key and emerging shale plays. These projects conduct field testing that complements research, modeling, and experimentation related to unconventional oil and natural gas development. Activities of these projects include borehole tests on the efficacy of production methods, surface and borehole geophysical and geochemical sampling of rocks and fluids, and determination and monitoring of water and gas chemistry at active oil and natural gas production sites.
- Conduct early-stage research and analysis through competitively selected DOE National Laboratory R&D on fluid flow and chemical interactions in unconventional reservoirs, and evaluation of causative factors of induced seismicity. This work is unique and separate from work being done by USGS (DOI) in addressing hazard assessments for induced seismicity, and instead addresses the opportunity to dynamically manage and manipulate the subsurface.

**Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Unconventional Fossil Energy Oil Technologies** | | | | |
| **Unconventional Fossil Energy Oil Technologies** | **21,000** | **20,857** | **14,000** | **-7,000** |
| **Total, Unconventional Fossil Energy Oil Technologies** | **21,000** | **20,857** | **14,000** | **-7,000** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

SBIR/STTR:

- FY 2017 Transferred: SBIR $632: STTR: $89
- FY 2018 CR Annualized: SBIR $628: STTR: $88
- FY 2019 Request: SBIR $421: STTR: $59

| Explanation of Major Changes ($K) | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies:** | |
| • The decrease in funding is the reduction in funding projects associated with the field laboratories focused on understanding of shale geology and fracture dynamics. | **-7,000** |
| **Total, Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies** | **-7,000** |

## Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies

**Description**

Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies

The Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies Program will conduct early-stage research focused on increasing understanding of shale geology and fracture dynamics through research and technology development at technology readiness levels ranging from proof of concept up to testing and prototype validation. The research and development activities will be conducted at existing Field Laboratories in key shale plays, gathering field data to inform modeling and analysis. Work will include fundamental research on fluid flow and chemical interactions in unconventional reservoirs. The Program will conduct analysis on the relationship between hydraulic fracturing and induced seismicity in order to understand and manipulate the subsurface. This includes the collection and evaluation of big data sets sourced from industry for causative factors of induced seismicity. Additional funding would support research focused on produced water treatment and reuse, and technologies for the conversion and utilization of stranded or flared gas. In FY 2019, these activities will be conducted through existing projects from previous competitive funding solicitations, new projects selected through a competitive solicitation focused on produced water and stranded/flared gas resources, and competitively selected DOE National Laboratory R&D.

**Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes<br>FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies $21,000,000** | **$14,000,000** | **-$7,000,000** |
| • Early-stage research on shale geology and fracture dynamics through existing and new Field Laboratories in emerging plays.<br>• Conduct early-stage research in fluid flow and chemical interactions in unconventional reservoirs and evaluation of causative factors of induced seismicity. | • Early-stage research on shale geology and fracture dynamics through existing and new Field Laboratories in emerging plays.<br>• Conduct early-stage research in fluid flow and chemical interactions in unconventional reservoirs and evaluation of causative factors of induced seismicity.<br>• Conduct research into advanced materials and technologies for treatment and reuse of produced water from unconventional oil & gas production<br>• Conduct research into advanced technologies for natural gas conversion and use in areas with stranded and/or flared natural gas resources. | • The decrease in funding is due to no new field laboratory projects planned for FY 2019. Funding at this level supports on-going research at the existing field laboratory sites. |

## Program Direction

### Overview

Program Direction provides for the Headquarters workforce responsible for the oversight and administration of the Fossil Energy Research and Development (FER&D) program. It also provides for technical staff at the National Energy Technology Laboratory (NETL) who perform Procurement, Finance and Legal functions, as well as Federal workforce and contractor support for Communications. It does not include NETL scientific researchers or project managers.

Also included in Program Direction is funding for the operations of the Import/Export Authorization Office. Import/Export Authorization is managed by the Division of Natural Gas Regulatory Activities within the Office of Oil & Natural Gas. The program has responsibility for regulating natural gas and liquefied natural gas (LNG) imports and exports under the Natural Gas Act of 1938, section 3, using both Federal staff and contractor support.

Each of these elements also fund the DOE-wide Human Resources Shared Service Center in Oak Ridge and the FE program office contribution to the DOE Working Capital Fund.

### Highlights of the FY 2019 Budget Request

The FY 2019 request reflects the planned HQ consolidation of International Affairs activities. The request reflects the transfer - of up to 8 Headquarters FTEs and associated funding of $1.1M from FER&D to the International Affairs office. Otherwise, there are no significant changes in the scope of work or activities required to effectively oversee the FER&D programs and projects. This budget request supports the Department's efforts to evaluate ways to improve operational efficiency.

Working Capital Fund (WCF) estimates for FY 2019 have increased due to projected inflation increases in existing WCF programs including cyber security, corporate business systems, building occupancy, interagency transfers, and telecommunications. FER&D's share of this estimated increase is included in the Program Direction Budget Request.

## Program Direction Funding ($K)

| | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Program Direction Summary** | | | | |
| **Washington Headquarters** | | | | |
| Salaries and Benefits | 16,259 | --- | 18,000 | +1,744 |
| Travel | 900 | --- | 440 | -460 |
| Support Services | 66 | --- | 500 | +434 |
| Other Related Expenses | 12,529 | --- | 11,200 | -1,329 |
| **Total, Washington Headquarters** | 29,754 | --- | 30,140 | -386 |
| | | | | |
| **National Energy Technology Laboratory** | | | | |
| Salaries and Benefits | 15,551 | --- | 16,000 | +449 |
| Travel | 475 | --- | 450 | -25 |
| Support Services | 9,030 | --- | 8,850 | -180 |
| Other Related Expenses | 3,210 | --- | 3,200 | -10 |
| **Total, National Energy Technology Laboratory** | 28,266 | --- | 28,500 | +234 |
| | | | | |
| **Import/Export Authorization** | | | | |
| Salaries and Benefits | 1,367 | --- | 1,617 | +250 |
| Travel | 20 | --- | 20 | 0 |
| Support Services | 0 | --- | 200 | +200 |
| Other Related Expenses | 593 | --- | 593 | 0 |
| **Total, Import/Export Authorization** | 1,980 | --- | 2,430 | +450 |

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Salaries and Benefits | 33,177 | --- | 35,617 | +2,440 |
| Travel | 1,395 | --- | 910 | -485 |
| Support Services | 9,096 | --- | 9,550 | +454 |
| Other Related Expenses | 16,332 | --- | 14,993 | -1,339 |
| **Total Program Direction** | **60,000** | **59,593** | **61,070** | **+1,070** |
| **Federal FTEs – HQ** | **116** | **116** | **108** | **-8** |
| **Federal FTE – NETL**[1] | **121** | **121** | **121** | **0** |
| **Federal FTE - Total** | **237** | **237** | **229** | **-8** |
| | | | | |
| **Support Services** | | | | |
| Technical Support | | | | |
| Headquarters | 66 | --- | **500** | **+434** |
| NETL | 0 | --- | **0** | **0** |
| Import/Export Authorization | 0 | --- | **200** | **+200** |
| Total, Technical Support | **66** | --- | **700** | **+634** |
| | | | | |
| Management Support | | | | |
| Headquarters | **0** | --- | **0** | **0** |
| NETL | **9,030** | --- | **8,850** | **-180** |
| Import/Export Authorization | **0** | --- | **0** | **0** |
| Total Management Support | **9,030** | --- | **8,850** | **-180** |
| **Total, Support Services** | **9,096** | --- | **9,550** | **+454** |
| | | | | |
| **Other Related Expenses** | | | | |
| Headquarters | 12,529 | --- | **11,200** | **-1,329** |
| NETL | 3,210 | --- | **3,200** | **-10** |

[1] Additional NETL FTEs are funded within the NETL Coal Research and Development and NETL Research and Operations budget lines.

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Import / Export Authorization | 593 | --- | **593** | **0** |
| **Total, Other Related Expenses** | **16,332** | --- | **14,993** | **-1,339** |

## Program Direction

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Program Direction $60,000,000** | **$61,070,000** | **$1,070,000** |
| **Salaries and Benefits $33,177,000** | **$35,617,000** | **$2,440,000** |
| • The funding supports HQ Federal staff who provide monitoring (oversight and audit) activities for the FER&D portfolio. | • The funding supports HQ Federal staff who provide monitoring (oversight and audit) activities for the FER&D portfolio. | • HQ net increase of $1,741 thousands allows HQ to fully staff at the requested level of FTEs. The 2017 Enacted Salaries & Benefits required vacancies in certain key positions. |
| • The funding supports the technical Federal staff at the National Energy Technology Laboratory. The staff covered in this area provide for management of the Lab, communications, legal, acquisition and finance activities. | • The funding supports the technical Federal staff at the National Energy Technology Laboratory. The staff covered in this area provide for management of the Lab, communications, legal, acquisition and finance activities. | • NETL increase of $449 thousand allows NETL to fully staff at the requested level of FTEs. The 2017 Enacted Salaries & Benefits required vacancies in certain key positions. |
| **Travel $1,395,000** | **$910,000** | **-$485,000** |
| • Travel includes funding for management meetings, training, etc. Instituted travel reduction to comply with the OMB directive for reduced travel from FY 2010 levels. | • Travel includes funding for management meetings, training, etc. Instituted travel reduction to comply with the OMB directive for reduced travel from FY 2010 levels. | • 35% reduction driven by HQ travel reductions, consistent with reduced extramural research activities. |
| **Support Services $9,096,000** | **$9,550,000** | **$454,000** |
| • Support Services at Headquarters includes technical support, IT support, and administrative support. | • Support Services at Headquarters includes; technical support, IT support, site operations support, administrative support. | • HQ increase reflects full cost of required support services and additional technical support at the Import/Export Authorization office. |
| • Support services at NETL include management and communications support, as well as finance and acquisition technicians. | • Support services at NETL include management and communications support, as well as finance and acquisition technicians. | • NETL reduction driven by efficiency efforts. |

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **Other Related Expenses $16,332,000** | **$14,993,000** | **-$1,339,000** |
| • The activities supported by this line item include E-Government initiatives, Working Capital fund, computer systems and support, contractual services for HQ and environmental, security, safety, and health requirements at HQ and Human Resources shared service center payments.<br>• The activities supported by this line item include staff replenishment and development-related activities, as well as general materials and supplies | • The activities supported by this line item include E-Government initiatives, Working Capital fund, computer systems and support, contractual services for HQ and environmental, security, safety, and health requirements at HQ and Human Resources shared service center payments. | • Decrease reflects efficiency efforts, partially offset by an increase in the amount of funds required to contribute to the Working Capital Fund for Cyber Security upgrades. |

**Special Recruitment Programs**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 700 | 695 | 200 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

The Office of Fossil Energy (FE) utilizes educational programs, such as the Mickey Leland Energy Fellowship (MLEF), Minority Educational Institution Student Partnership Program (MEISPP), and the DOE Scholars Program to support an increase in the number of females and under-represented minorities entering the scientific and engineering career fields within the U.S. workforce. The MLEF Program, developed by FE, is a ten-week summer educational program that offers undergraduate, graduate, and post-graduate students majoring in science, technology, engineering, and mathematic (STEM) disciplines the opportunity to learn about the programs, policies, and research and development initiatives within the Office of Fossil Energy and the challenges in providing clean, affordable energy for future generations. The MEISPP and DOE Scholars Programs also provide students the opportunity to gain work experience and learn about the FE and DOE missions.

**Highlights of the FY 2018 Budget Request**

In FY 2018, a diverse group of undergraduate, graduate, and post-graduate students in science, technology, engineering, and mathematic majors will be recruited and selected to participate in the MLEF program. Students may also be selected into the MEISPP and DOE Scholars Program, as funding permits. All participants in the MLEF will complete a hands-on research project under the mentorship of a Fossil Energy scientist, researcher, or program official. MEISPP and DOE Scholars will participate on challenging assignments supporting the FE mission.

**Special Recruitment Programs Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Special Recruitment Programs | 700 | 695 | 200 | -500 |
| **Total, Special Recruitment Programs** | **700** | **700** | **200** | **-500** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Special Recruitment Programs**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **Special Recruitment Programs:** Funding is reduced by 71 percent; the program will continue at a reduced level. | **-500** |
| **Total, Special Recruitment Programs** | **-500** |

**Special Recruitment Programs**

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | FY 2019 vs FY 2017 |
|---|---|---|
| **Special Recruitment Programs $700,000** | **$200,000** | **-$500,000** |
| • A diverse group of undergraduate, graduate, and post-graduate students in science, technology, engineering and mathematic majors will be recruited and selected to participate in the MLEF program, the MEISPP, or DOE Scholars program. Provides students opportunity to gain hands-on research and work experience and learn more about the DOE and FE missions. | • A diverse group of undergraduate, graduate, and post-graduate students in science, technology, engineering and mathematic majors will be recruited and selected to participate in the MLEF program, the MEISPP, or DOE Scholars program. Provides students opportunity to gain hands-on research and work experience and learn more about the DOE and FE missions. | The decrease in funding is due to an envisioned reduction in program size due to reprioritizations across the FER&D organization. |

**NETL Infrastructure**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 40,500 | 40,225 | 38,000 |

*A full-year 2018 appropriation was not enacted at the time the budget was prepared; therefore, the budget assumes operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. These amounts are shown only at the Congressional control level and above, below that level, a dash (—) is shown.

**Overview**

The NETL Infrastructure Program supports the fixed costs of NETL's lab footprint in three geographic locations: Morgantown, WV; Pittsburgh, PA; and Albany, OR. Table 1 below provides relevant information on the relative sizes of the sites.

The NETL Infrastructure Program comprises the following subprograms:

(1) **High Performance Computer** provides funding for the ongoing 3-year lease of Joule, NETL's high performance computer. Joule was originally commissioned in 2012 and funding was first provided for a refresh in FY 2017.

(2) **Plant and Capital Equipment** includes repairs to existing laboratory facilities and general-purpose buildings and site-wide infrastructure. Priorities for funding are established to ensure compliance with life safety standards, ensure critical laboratory research facilities and infrastructure, and comply with High Performance Sustainable Building goals.

(3) **Safeguards and Security** provides funds to ensure protection of workers (physical and cyber), the public, the environment, facilities, and operations in performing the FER&D mission.

(4) **Environmental Restoration** supports NETL's Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) obligations across all NETL sites and two off-site locations in Wyoming.

Table 1: Comparison of Physical Footprint, Workforce, and Value of Assets by Campus and in Total, National Energy Technology Laboratory as of January 21, 2018

| | Morgantown | Pittsburgh | Albany | Total NETL |
|---|---|---|---|---|
| Buildings | 47 | 28 | 37 | 112 |
| Sq. Ft. of building space | 456,820 | 431,614 | 254,472 | 1,142,906 |
| Acres | 136.0 | 62.6 | 43.9 | 242.5 |
| NETL Federal Workforce (FTEs) | 226 | 224 | 38 | 488 |
| NETL Contractor Workforce (FTEs) | 386 | 323 | 56 | 765 |
| Assets Replacement Value | $230.6M | $207.0M | $111.9M | $549.5M |

Table 2: Reconciliation of FER&D Federal Employees (FTEs)

| Program FTEs are funded in: | | | | |
|---|---|---|---|---|
| | | **FY 2017** | **FY 2018** | **FY 2019** |
| NETL Coal Research & Development | | 165 | 165 | 165 |
| NETL Program Direction | | 121 | 121 | 121 |
| NETL Research & Operations | | 236 | 217 | 217 |
| TOTAL NETL | | 522 | 503 | 503 |
| FE HQ Program Direction | | 116 | 112 | 108 |
| **TOTAL FER&D** | | **638** | **615** | **611** |

**Highlights of the FY 2019 Budget Request**

The NETL Infrastructure request is $2.5M lower than the FY 2017 Enacted level. While the NETL Infrastructure line funds primarily fixed costs, the overall reduction in Fossil Energy R&D requested funding necessitates the prudent identification of cost reduction opportunities across the board. Funding to maintain the three-year lease of NETL's high performance computer, costs related to safeguards and security, and costs for environmental restoration are prioritized and maintained constant. Within Laboratory and Site wide facilities, funding for required laboratory capital projects are also prioritized. Cost reductions are driven by the deferral of low-risk maintenance capital and operating expenditures for office buildings and site wide infrastructure.

**FY 2019 Departmental Crosscuts**
**($K)**

| Cybersecurity | |
|---|---|
| 2018 Request | 2019 Request |
| 3,183 | 3,183 |

**NETL Infrastructure**

Within the FY 2019 Budget Request, the NETL Infrastructure line supports one Departmental Crosscut: Cybersecurity. For FER&D, this includes operation and enhancement of the FER&D cybersecurity policy and program as it relates to the enterprise computing environment at field locations. Key activities include cybersecurity policy implementation, governance and oversight activities, incident detection and response through continuous monitoring and diagnostics, and meeting Departmental requirements for the Identity Control and Access Management initiative. Within the FY 2019 budget request for NETL Infrastructure, $3.183 million will be used to support these crosscutting cyber activities. Cybersecurity is funded under the Safeguards and Security subprogram.

**NETL Infrastructure Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **NETL Infrastructure** | | | | |
| Super Computer | 5,500 | --- | 5,500 | 0 |
| Laboratory & Site wide Facilities | 26,324 | --- | 23,500 | -2,824 |
| Safeguards and Security | 6,454 | --- | 7,000 | +546 |
| Environmental Restoration | 2,222 | --- | 2,000 | -222 |
| **Total, NETL Infrastructure** | **40,500** | **40,226** | **38,000** | **-2,500** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**NETL Infrastructure**
**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **NETL Infrastructure:** A requested decrease of $2,500,000 from the FY 2017 Enacted funding level reflects reduced Laboratory and Site wide Facilities funding at NETL to maintain mission-relevant laboratory facilities. | **-2,500** |
| **Total, NETL Infrastructure** | **-2,500** |

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **NETL Infrastructure $40,500,000** | **$38,000,000** | **-$2,500,000** |
| **High Performance Computer $5,500,000** | **$5,500,000** | **0** |
| • Funding is for the ongoing 3-year lease of Joule, NETL's high performance computer. Joule was originally commissioned in 2012 and funding was first provided for a refresh in FY 2017. | • Funding is for the ongoing 3-year lease of Joule, NETL's high performance computer. Joule was originally commissioned in 2012 and funding was first provided for a refresh in FY 2017 | • No change |
| **Laboratory and Site wide Facilities $26,324,000** | **$23,500,000** | **-$2,824,000** |
| • Funding includes construction of new, and renovation of existing, laboratory facilities and general-purpose buildings and site-wide infrastructure. Priorities for funding are established to ensure compliance with life safety standards, ensure critical laboratory research facilities and infrastructure, and comply with High Performance Sustainable Building goals | • Funding includes repairs to existing, laboratory facilities and general-purpose buildings and site-wide infrastructure. Priorities for funding are established to ensure compliance with life safety standards, ensure critical laboratory research facilities and infrastructure, and comply with High Performance Sustainable Building goals | • NETL will use funding to maintain mission-relevant laboratory facilities. The reduction in funding will result in an increase in deferred maintenance of site wide facilities and infrastructure. |
| **Safeguard and Securities $6,454,000** | **$7,000,000** | **+$546,000** |
| • Funding is to ensure protection of workers (physical and cyber), the public, the environment, facilities, and operations in performing the FER&D mission. | • Funding is to ensure protection of workers (physical and cyber), the public, the environment, facilities, and operations in performing the FER&D mission | • Funding increase reflects cost increases in physical security and environmental compliance costs. |
| **Environmental Restoration $2,222,000** | **$2,000,000** | **-$222,000** |
| • Continue active operation and maintenance of the air sparge remediation system at Rock Springs Sites 4, 6, 7, 9, and 12 as well as well as a 10-year surface revegetation at the Hoe Creek Site. Continue RCRA-related on-site regulatory, corrective, preventative, and maintenance activities – such as asbestos and lead abatement, waste minimization, and pollution prevention – along with the NETL Albany ground water investigation and compliance activities. | • Continue active operation and maintenance of the air sparge remediation system at Rock Springs Sites 4, 6, 7, 9, and 12 as well as well as a 10-year surface revegetation at the Hoe Creek Site. Continue RCRA-related on-site regulatory, corrective, preventative, and maintenance activities – such as asbestos and lead abatement, waste minimization, and pollution prevention – along with the NETL Albany ground water investigation and compliance activities. | • Funding reduction reflects natural spending trajectory as remediation activities are completed. |

**Plant and Capital Equipment Capital Summary**
**($K)**

| | FY 2017 Enacted | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|
| **Capital Operating Expenses Summary (including (Major Items of Equipment (MIE))** | | | |
| Plant Projects (GPP and IGPP) (<$10M) | 15,782 | 15,000 | -782 |
| **Total, Capital Operating Expenses** | **15,782** | **15,000** | **-782** |
| | | | |
| **Plant Projects (GPP and IGPP) (Total Estimated Cost (TEC) <$10M)** | | | |
| Total Plant Projects (GPP/IGPP) (Total Estimated Cost (TEC) <$5M) | 15,782 | 15,000 | -782 |
| **Total, Plant Projects (GPP/IGPP) (Total Estimated Cost (TEC) <$10M)** | **15,782** | **15,000** | **-782** |
| | | | |
| **Total, Capital Summary** | **15,782** | **15,000** | **-782** |

**NETL Research and Operations**
**($K)**

| FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request |
|---|---|---|
| 43,000 | 42,708 | 40,000 |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Overview**

NETL supports the DOE mission to advance the energy security of the United States, as well as Administration interests in domestic energy production, clean coal technologies, and reviving America's coal industry. NETL has expertise in coal, natural gas, and oil technologies; contract and project management; and analysis of fossil energy systems.

The NETL Research and Operations Program supports variable costs in NETL's science and technology activities. The Program comprises three subprograms:

(1) **Research and Development** funds NETL science and technology development functions, including technical program management. Specifically, Research and Development funding supports salaries and benefits, travel, and other employee costs for the NETL staff of engineers and technical project managers who conduct collaborative research activities for Fossil Energy Research and Development (FER&D) programs. This subprogram also funds contractor costs related to these collaborative research activities.
(2) **Site Operations** includes funding for: (a) building operations and maintenance such as structural repairs, utilities, and janitorial support; and (b) grounds maintenance including parking lot repair, mowing, snow removal, etc.
(3) **Program oversight** includes funding for Federal employees and contractors performing research-enabling functions such as financial assistance, legal, and finance oversight of research grants and awards.

**Highlights of the FY 2019 Budget Request**

The NETL Research and Operations request is $3M lower than the FY 2017 Enacted level. The overall reduction in Fossil Energy R&D requested funding necessitates the prudent identification of cost reduction opportunities across the board. NETL continues to work to identify operational efficiencies and redeploy those resources into direct research-related areas. While opportunities to reduce NETL's cost structure are somewhat constrained by its existing footprint, there is an ongoing effort to analyze spending and identify areas where more optimal procurement techniques can be applied. An example is moving to fixed-price contracts that shift risk of cost overruns to third parties. The ongoing spend analysis is also identifying opportunities to consolidate or reprioritize activities, resulting in additional cost avoidance.

**NETL Research and Operations Funding**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR* | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **NETL Research and Operations** | | | | |
| Research and Development | 20,920 | --- | 20,500 | -420 |
| Site Operations | 13,644 | --- | 12,000 | -1,644 |
| Program Oversight | 8,436 | --- | 7,500 | -936 |
| **TOTAL NETL Research Operations** | **43,000** | **42,708** | **40,000** | **-3,000** |
| **Federal FTEs** | **236** | **217** | **217** | **-19** |

*A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

Federal FTEs shown above include technical project managers and procurement and finance personnel providing support to DOE's Office of **Energy Efficiency and Renewable Energy** (**EERE**) and **Office of Electricity Delivery and Energy Reliability** (OE). These NETL personnel are funded by those non-FER&D offices to the extent that their time is spent supporting those offices.

**Explanation of Major Changes**
**($K)**

| | FY 2019 Request vs FY 2017 Enacted |
|---|---|
| **NETL Research and Operations:** A requested decrease of $3,000,000 from the FY 2017 Enacted level reflects operational efficiencies in the site operations areas combined with a reduction in project oversight activities. These operational reductions are a combination of reduced contractor support and efficiencies gained through more optimal procurement methods. | **-3,000** |
| **Total, NETL Research and Operations** | **-3,000** |

## NETL Research and Development

**Activities and Explanation of Changes**

| FY 2017 Enacted | FY 2019 Request | Explanation of Changes FY 2019 Request vs FY 2017 Enacted |
|---|---|---|
| **NETL Research and Development $43,000,000** | **$40,000,000** | **-3,000,000** |
| | | |
| **Research and Development $20,920,000** | **$20,500,000** | **-$420,000** |
| • Research and Development funding at NETL provides for collaborative research and development activities, including Federal salaries/benefits, travel and employee costs for engineers and technical project managers associated with the fossil programs.<br>• Funding also provides for contractor costs supporting the collaborative research activities.<br>• Funding also provides for ongoing operation and maintenance of project management information systems. | • Research and Development funding at NETL provides for collaborative research and development activities, including Federal salaries/benefits, travel and employee costs for engineers, and technical project managers associated with the fossil programs.<br>• Funding also provides for contractor costs supporting the collaborative research activities.<br>• Funding also provides for ongoing operation and maintenance of project management information systems. | • Decrease reflects a 2017 investment in obsolete project management information system that enables cost avoidance in 2019. |
| **Site Operations $13,644,000** | **$12,000,000** | **-$1,644,000** |
| • Site Operations funding supports variable costs of operating NETL's laboratories and research sites. Funding provides for operations personnel along with support contractors for building operations, grounds maintenance, utilities, etc. | • Site Operations funding supports variable costs of operating NETL's laboratories and research sites. Funding provides for operations personnel along with support contractors for building operations, grounds maintenance, utilities, etc. | • Decrease reflects operational efficiencies in the site operations areas. These reductions are a combination of reduced contractor support and efficiencies gained through more optimal procurement methods. |
| **Program Oversight $8,436,000** | **$7,500,000** | **-$936,000** |
| • Program Oversight funding at NETL supports salaries/benefits for federal employees performing research-enabling support functions necessary for the performance of NETL's research activities. | • Program Oversight funding at NETL supports salaries/benefits for federal employees performing research-enabling support functions necessary for the performance of NETL's research activities. | • Decrease reflects a combination of eliminating contractor support and efficiencies gained through more optimal procurement methods. |

## Fossil Energy Research and Development
## Facilities Maintenance and Repair

The Department's Facilities Maintenance and Repair activities are tied to its programmatic missions, goals, and objectives. Facilities Maintenance and Repair activities funded by this budget are displayed below.

**Costs for Direct-Funded Maintenance and Repair (including Deferred Maintenance Reduction)**

**($K)**

| | FY 2017 Actual Cost | FY 2017 Planned Cost | FY 2018 Planned Cost | FY 2019 Planned Cost |
|---|---|---|---|---|
| National Energy Technology Laboratory | 19,412 | 14,363 | 14,363 | 14,363 |
| **Total, Direct-Funded Maintenance and Repair** | **19,412** | **14,363** | **14,363** | **14,363** |

**Report on FY 2016 Expenditures for Maintenance and Repair**

This report responds to legislative language set forth in Conference Report (H.R. Conf. Rep. No. 108-10) accompanying the Consolidated Appropriations Resolution, 2003 (Public Law 108-7) (pages 886-887), which requests the Department of Energy provide an annual year-end report on maintenance expenditures to the Committees on Appropriations. This report compares the actual maintenance expenditures in FY 2017 to the amount planned for FY 2017, including Congressionally directed changes.

**Total Costs for Maintenance and Repair**

**($K)**

| | FY 2017 Actual Cost | FY 2017 Planned Cost |
|---|---|---|
| National Energy Technology Laboratory | 19,412 | 14,363 |
| **Total, Direct-Funded Maintenance and Repair** | **19,412** | **14,363** |

In review of the planned vs actual costs for FY2017, the National Energy Technology Laboratory utilized an additional $5,048(K) of capital funding toward multiple small projects for maintenance and repair to limit growth in deferred maintenance levels. The Actual Cost includes funding from program direction and Plant and Capital Equipment accounts. Planned funding is identified from program direction.

**Fossil Energy Research and Development**
**Research and Development**
**($K)[1]**

| | FY 2017 Enacted | FY 2018 Annualized CR[2] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| Basic | 6,019 | 29,890 | 21,044 | +15,025 |
| Applied | 222,700 | 567,916 | 399,827 | +177,127 |
| Development | 373,173 | 0 | 0 | -373,173 |
| **Subtotal, R&D** | **601,892** | **597,806** | **420,870** | **-181,022** |
| Equipment | 21,156 | 21,013 | 15,000 | -6,156 |
| Construction | 0 | 0 | 0 | 0 |
| **Total, R&D** | **623,048** | **618,819** | **435,870** | **-187,178** |

[1] R&D reporting includes a proportional share of Program Direction (minus import/export), NETL Infrastructure (minus supercomputer, CERCLA, RCRA and plant and capital equipment). Plant and Capital Equipment and funding for the Supercomputer are counted as Equipment. This funding was not included in the R&D reporting in the FY 2016 and prior year budget justifications. It was included in our FY 2017 budget submission and is included in this submission as well. This change is being made to better align with international standards on reporting funding for R&D. Since these activities are necessary in order for R&D to be performed, they are now included in the conduct of R&D.

[2] The FY 2018 Annualized CR reflects a shift towards emphasis on early-stage technology.

**Fossil Energy Research and Development**
**Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR)**
**($K)**

| | FY 2017 Enacted/ Transferred | FY 2018 Annualized CR Projected Transfer | FY 2019 Request/ Projected Transfer | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| CCS and Power Systems | | | | |
| SBIR | 11,038 | 10,963 | 8,186 | -2,852 |
| STTR | 1,552 | 1,542 | 1,151 | -401 |
| Natural Gas Technologies | | | | |
| SBIR | 1,294 | 1,285 | 166 | -1,128 |
| STTR | 182 | 181 | 23 | -159 |
| Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies | | | | |
| SBIR | 632 | 628 | 421 | -211 |
| STTR | 89 | 88 | 59 | -30 |
| **Total, SBIR/STTR** | **14,787** | **14,687** | **10,006** | **-4,781** |

**Fossil Energy Research and Development**
**Safeguards and Security**
**($K)**

| | FY 2017 Enacted | FY 2018 Annualized CR[1] | FY 2019 Request | FY 2019 Request vs FY 2017 Enacted |
|---|---|---|---|---|
| **Physical Protection Protective Forces** | **2,775** | **---** | **2,840** | **+65** |
| **Physical Security Protection Systems** | **193** | **---** | **151** | **-42** |
| **Information Security** | **89** | **---** | **91** | **+2** |
| **Personnel Security** | **151** | **---** | **154** | **+3** |
| **Research and Development** | **0** | **---** | **0** | **0** |
| **Program Management** | **247** | **---** | **254** | **+7** |
| **Line Item Construction** | **0** | **---** | **0** | **0** |
| **Total, Safeguards and Security** | **3,455** | **3,490** | **3,490** | **35** |

[1] A full-year 2018 appropriation for this account was not enacted at the time the budget was prepared; therefore, the budget assumes this account is operating under the Continuing Appropriations Act, 2018 (Division D of P.L. 115-56, as amended). The amounts included for 2018 reflect the annualized level provided by the continuing resolution. (These amounts are shown only at the Congressional control level and above; below that level, a dash (—) is shown).

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Fossil Energy Research and Development | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Ames Laboratory** | | | |
| **CCS and Power Systems** | | | |
| Advanced Energy Systems | 500 | 497 | 0 |
| Cross Cutting Research | 519 | 515 | 0 |
| **Total, CCS and Power Systems** | **1,019** | **1,012** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Advanced Energy Systems | 0 | 0 | 500 |
| Crosscutting Research | 0 | 0 | 200 |
| **Total, Advanced Coal Energy Systems and CCUS** | **0** | **0** | **700** |
| **Total, Ames Laboratory** | **1,019** | **1,012** | **700** |
| **Argonne National Laboratory** | | | |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Advanced Energy Systems | 0 | 0 | 284 |
| **Total, Argonne National Laboratory** | **0** | **0** | **284** |
| **Lawrence Berkeley National Laboratory** | | | |
| **CCS and Power Systems** | | | |
| Carbon Storage | 8,212 | 8,156 | 0 |
| Cross Cutting Research | 2,091 | 2,077 | 0 |
| **Total, CCS and Power Systems** | **10,303** | **10,233** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Carbon Capture Utilization and Storage | 0 | 0 | 1,500 |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 1,400 | 1,390 | 0 |
| **Total, Lawrence Berkeley National Laboratory** | **11,703** | **11,623** | **1,500** |
| **Lawrence Livermore National Laboratory** | | | |
| **CCS and Power Systems** | | | |
| Carbon Capture | 2,983 | 2,963 | 0 |
| Advanced Energy Systems | 149 | 148 | 0 |
| Cross Cutting Research | 300 | 298 | 0 |
| **Total, CCS and Power Systems** | **3,432** | **3,409** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Carbon Capture Utilization and Storage | 0 | 0 | 1,450 |
| **Total, Lawrence Livermore National Laboratory** | **3,432** | **3,409** | **1,450** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Fossil Energy Research and Development | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Los Alamos National Laboratory** | | | |
| **CCS and Power Systems** | | | |
| Carbon Capture | 941 | 935 | 0 |
| Carbon Storage | 7,530 | 7,479 | 0 |
| Cross Cutting Research | 400 | 397 | 0 |
| **Total, CCS and Power Systems** | **8,871** | **8,811** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Carbon Capture Utilization and Storage | 0 | 0 | 1,450 |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 860 | 854 | 0 |
| **Total, Los Alamos National Laboratory** | **9,731** | **9,665** | **1,450** |
| **National Energy Technology Lab** | | | |
| **CCS and Power Systems** | | | |
| Carbon Capture | 93,257 | 92,623 | 0 |
| Carbon Storage | 74,924 | 74,415 | 0 |
| Advanced Energy Systems | 100,304 | 99,623 | 0 |
| Cross Cutting Research | 32,711 | 32,489 | 0 |
| STEP (Supercritical CO2) | 24,000 | 23,837 | 0 |
| NETL Coal R&D | 53,000 | 52,640 | 0 |
| **Total, CCS and Power Systems** | **378,196** | **375,627** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Advanced Energy Systems | 0 | 0 | 172,336 |
| Carbon Capture Utilization and Storage | 0 | 0 | 32,950 |
| STEP (Supercritical CO2) | 0 | 0 | 25,000 |
| NETL Coal Research and Development | 0 | 0 | 50,000 |
| Crosscutting Research | 0 | 0 | 53,100 |
| **Total, Advanced Coal Energy Systems and CCUS** | **0** | **0** | **333,386** |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 35,587 | 35,346 | 5,500 |
| **Program Direction** | | | |
| NETL Program Direction | 28,266 | 28,074 | 31,000 |
| **Unconventional FE Technologies from Petroleum – Oil** | | | |
| Unconventional FE Technologies from Petroleum – Oil | 19,229 | 19,098 | 14,000 |
| **NETL Research and Operations** | | | |
| NETL Research and Operations | 43,000 | 42,708 | 40,000 |
| **NETL Infrastructure** | | | |
| NETL Infrastructure | 40,500 | 40,226 | 38,000 |
| **Fossil Fuel Pilots** | | | |
| Fossil Fuel Pilots | 50,000 | 49,660 | 0 |
| **Total, National Energy Technology Lab** | **594,778** | **590,739** | **461,886** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Fossil Energy Research and Development | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **National Renewable Energy Laboratory** | | | |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 61 | 61 | 0 |
| **Total, National Renewable Energy Laboratory** | **61** | **61** | **0** |
| **Oak Ridge National Laboratory** | | | |
| **CCS and Power Systems** | | | |
| Carbon Capture | 500 | 497 | 0 |
| Carbon Storage | 633 | 629 | 0 |
| Advanced Energy Systems | 1,300 | 1,291 | 0 |
| Cross Cutting Research | 4,139 | 4,111 | 0 |
| **Total, CCS and Power Systems** | **6,572** | **6,528** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Advanced Energy Systems | 0 | 0 | 1,705 |
| Carbon Capture Utilization and Storage | 0 | 0 | 750 |
| **Total, Advanced Coal Energy Systems and CCUS** | **0** | **0** | **2,455** |
| **Total, Oak Ridge National Laboratory** | **6,572** | **6,528** | **2,455** |
| **Pacific Northwest National Laboratory** | | | |
| **CCS and Power Systems** | | | |
| Carbon Capture | 3,319 | 3,296 | 0 |
| Cross Cutting Research | 400 | 397 | 0 |
| **Total, CCS and Power Systems** | **3,719** | **3,693** | **0** |
| **Advanced Coal Energy Systems and CCUS** | | | |
| Advanced Energy Systems | 0 | 0 | 175 |
| Carbon Capture Utilization and Storage | 0 | 0 | 1,900 |
| **Total, Advanced Coal Energy Systems and CCUS** | **0** | **0** | **2,075** |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 100 | 99 | 0 |
| **Total, Pacific Northwest National Laboratory** | **3,819** | **3,792** | **2,075** |
| **Sandia National Laboratories** | | | |
| **CCS and Power Systems** | | | |
| Carbon Storage | 622 | 618 | 0 |
| Cross Cutting Research | 285 | 283 | 0 |
| **Total, CCS and Power Systems** | **907** | **901** | **0** |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 1,210 | 1,202 | 0 |
| **Total, Sandia National Laboratories** | **2,117** | **2,103** | **0** |

**Department of Energy**

**FY 2019 Congressional Budget**

**Funding by Appropriation by Site**

($K)

| Fossil Energy Research and Development | FY 2017 Enacted | FY 2018 Annualized CR | FY 2019 Request |
|---|---|---|---|
| **Washington Headquarters** | | | |
| **CCS and Power Systems** | | | |
| Carbon Storage | 3,379 | 3,356 | 0 |
| Advanced Energy Systems | 2,747 | 2,728 | 0 |
| Cross Cutting Research | 4,655 | 4,623 | 0 |
| **Total, CCS and Power Systems** | **10,781** | **10,707** | **0** |
| **Natural Gas Technologies** | | | |
| Natural Gas Technologies | 3,782 | 3,756 | 0 |
| **Program Direction** | | | |
| Headquarters Program Direction | 31,734 | 31,519 | 30,070 |
| **Special Recruitment Programs** | | | |
| Special Recruitment Programs | 700 | 695 | 200 |
| **Unconventional FE Technologies from Petroleum – Oil** | | | |
| Unconventional FE Technologies from Petroleum – Oil | 1,771 | 1,759 | 0 |
| **Total, Washington Headquarters** | **48,768** | **48,436** | **30,270** |
| **Total, Fossil Energy Research and Development** | **682,000** | **677,368** | **502,070** |

## GENERAL PROVISIONS—DEPARTMENT OF ENERGY
## (INCLUDING TRANSFER OF FUNDS)

SEC. 301. (a) No appropriation, funds, or authority made available by this title for the Department of Energy shall be used to initiate or resume any program, project, or activity or to prepare or initiate Requests For Proposals or similar arrangements (including Requests for Quotations, Requests for Information, and Funding Opportunity Announcements) for a program, project, or activity if the program, project, or activity has not been funded by Congress.

(b) (1) Unless the Secretary of Energy notifies the Committees on Appropriations of both Houses of Congress at least 3 full business days in advance, none of the funds made available in this title may be used to—

(A) make a grant allocation or discretionary grant award totaling $1,000,000 or more;

(B) make a discretionary contract award or Other Transaction Agreement totaling $1,000,000 or more, including contract covered by the Federal Acquisition Regulation;

(C) issue a letter of intent to make an allocation, award, or Agreement in excess

(D) of the limits in subparagraph (A) or (B); or announce publicly the intention to make an allocation, award, or Agreement in excess of the limits in subparagraph (A) or (B).

(2) The Secretary of Energy shall submit to the Committees on Appropriations of both Houses of Congress within 15 days of the conclusion of each quarter a report detailing each grant allocation or discretionary grant award totaling less than $1,000,000 provided during the previous quarter.

(3) The notification required by paragraph (1) and the report required by paragraph (2) shall include the recipient of the award, the amount of the award, the fiscal year for which the funds for the award were appropriated, the account and program, project, or activity from which the funds are being drawn, the title of the award, and a brief description of the activity for which the award is made.

(c) The Department of Energy may not, with respect to any program, project, or activity that uses budget authority made available in this title under the heading "Department of Energy—Energy Programs", enter into a multiyear contract, award a multiyear grant, or enter into a multiyear cooperative agreement unless—

(1) the contract, grant, or cooperative agreement is funded for the full period of performance as anticipated at the time of award; or

(2) the contract, grant, or cooperative agreement includes a clause conditioning the Federal Government's obligation on the availability of future year budget authority and the Secretary notifies the Committees on Appropriations of both Houses of Congress at least 3 days in advance.

(d) Except as provided in subsections (e), (f), and (g), the amounts made available by this title shall be expended as authorized by law for the programs, projects, and activities specified in the "Final Bill" column in the "Department of Energy" table included under the heading "Title III—Department of Energy" in the explanatory statement accompanying this Act.

(e) The amounts made available by this title may be reprogrammed for any program, project, or activity, and the Department shall notify the Committees on Appropriations of both Houses of Congress at least 30 days prior to the use of any proposed reprogramming that would cause any program, project, or activity funding level to increase or decrease by more than $5,000,000 or 10 percent, whichever is less, during the time period covered by this Act.

(f) None of the funds provided in this title shall be available for obligation or expenditure through a reprogramming of funds that—

(1) creates, initiates, or eliminates a program, project, or activity;

(2) increases funds or personnel for any program, project, or activity for which funds are denied or restricted by this Act; or

(3) reduces funds that are directed to be used for a specific program, project, or activity by this Act.

(g) (1) The Secretary of Energy may waive any requirement or restriction in this section that applies to the use of funds made available for the Department of Energy if compliance with such requirement or restriction would pose a substantial risk to human health, the environment, welfare, or national security.

(2) The Secretary of Energy shall notify the Committees on Appropriations of both Houses of Congress of any waiver under paragraph (1) as soon as practicable, but not later than 3 days after the date of the activity to which a requirement or restriction would otherwise have applied. Such notice shall include an explanation of the substantial risk under paragraph (1) that permitted such waiver.

SEC. 302. The unexpended balances of prior appropriations provided for activities in this Act may be available to the same appropriation accounts for such activities established pursuant to this title. Available balances may be merged with funds in the applicable established accounts and thereafter may be accounted for as one fund for the same time period as originally enacted.

SEC. 303. Funds appropriated by this or any other Act, or made available by the transfer of funds in this Act, for intelligence activities are deemed to be specifically authorized by the Congress for purposes of section 504 of the National Security Act of 1947 (50 U.S.C. 3094) during fiscal year 2019 until the enactment of the Intelligence Authorization Act for fiscal year 2019.

SEC. 304. None of the funds made available in this title shall be used for the construction of facilities classified as high-hazard nuclear facilities under 10 CFR Part 830 unless independent oversight is conducted by the Office of Enterprise Assessments to ensure the project is in compliance with nuclear safety requirements.

SEC. 305. None of the funds made available in this title may be used to approve critical decision–2 or critical decision–3 under Department of Energy Order 413.3B, or any successive departmental guidance, for construction projects where the total project cost exceeds $100,000,000, until a separate independent cost estimate has been developed for the project for that critical decision.

SEC. 306. Notwithstanding section 301(c) of this Act, none of the funds made available under the heading "Department of Energy—Energy Programs—Science" in this or any subsequent Energy and Water Development and Related Agencies appropriations Act for any fiscal year may be used for a multiyear contract, grant, cooperative agreement, or Other Transaction Agreement of $1,000,000 or less unless the contract, grant, cooperative agreement, or Other Transaction Agreement is funded for the full period of performance as anticipated at the time of award.

SEC. 307. (a) NEW REGIONAL RESERVES.—The Secretary of Energy may not establish any new regional petroleum product reserve unless funding for the proposed regional petroleum product reserve is explicitly requested in advance in an annual budget submission and approved by the Congress in an appropriations Act.

(b) The budget request or notification shall include—

(1) the justification for the new reserve;

(2) a cost estimate for the establishment, operation, and maintenance of the reserve, including funding sources;

(3) a detailed plan for operation of the reserve, including the conditions upon which the products may be released;

(4) the location of the reserve; and

(5) the estimate of the total inventory of the reserve.

SEC. 308. Treatment of Lobbying and Political Activity Costs as Allowable Costs under Department of Energy Contracts.

(a) Allowable Costs.—

(1) Section 4801(b) of the Atomic Energy Defense Act (50 U.S.C. 2781(b)) is amended—

(A) by striking "(1)" and all that follows through "the Secretary" and inserting The Secretary"; and

(B) by striking paragraph (2).

(2) Section 305 of the Energy and Water Development Appropriation Act, 1988, as contained in section 101(d) of Public Law 100–202 (101 Stat. 1329–125), is repealed.

(b) Regulations Revised.—The Secretary of Energy shall revise existing regulations consistent with the repeal of 50 U.S.C. 2781(b)(2) and section 305 of Public Law 100–202 and shall issue regulations to implement 50 U.S.C. 2781(b), as amended by subsection (a), no later than 150 days after the date of the enactment of this Act. Such regulations shall be consistent with the Federal Acquisition Regulation 48 C.F.R. 31.205–22.

SEC. 309. Not to exceed 5 percent of any appropriation made available for Department of Energy activities funded in this Act may be transferred between such appropriations, but no such appropriation, except as otherwise provided, shall be increased or decreased by more than 5 percent by any such transfers, and notification of any such transfers shall be submitted promptly to the Committees on Appropriations of the House of Representatives and the Senate.

SEC. 310. Notwithstanding section 161 of the Energy Policy and Conservation Act (42 U.S.C. 6241), the Secretary of Energy shall draw down and sell one million barrels of refined petroleum product from the Strategic Petroleum Reserve during

fiscal year 2019. Proceeds from sales under this section shall be deposited into the general fund of the Treasury during fiscal year 2019.

SEC. 311. The Secretary of Energy may draw down and sell up to 1 million barrels of crude oil from the Strategic Petroleum Reserves during fiscal year 2019. The proceeds of such sale shall be deposited into the SPR Petroleum Account and shall remain available until expended.

## TITLE V—GENERAL PROVISIONS

SEC. 501. None of the funds appropriated by this Act may be used in any way, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

SEC. 502. None of the funds made available by this Act may be used in contravention of Executive Order No. 12898 of February 11, 1994 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations).