Department of Energy
FY 2022Congressional Budget Request

Other Defense Activities
Departmental Administration
Inspector General
Technology Transitions
Working Capital Fund
Crosscutting Activities

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Volume 2

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DEPARTMENT OF ENERGY
Appropriation Summary
FY 2022
(Dollars in Thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted	
				$	%
Department of Energy Budget by Appropriation					
Energy Efficiency and Renewable Energy	2,777,277	2,861,760	4,732,000	+1,870,240	+65.35%
Electricity	190,000	211,720	327,000	+115,280	+54.45%
Cybersecurity, Energy Security and Emergency Response	156,000	156,000	201,000	+45,000	+28.85%
Strategic Petroleum Reserve	195,000	188,000	197,000	+9,000	+4.79%
Naval Petroleum and Oil Shale Reserve	14,000	13,006	13,650	+644	+4.95%
Strategic Petroleum Reserve Petroleum Account	10,000	1,000	7,350	+6,350	+635.00%
Northeast Home Heating Oil Reserve	10,000	6,500	0	-6,500	-100.00%
Total, Petroleum Reserve Accounts	229,000	208,506	218,000	+9,494	+4.55%
Total, Cybersecurity, Energy Security, and Emergency Response	385,000	364,506	419,000	+54,494	+14.95%
Nuclear Energy (270)	1,340,000	1,357,800	1,700,700	+342,900	+25.25%
Fossil Energy and Carbon Management	750,000	750,000	890,000	+140,000	+18.67%
Uranium Enrichment Decontamination and Decommissioning (D&D) Fund	881,000	841,000	831,340	-9,660	-1.15%
Energy Information Administration	126,800	126,800	126,800	+0	+0.00%
Non-Defense Environmental Cleanup	319,200	319,200	338,860	+19,660	+6.16%
Science	7,000,000	7,026,000	7,440,000	+414,000	+5.89%
Office of Technology Transitions (OTT)	0	0	19,470	+19,470	N/A
Office of Clean Energy Demonstration (OCED)	0	0	400,000	+400,000	N/A
Advanced Research Projects Agency - Energy	425,000	427,000	500,000	+73,000	+17.10%
Advanced Research Projects Agency - Climate	0	0	200,000	+200,000	N/A
Nuclear Waste Disposal	0	27,500	7,500	-20,000	-72.73%
Departmental Administration	161,000	166,000	321,760	+155,760	+93.83%
Indian Energy Policy and Programs	22,000	22,000	122,000	+100,000	+454.55%
Inspector General	54,215	57,739	78,000	+20,261	+35.09%
Title 17 Innovative Technology Loan Guarantee Program	29,000	-363,000	179,000	+542,000	-149.31%
Advanced Technology Vehicles Manufacturing Loan Program	5,000	-1,903,000	5,000	+1,908,000	-100.26%
Tribal Energy Loan Guarantee Program	2,000	2,000	2,000	+0	+0.00%
Total, Credit Programs	**36,000**	**-2,264,000**	**186,000**	**2,450,000**	**-108.22%**
Total, Energy Programs	**14,467,492**	**12,295,025**	**18,640,430**	**6,345,405**	**+51.61%**
Federal Salaries and Expenses	434,699	443,200	464,000	+20,800	+4.69%
Weapons Activities	12,457,097	15,345,000	15,484,295	+139,295	+0.91%
Defense Nuclear Nonproliferation	2,164,400	2,260,000	1,934,000	-326,000	-14.42%
Naval Reactors	1,648,396	1,684,000	1,860,705	+176,705	+10.49%
Total, National Nuclear Security Administration	**16,704,592**	**19,732,200**	**19,743,000**	**10,800**	**+0.05%**
Defense Environmental Cleanup	6,255,000	6,426,000	6,841,670	+415,670	+6.47%
Other Defense Activities	906,000	920,000	1,170,000	+250,000	+27.17%
Total, Environmental and Other Defense Activities	**7,161,000**	**7,346,000**	**8,011,670**	**665,670**	**+9.06%**
Nuclear Energy (050)	153,408	149,800	149,800	+0	+0.00%
Total, Atomic Energy Defense Activities	**24,019,000**	**27,228,000**	**27,904,470**	**676,470**	**+2.48%**
Southeastern Power Administration (SEPA)	0	0	0	+0	+0.00%
Southwestern Power Administration (SWPA)	10,400	10,400	10,400	+0	+0.00%
Western Area Power Administration	89,196	89,372	90,772	+1,400	+1.57%
Falcon and Amistad Operating and Maintenance Fund	228	228	228	+0	+0.00%
Colorado River Basins Power Marketing Fund *	-21,400	-21,400	-21,400	+0	+0.00%
Total, Power Marketing Administrations	**78,424**	**78,600**	**80,000**	**1,400**	**+1.78%**
Federal Energy Regulatory Commission	0	0	0	+0	+0.00%
Total, Energy and Water Development and Related Agencies	**38,564,916**	**39,601,625**	**46,624,900**	**7,023,275**	**+17.73%**
Excess Fees and Recoveries, FERC	-16,000	-9,000	-9,000	+0	+0.00%
Title XVII Loan Guar. Prog Section 1703 Negative Credit Subsidy Receipt	-15,000	0	-10,800	-10,800	N/A
UED&D Fund Offset	0	0	-415,670	-415,670	N/A
Discretionary Funding by Appropriation	**38,533,916**	**39,592,625**	**46,189,430**	**+6,596,805**	**+16.66%**
DOE Budget Function	**38,533,916**	**39,592,625**	**46,189,430**	**+6,596,805**	**+16.66%**
NNSA Defense (050) Total	16,704,592	19,732,200	19,743,000	+10,800	+0.05%
Non-NNSA Defense (050) Total	7,314,408	7,495,800	8,161,470	+665,670	+8.88%
Defense (050)	*24,019,000*	*27,228,000*	*27,904,470*	*676,470*	*2.48%*
Science (250)	7,000,000	7,026,000	7,440,000	+414,000	+5.89%
Energy (270)	7,514,916	5,338,625	10,844,960	+5,506,335	+103.14%
Non-Defense (Non-050)	*14,514,916*	*12,364,625*	*18,284,960*	*5,920,335*	*47.88%*

* Amount has been adjusted per Section 127 of Public Law 116-159, Continuing Appropriations Act, 2021 and Other Extensions Act.

Other Defense Activities

Other Defense Activities

Other Defense Activities

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Other Defense Activities
Proposed Appropriation Language

For Department of Energy expenses, including the purchase, construction, and acquisition of plant and capital equipment and other expenses, necessary for atomic energy defense, other defense activities, and classified 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 [$920,000,000] *$1,170,000,000*, to remain available until expended: Provided, That of such amount, [$334,948,000] *$319,559,000* shall be available until September 30, [2022] *2023*, for program direction.

(Energy and Water Development and Related Agencies Appropriations Act, 2021.)

Explanation of Changes

Request includes funding for the Formerly Utilized Sites Remedial Action Program that had been funded by the U.S. Army Corps of Engineers in prior years. Funding in Legacy Management will also support Long-Term Surveillance and Maintenance core activities related to environmental justice priorities that provide support to historically disadvantaged communities.

Other Defense Activities
($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
	906,000	920,000	1,170,000

Overview

The Other Defense Activities appropriation funds elements that relate to and support the defense-oriented activities within the Department. These include Environment, Health, Safety and Security (EHSS), Enterprise Assessments (EA), Specialized Security Activities (SSA), Legacy Management (LM), Hearings and Appeals (OHA), and Defense Related Administrative Support (DRAS). Funding from DRAS is used to offset administrative expenses for work supporting defense-oriented activities.

Highlights and Major Changes in the FY 2022 Budget Request

- Within EA, the budget provides increased funding for Safety and Security Training and needed operating levels at the National Training Center (NTC).
- SSA assures coverage of national security related activities.
- Within LM, increased funding supports the Formerly Utilized Sites Remedial Action Program (FUSRAP), previously funded by the U.S. Army Corps of Engineers; and Long-Term Surveillance and Maintenance core activities related to environmental justice priorities for historically disadvantaged communities.

Other Defense Activities
Funding by Congressional Control
($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Environment, Health, Safety and Security	207,839	206,320	206,320	-
Office of Enterprise Assessments	78,779	79,070	83,384	+4,314
Specialized Security Activities	273,409	283,500	283,500	-
Legacy Management	162,029	163,059	428,730	+265,671
Defense-Related Administrative Support	179,092	183,789	163,710	-20,079
Office of Hearings and Appeals	4,852	4,262	4,356	+94
Total, Other Defense Activities	**906,000**	**920,000**	**1,170,000**	**+250,000**

Environment, Health, Safety and Security

Overview

The Office of Environment, Health, Safety and Security (EHSS) provides corporate leadership and strategic approaches in enabling the Department of Energy (DOE) mission and furthering the protection afforded the DOE workers, the public, the environment, and national security assets. This is accomplished through the maintenance of corporate-level policies and standards and providing implementation guidance; sharing operating experience, lessons learned, and best practices; and providing assistance and supporting services to line management with the goal of mission success as DOE's environment, health, safety and security advocate.

EHSS accomplishes its overall mission in the following focus areas:

Environment, Health and Safety Policy and Support:

- Protecting the health and safety of DOE's Federal and contractor workforce, addressing the health effects legacy of the Nation's nuclear weapons program, and conducting national and international health studies.

- Minimizing DOE's radiological and other environmental footprints and improving DOE's safety performance through analysis, policy development, and sharing lessons learned.

- Promoting the safe design, construction, and operation of DOE's facilities, both nuclear and non-nuclear, and providing cross-organizational leadership in resolving related issues.

Security Policy and Support:

- Establishing effective policies, through a collaborative, enterprise approach, by which the national security assets entrusted to the Department are protected and secured.

- Furthering DOE's national security, nonproliferation and open governmental goals through the identification of classified, controlled and unclassified information.

- Providing specialized security services, to include protective force and personnel security, to DOE Headquarters facilities and securing the work environment for Federal and contractor personnel.

As the Department's environment, health, safety and security advocate, EHSS supports the Department by identifying the risks in these areas that could jeopardize DOE's mission. EHSS works closely with DOE line management personnel who are directly responsible for ensuring that the Department's work is managed and performed in a manner that protects workers, the public, the environment, and the Department's material and information assets. As part of this partnership, EHSS develops and promulgates environment, health, safety and security policy and provides expert advice and implementation assistance to help line management accomplish the Department's mission in a safe and secure manner. EHSS also represents the Department in national and international environment, health, safety, and security matters.

EHSS leads the Department in meeting the expectation that its organizations embrace a healthy organizational culture where safe and secure performance of work and involvement of workers are deeply, strongly, and consistently held by managers and workers. EHSS contributes to more efficient and cost-effective mission accomplishment by providing quality products and timely expertise to eliminate or mitigate major risks to the mission. EHSS informs Secretarial decisions and improves DOE performance through expert advice to the Department's senior nuclear safety and nuclear security decision makers.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Environment, Health, Safety and Security					
Environment, Health and Safety					
Worker Safety	5,084	4,603	4,448	-155	-3.4%
Nuclear Safety	5,841	5,379	5,638	+259	+4.8%
Environment	2,407	2,407	2,407	0	0%
Health Programs					
Domestic Health Programs					
Health Research	3,370	2,970	2,470	-500	-16.8%
Former Worker Medical Screening	19,850	19,850	19,850	0	0%
Employee Compensation Program	6,507	5,135	4,200	-935	
International Health Programs					
Russian Health Studies	2,750	2,750	2,750	0	0%
Japanese Health Studies	14,000	14,000	14,000	0	0%
Marshall Islands Program	6,300	6,300	6,300	0	0%
Total, Environment, Health and Safety	66,109	63,394	62,063	-1,331	-2.1%
Security					
Insider Threat Program	3,000	3,000	1,500	-1,500	-50.0%
Security Operational Support	7,319	5,940	7,341	+1,401	+23.6%
Classification, Declassification and Controlled Information	11,679	13,679	13,179	-500	-3.7%
Security Investigations	5,200	4,533	4,000	-533	-11.8%
Headquarters Security Operations	43,532	43,774	44,649	+875	+2.0%
Total, Security	70,730	70,926	70,669	-257	-0.4%
Total, Environment, Health, Safety and Security	**136,839**	**134,320**	**132,732**	**-1,588**	**-1.2%**
Program Direction	**71,000**	**72,000**	**73,588**	**+1,588**	**+2.2%**
Total, Environment, Health, Safety and Security	**207,839**	**206,320**	**206,320**	**0**	**0.0%**

	FY 2022 Request vs FY 2021 Enacted

Environment, Health, Safety and Security:

Worker Safety: No significant change.	-155
Nuclear Safety: No significant change.	+259
Domestic Health Research: No significant change.	-500
Energy Employees Occupational Illness Compensation Program (EEOICPA): No significant change.	-935
Insider Threat: Funding decrease reflects completion of Insider Threat studies and moving support for the Security, Suitability, Credentialing Line of Business from Insider Threat to Security Operational Support.	-1,500
Security Operational Support: Funding increase primarily reflects moving support for the Security, Suitability, Credentialing Line of Business from Insider Threat to Security Operational Support.	+1,401
Classification/Declassification: No significant change.	-500
Security Investigations: No significant change.	-533
Headquarters Security Operations: No significant change.	+875
Program Direction: Funding increase reflects 2.7% pay raise and additional Working Capital Fund (WCF) expenses.	+1,588

Environment, Health and Safety

Description
The Environment, Health and Safety subprogram provides technical and analytical expertise to protect and enhance the safety of DOE workers, the public, and the environment. This subprogram maintains policies and guidance for the establishment of safe, environmentally sound work practices to achieve best-in-class performance in occupational, facility, nuclear, and radiation safety; protection of the environment and cultural and natural resources; and quality assurance. Environment, Health and Safety provides assistance to DOE offices and laboratories through site-specific activities, such as nuclear facility safety basis reviews, and corporate-wide services, such as accrediting commercial laboratories used by DOE sites for regulatory compliance and employee monitoring programs; administering the accident investigation and analytical services programs; supporting the Radiation Emergency Assistance Center/Training Site; and testing of high efficient particulate air filters. Corporate databases, such as those pertaining to accidents and illnesses, occurrence reporting, radiation monitoring and dose assessment, safety basis information, and hazardous substances inventories are maintained and used to support analyses of health and safety performance for senior management.

The Environment, Health and Safety subprogram provides technical support for the implementation of Department-wide safety and environmental programs, such as the DOE Federal Occupational Safety and Health program; the Voluntary Protection Program, which encourages and rewards safety performance that exceeds industry averages through universally recognized certifications; environmental management systems, which support sustainable practices that promote pollution prevention, greenhouse gas reduction, and effective resource utilization, and radiological clearance; and control programs for the safe reuse and recycle of DOE equipment and materials and for the radiological release of lands and buildings. These DOE-wide safety and environmental programs are integrated with mission activities to optimize protection and effective implementation.

The Environment, Health and Safety subprogram also provides support to the Department of Labor for the implementation of the Energy Employees Occupational Illness Compensation Program Act, and supports the former worker medical screening program, and radiation health studies in Japan and Russia. These projects and programs provide for the evaluation and documentation of health effects and outcomes that support the basis for national and international worker protection policies and standards, which, in turn, provide updated levels of protection appropriate for the risk posed to DOE workers and the public.

In FY 2022, Environment, Health and Safety will continue:
- Developing cost-effective solutions for achieving best-in-class safety performance founded on integrated safety management and enhanced through such concepts as safety culture, voluntary protection, and environmental management systems.
- Honoring the national and Departmental commitment to current and former workers through cost-effective implementation of the former worker medical screening program and support to the Department of Labor for the implementation of the Energy Employees Occupational Illness Compensation Program Act.

Worker Safety
Worker safety and health policies establish Department-wide safe work practices to achieve best-in-class safety performance, as compared to industrial operations, resulting in work conducted with a full understanding of health and safety related risks and controls necessary to mitigate those risks leading to minimization or avoidance of worker compensation liabilities. Funding provides for the maintenance of existing standards and the development of new requirements based on new or evolving working conditions and new developments in health science; technical assistance to DOE programs, laboratories, and sites in implementing health and safety requirements and programs; promotion of improvements in overall safety culture; and implementation of corporate health- and safety-related programs and information technology systems. Funding also provides for collecting, analyzing, and trending operational data to identify strengths and weaknesses of safety programs in support of continuous improvement in safety performance and cost-effective implementation. Funding provides for the Employee Concerns Program that manages and provides a DOE enterprise approach to ensure that employee concerns related to environment, health, safety and security and the management of DOE and NNSA programs and facilities are addressed.

Nuclear Safety
Nuclear Safety activities include establishing and maintaining nuclear safety policies and requirements to ensure adequate protection of workers, the public, and the environment from hazards associated with the design and operation of DOE nuclear facilities. This includes the establishment of general facility safety requirements in fire protection, response to natural phenomena, maintenance, and quality assurance to ensure that products and services meet or exceed the Department's objectives. Nuclear safety provides assistance to field elements in implementing requirements and resolving issues; and provides oversight of DOE nuclear operations and facilities. Nuclear Safety maintains a DOE-wide nuclear safety research and development program to provide corporate-level leadership supporting the coordination and integration of nuclear safety science and technology, share nuclear safety research and development information across the Department, and coordinate the conduct of nuclear safety research and development activities.

Environment
Environmental activities support DOE's efficient use of resources and energy and its compliance with environmental requirements. Funding provides technical support for the development of policies, requirements, and guidance related to responsible management of natural and cultural resources on and around DOE sites, and performance tracking across the DOE complex. Environmental activities also fund technical analyses supporting EHSS's role representing DOE to external agencies and stakeholders to develop cost effective and efficient means of meeting environmental and public protection objectives and avoiding future liabilities. Environmental activities also support the development of guidance and tools for implementation of consensus standards that are practical and broadly accepted. Funding supports programs that provide assurance that environmental monitoring and sampling data meet DOE data quality objectives and ensures computer codes that are used to demonstrate compliance with DOE public and environmental protection requirements are appropriate and employ the best science. Funding also supports the development and maintenance of plans, models, and guidance to respond to radiological and nuclear-related emergencies and support for interagency and national consensus standard development with a goal to harmonize Federal radiation protection policies and guidance for protection of the public and environment.

Domestic Health Programs
Health Research
Domestic health research activities provide for the conduct of health studies on DOE workers and communities surrounding DOE sites, technical assistance to DOE programs in addressing specific health issues, support to national assets used to respond to radiological events throughout the country, and expertise to support national and international efforts in response to disease outbreaks. These activities also support the maintenance of the electronic comprehensive epidemiologic data resource; the beryllium and U.S. transuranium and uranium registries; and the illness and injury surveillance database and access to the data these systems contain.

Former Worker Medical Screening
Former worker medical screening activities provide for the conduct of medical screenings for former DOE and DOE-related beryllium vendor employees to identify adverse health conditions that may have resulted from work conducted at DOE facilities. In addition, EHSS also screens DOE-related beryllium vendor facilities on behalf of DOE, as mandated by Congress in the FY 1993 Defense Authorization Act (Public Law 102-484). Workers who are found to have illnesses related to work on behalf of DOE are referred to the Department of Labor for potential compensation through the Energy Employees Occupational Illness Compensation Program Act.

Employee Compensation Program
DOE Energy Employees Occupational Illness Compensation Program Act (EEOICPA) activities support the implementation of Parts B and E of the Act by the Department of Labor to provide compensation to DOE and DOE-related vendor employees who have become ill as a result of work for DOE. Part B provides for compensation to workers with beryllium disease, silicosis, or radiation-induced cancer, and Part E provides for compensation and medical benefits to DOE contractor and subcontractor employees whose illnesses were caused by exposure to any toxic substance, such as beryllium or other chemical hazards. DOE's support consists primarily of providing information regarding employment status, exposures to radiation and toxic substances, and operational history of DOE facilities to the Department of Labor, the National Institute for Occupational Safety and Health, and the President's Advisory Board on Radiation and Worker Health in support of claims filed by current and former DOE Federal and contractor employees.

International Health Programs:

Russian Health Studies
The Russian health studies program supports the collaborative radiation health effects research program between U.S. and Russian scientists to determine the risks associated with working at or living near Russian former nuclear weapons production sites. The research is performed under the Cooperation in Research on Radiation Effects for the Purpose of Minimizing the Consequences of Radioactive Contamination on Health and the Environment, an agreement between the United States and Russia that was signed in 1994 and renewed in 2000, 2007, and 2011, and automatically extended every five years unless terminated by either Party. The agreement is implemented through the Joint Coordinating Committee for Radiation Effects Research, representing agencies from the United States and the Russian Federation. The goals of the program are to better understand the relationship between health effects and chronic, low-to-medium radiation exposure; determine radiation-induced cancer risks from exposure to gamma, neutron, and alpha radiation; and to improve and validate U.S. and international radiation protection standards and practices.

Japanese Health Studies
The Japanese health studies activity supports the Radiation Effects Research Foundation (RERF), pursuant to an agreement between the United States and Japan. RERF conducts epidemiologic studies and medical surveillance of the survivors of the atomic bombings of Hiroshima and Nagasaki; and engages in innovative science to develop new research methods and approaches for assessing radiation health effects for use as a basis for the development of radiation standards.

Marshall Islands Program
The Marshall Islands program provides medical surveillance and treatment of Marshallese citizens who were affected by U.S. nuclear weapons testing in the Pacific. It also provides for environmental monitoring for safe resettlement of four atolls affected by the testing. The work was specified by the Compact of Free Association Acts of 1986 and 2003 between the United States and the Republic of the Marshall Islands and by the Insular Areas Act of 2011 that required enhanced monitoring of the Runit Island Nuclear Waste Containment Structure beginning in FY 2013.

Health and Safety

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Environment, Health, Safety $63,394,000	**$62,063,000**	**-$1,331,000**
Worker Safety $4,603,000	**$4,448,000**	**-$155,000**
• Research, update, and maintain existing DOE regulations, directives and technical standards, and develop new safety and health requirements based on new or evolving working conditions, when warranted. • Provide technical assistance to DOE programs, laboratories, and sites in the implementation of health and safety requirements and programs, such as integrated safety management. • Provide support in development of technical qualification standards and description of required competencies and training for Federal staff involved in management of defense nuclear facilities. • Promote the implementation of the DOE voluntary protection program, which encourages and rewards safety performance that exceeds industry averages. • Provide technical support for the implementation of the DOE contractor employee assistance program that provides for the collection and analysis of causes of lost time and disabilities and the medical and psychological interventions available to reduce those losses. • Maintain the electronic Radiation Exposure Monitoring System, which serves as the Department's central repository for radiation exposure information at DOE in support of 10 C.F.R. 835, Occupational Radiation Protection, Subpart I, requirements regarding annual monitoring of individual occupational radiation exposure records for DOE employees, contractors, and subcontractors, as well as members of the public who visit DOE sites. • Provide technical support for the implementation of the DOE Federal employee occupational safety and health program, as required by Presidential Executive Order 12196, Occupational Safety and Health Programs for Federal Employees; Section 19 of Public Law 91-596, the Occupational Safety and Health Act of	• Continuation of all FY 2021 activities.	• No significant change.

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
	1970; and 29 C.F.R. 1960, Basic Program Elements for Federal Employee Occupational Safety and Health Programs and Related Matters. • Conduct and communicate analysis and trending of safety performance information to identify excellent performance and areas needing improvement in order to reduce or prevent adverse events and injuries and minimize mission interruptions. • Provide information to DOE operating entities regarding operating experience, lessons learned, and suspect, defective, and counterfeit items. • Provide overall program administration and assistance, including training, to DOE program offices in support of implementing the Department's accident investigation program, which provides for independent Federal investigations of high-consequence incidents involving worker fatalities or serious injuries, acute exposures to radiation or chemicals, environmental releases, or significant loss of capital assets. Upon request, or as directed by DOE leadership, assist DOE program offices in conducting specific accident investigations. • Maintain the differing professional opinion program and process, including a web page and online submittal form that DOE and contractor employees can use to identify and document differing professional opinions concerning technical issues. • Maintain corporate health- and safety-related information management technology systems, such as the Computerized Accident/Incident Reporting System, the Occurrence Reporting and Processing System, the Radiation Exposure Monitoring System, and the lessons learned system. • Support continuous improvement in meeting the Department's safety culture and safety conscious work environment (SCWE) across the complex and to ensure consistent leadership and focus on all aspects of DOE's safety culture initiatives. • Support the DOE enterprise-wide Employee Concerns Program that provides management and administration of the program to ensure that employee concerns related to environment, health, safety, and security and the management of DOE and NNSA		

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
	programs and facilities are addressed utilizing well-established processes that include prompt identification, reporting, and resolution of employee concerns regarding DOE facilities or operations in a manner that provides the highest degree of safe operations.		
Nuclear Safety $5,379,000		**$5,638,000**	**+$259,000**
	• Assess, update, and maintain DOE regulations, directives, and technical standards and lead the development of nuclear safety and quality assurance requirements based on new or evolving facility hazards and/or operating conditions, when warranted (including fire protection, natural phenomena hazards, nuclear materials packaging, and maintenance). • Maintain a DOE-wide nuclear safety research and development program to provide corporate-level leadership supporting the coordination and integration of nuclear safety science and technology, share nuclear safety research and development information across the Department, and coordinate the conduct of nuclear safety research and development activities. • Provide technical assistance to DOE program and line organizations, national laboratories, and sites in implementing nuclear safety and quality assurance requirements and programs and resolving issues and recommendations identified by the Defense Nuclear Facilities Safety Board. • Provide technical assistance to national standards development organizations in developing and maintaining nuclear safety and quality assurance consensus standards. • Support DOE program offices in assessing conduct of operations, maintenance, and/or training evaluations for hazard category 1, 2, and 3 nuclear facilities prior to authorizing startup or restart of these facilities or their operations. • Facilitate continuous improvement to the DOE facility representative and safety system programs, supporting approximately 280 site office resident nuclear safety subject matter experts funded by and reporting to DOE line management. • Assist in coordinating information exchanges in various safety concepts relevant to DOE including nuclear safety; safety and	• Continuation of all FY 2021 activities.	• No significant change.

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
	organizational culture, high reliability performance and human performance improvement; and probabilistic risk assessment with the Institute of Nuclear Power Operations, a non-profit organization established by the commercial nuclear power industry to promote the highest levels of safety and reliability in the operation of nuclear power plants.		
	• Maintain web-based systems to provide the status of the safety basis of each hazard category 1, 2, or 3 DOE nuclear facility and provide public information on how to obtain copies of safety basis and related documents for DOE nuclear facilities.		
	• Implement safety software quality assurance activities that provide for the maintenance of the DOE safety software central registry of approved computer codes, including a user-oriented communication forum, and operation of the safety software expert working group for enabling effective and consistent use of high-quality safety software across DOE.		
	• Provide for the testing of 100 percent of all high efficiency particulate air filters used in safety class and safety significant systems, and other ventilation systems for confinement of radioactive materials prior to their use at DOE nuclear facilities.		
Environment $2,407,000		**$2,407,000**	**$0**
	• Research, update, and maintain existing DOE regulations, directives, and technical standards, and develop new environmental protection, and public radiation protection requirements based on new or evolving science, protection strategies, national radiation protection guidance, and techniques based on new or evolving DOE activities and programs, when warranted.	• Continuation of all FY 2021 activities.	• No change in work scope.
	• Provide technical assistance to DOE programs, laboratories, and sites in implementing public radiation protection requirements and programs.		
	• Provide technical support to DOE site and program offices and laboratories in evaluating and resolving regulatory compliance issues through the interpretation of regulatory requirements, development of cost-effective implementation strategies, and maintenance of web-based compliance tools.		

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted

- Coordinate and develop consolidated responses to proposed changes in environmental regulations that may impact Departmental operations to improve implementation and optimize the use of protective resources.
- Review data from environmental reports required by Federal and state environmental protection agencies to validate adherence to reporting requirements; evaluate the effectiveness of the Department's toxic chemical release reduction and pollution prevention efforts; produce annual reports on DOE environmental performance; and develop annual radionuclide emissions summaries submitted to the EPA under an interagency agreement.
- Conduct proficiency and quality assurance audits and reviews of environmental analytical laboratories and commercial waste treatment, storage, and disposal vendors used by DOE operating entities in support of ongoing operations, remediation, and other cleanup projects, compliance programs, and long-term monitoring and surveillance activities to ensure consistency of services while minimizing the number of DOE audits of these commercial service providers.
- Support development and maintenance of software toolkits to assist DOE operating elements in meeting data quality objectives related to environmental field sampling and to support user training at DOE field element sites.
- Provide assistance to and oversight of DOE site property radiological clearance and control programs to ensure the public and environment are protected from radiological harm associated with the use or disposition of DOE property.
- Continue development and maintenance of residual radioactivity models and codes that support evaluations and safe disposition of lands, structures, equipment, soil, and other material that may contain small amounts of residual radioactive material.
- Support development of Federal radiation protection policies and guidelines and consistent, cost effective implementation of radiation protection programs within DOE including the review, evaluation and implementation of the 2014 and 2015 updates to the recommendations of the International Commission on

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted

Radiological Protection and associated revisions to Federal guidance reports on radiation protection.

- Provide assistance to support development and effective use of national consensus standards for radiation protection, radioactive waste and materials management, environmental protection, and operational resilience.
- Support the Center for Radiation Protection Knowledge at the Oak Ridge National Laboratory to ensure U.S. leadership in radiation dosimetry and risk assessment.
- Maintain operational guidelines and other radiological criteria that support protective action decisions and Federal policy governing response to and recovery from radiological and nuclear terrorism incidents (radiological dispersal devices and improvised nuclear devices) and major nuclear accidents, and support NNSA emergency response and preparedness activities associated with such incidents.
- Provide technical assistance to DOE programs, laboratories, and sites in implementing natural and cultural resource protection requirements and programs.

Domestic Health Programs $27,795,000	**$26,520,000**		**-$1,435,000**

Health Research $2,970,000

- Provide for the operation and maintenance of the electronic comprehensive epidemiologic data resource, the illness and injury surveillance database, and the U.S. Transuranium and Uranium Registry.
- Support the Radiation Emergency Assistance Center/Training Site, which provides medical expertise to DOE occupational medicine clinics, supplies chelating pharmaceuticals to treat radiation-exposed workers, and trains physicians to respond to radiological accidents anywhere in the United States.
- Provide for maintenance of the beryllium registry, which collects, analyzes, summarizes, and disseminates health and exposure data to improve chronic beryllium disease prevention programs.
- Provide for the conduct of public health studies and other activities performed by the Department of Health and Human Services through the National Institute for Occupational Safety and

$2,470,000
- Continuation of all FY 2021 activities.

- No significant change.

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
	Health, the National Center for Environmental Health, and the Agency for Toxic Substances and Disease Registry to provide third-party objectivity regarding the effect of DOE operations on communities surrounding DOE sites. • Provide funding for the Million Person Radiation Workers and Veterans Study that will provide the most precise estimate possible of the lifetime risk of cancer resulting from low levels of chronic radiation exposure and be of significant value to workers and the public. Results also would appreciably improve the data used for compensation of workers with prior exposures to ionizing radiation.		
	Former Worker Medical Screening $19,850,000 • Conduct site assessments to identify groups of at-risk former DOE Federal and contractor/ subcontractor workers and DOE site-specific exposures. • Provide for outreach efforts to inform former workers of the availability and benefits of the program. • Provide for approximately 8,000 medical screenings annually to check for adverse health effects that could be related to occupational exposures to radiation, noise, beryllium, asbestos, silica, lead, cadmium, chromium, and solvents, conducted by independent health experts through seven cooperative agreements held by a consortia of universities, labor unions, and commercial organizations throughout the United States with expertise in administration of medical programs. • Refer workers who are found to have illnesses related to work on behalf of DOE to the Department of Labor for potential compensation through the Energy Employees Occupational Illness Compensation Program Act. • Support the DOE central institutional review board, jointly funded with Science and NNSA, which reviews all medical screening programs funded by DOE and/or involving the DOE workforce to ensure the risks to human participants are minimized and reasonable in relation to the anticipated benefits.	$19,850,000 • Continuation of all FY 2021 activities.	$0 • No change in work scope.
	Energy Employee Occupational Illness Compensation Program (EEOICPA) $5,135,000	$4,200,000 • Continuation of all FY 2021 activities.	• No significant change.

FY 2021 Enacted	FY 2022 Request	**Explanation of Changes** **FY 2022 Request vs FY 2021 Enacted**
• Conduct searches for records related to the employment and hazardous exposures for workers who applied to the Department of Labor for benefits under EEOICPA, declassify relevant records, and provide copies of those records to the Department of Labor (DOL) and the National Institute for Occupational Safety and Health. • Provide for large-scale records research projects conducted by DOL, the National Institute for Occupational Safety and Health, and the President's Advisory Board on Radiation and Worker Health. • Provide for the continued transition of hard copy, paper records to electronic records, as well as records indexing projects to improve the efficiency of responses to the DOL and the National Institute for Occupational Safety and Health. • Continue coordination and interface between former worker medical screening activities and EEOICPA activities, including identifying mechanisms for outreach to former workers and enhancing the exchange of medical, site, and exposure information among former worker medical screening service providers, the DOL, and the National Institute for Occupational Safety and Health to assist the agencies tasked with adjudicating claims.		
International Health Program $23,050,000	**$23,050,000**	**$0**
Russian Health Studies $2,750,000 • Provide for the conduct of radiation exposure historical dose reconstruction studies, epidemiologic studies, and for a tissue repository of Russian nuclear workers and people living in communities surrounding the Russian nuclear facilities. • Assess radiation health effects of ionizing radiation. • Publish analyses of radiation health effects assessments.	$2,750,000 • Continuation of all FY 2021 activities.	$0 • No change in work scope.
Japanese Health Studies $14,000,000 • Conduct epidemiologic studies and medical surveillance of the survivors of the atomic bombings of Hiroshima and Nagasaki at the Radiation Effects Research Foundation. • Assess radiation health effects of ionizing radiation. • Publish analyses of radiation health effects assessments.	$14,000,000 • Continuation of all FY 2021 activities.	$0 • No change in work scope.

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Marshall Islands Program $6,300,000 • Conduct whole-body counting and plutonium urinalyses to measure individual exposure to radionuclides. • Conduct comprehensive annual screening examinations. • Provide medical care for specified Marshallese. • Provide environmental monitoring services in support of resettlement activities.	$6,300,000 • Continuation of all FY 2021 activities.	$0 • No change in work scope.

Security

Description

The Security subprogram provides support to develop and assist in the implementation of safeguards and security programs that provide protection to national security and other vital national assets entrusted to DOE, and to implement the U.S. Government's nuclear weapons-related technology classification and declassification program. Policies and guidance related to physical, personnel, and information security and nuclear materials accountability are designed to promote responsiveness to national security needs and changing threat environments. Assistance is provided to DOE programs and site offices and laboratories via working groups, site-specific support, and corporate program support to implement cost-effective security measures tailored to Departmental mission accomplishment. Corporate security-related information management systems are maintained to identify and reduce the potential for undue risk to individual sites, the Department, and national security. This subprogram also provides for the continuous physical protection and security of DOE facilities and information in the National Capital Area and access authorization security background investigations for EHSS Headquarters Federal and contractor personnel. Additionally, DOE implements the information control program for the U.S. Government to mitigate national security threats by preventing the release of information regarding weapons of mass destruction. Support is also provided to review over 400 million pages of documents at the National Archives for potential release as required by Executive Order 13526.

In FY 2022, Security activities will include developing comprehensive, reasonable, and cost-effective security policies and operational guidelines to assure that the Nation's nuclear and energy assets and DOE's personnel and facilities are secure from insider and external threats.

Insider Threat Program

The DOE Insider Threat Program (ITP) is intended to: deter cleared employees from becoming insider threats; detect insiders who pose a risk to personnel, assets, facilities, or classified or sensitive information; and mitigate insider threat risks through administrative, investigative, or other response actions. The Secretary of Energy designated an EHSS Senior Executive as the Designated Senior Official for the ITP to provide guidance for and oversight of DOE's enterprise-wide ITP activities. On a continuing basis, this Designated Senior Official engages with senior security and intelligence officials across the Department and advises and reports directly to the Secretary and Deputy Secretary regarding the planning, construct, and operation of the Department's ITP.

Security Operational Support

Security operational support provides technical expertise to develop safeguards and security policy requirements and guidance; assistance to DOE operations, to include foreign ownership, control and influence analysis; security technology research, development, test and evaluations to effectively mitigate current and emerging threats; and maintenance and management of corporate-level safeguards and security-related programs and information technology systems. These activities support Departmental objectives by providing an appropriately tailored level of security requirements and cost-effective protection options for a wide range of scientific, research, and national security operations based on the significance of the national assets involved.

Security policies, requirements, and guidance are developed to be clear and easily implemented, with the goal of securing nuclear material and classified matter and protecting the highly specialized DOE workforce. Corporate Security/Complex Wide initiatives provide specialized assessments and analyses of enterprise-wide security activities and issues affecting DOE safeguards and security programs and the identification of approaches to address them. Human Reliability Program, under 10 C.F.R. 712, provides trending, analysis and training to ensure compliance and a consistent enterprise approach to implementation. Funding to implement EHSS's share of program responsibilities includes the DOE share for the inter-agency Security, Suitability and Credential Line of Business (SSCLoB) budget supporting Executive Branch-wide reforms to the security clearance, employment suitability, and credentialing processes.

Classification, Declassification, and Controlled Information

The classification, declassification, and controlled information activity ensures that the Department meets its statutory responsibility to implement the U.S. Government-wide program to classify and declassify nuclear weapons-related information (i.e., Restricted Data and Formerly Restricted Data) in order to prevent proliferation of nuclear weapons and

technology. This activity supports the implementation of Executive Order 13526, Classified National Security Information, to classify other information critical to national security (i.e., National Security Information), such as security-related information concerning U.S. nuclear sites and chemical/biological and radiological dispersal devices. Funding provides for declassification review of DOE records and the development of policies, requirements, and guidance and technical support for the protection of controlled unclassified information. Advanced Computer Tools to Identify Classified Information (ACTICI) is an artificial intelligence/machine learning initiative to develop advanced computer tools to identify classified information embedded in electronic documents and augment human classification reviews. The goals of the program are to develop and deploy advanced tools that can automatically identify the subject areas of a document, determine whether a document needs a classification review, determine if the document is classified, determine which parts of the document are sensitive, and determine which classification guides are applicable.

Security Investigations
Security investigation activities provide for background investigations conducted by the Defense Counterintelligence and Security Agency (DCSA) (formerly the National Background Investigations Bureau) of EHSS Headquarters federal and contractor personnel who require access to classified information or certain quantities of special nuclear material, as required by Section 145 of the Atomic Energy Act of 1954 (as amended) and Executive Order 12968, Access to Classified Information. The conduct of investigations and granting of access authorizations are based on 10 C.F.R. 710, Procedures for Determining Eligibility for Access to Classified Matter or Special Nuclear Material.

Headquarters Security Operations
Headquarters security operations provide a comprehensive safeguards and security program for the protection of DOE Headquarters facilities and assets in the Washington, DC, area. This is accomplished through the deployment of a protective force; security education programs; the management and operation of countermeasures, alarms, and access control equipment; and the implementation of security-related programs. Funding provides for a secure work environment and assures management, workers, and stakeholders that activities within Headquarters facilities are effectively protected.

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Security $70,926,000	**$70,669,000**	**-$257,000**
Insider Threat Program $3,000,000	**$1,500,000**	**-$1,500,000**
• Develop and maintain a robust program to deter, detect, and centrally analyze and respond to insider threats facing the Department. • Enhance existing information-sharing partnerships with law enforcement, intelligence, and community organizations. • Assist field sites in the establishment of Local Insider Threat Working Groups. • Assist Local Insider Threat Working Groups in the implementation of the Insider Threat Program. • Develop measures of success and program review criteria. • Develop and implement insider threat program training in fundamentals of counterintelligence, security, agency procedures for insider threat response, as well as applicable laws and regulations on gathering, integrating, retaining, safeguarding and use of collected insider threat data. • Produce an annual report for the Secretary to provide to the President. • Provide for the inter-agency Security, Suitability and Credentialing Line of Business operating budget.	• Continuation of all FY 2021 activities except for the inter-agency Security, Suitability and Credentialing Line of Business operating budget which is being moved to Security Operational Support.	• Funding decrease reflects completion of Insider Threat studies and moving support for the Security, Suitability, Credentialing Line of Business from Insider Threat to Security Operational Support.
Security Operational Support $5,940,000	**$7,341,000**	**+$1,401,000**
• Research, update, and maintain existing DOE regulations, directives and technical standards, and develop new safeguards and security requirements based on new or evolving threats or working conditions, when warranted. • Provide technical assistance to DOE programs, laboratories, and sites in implementing safeguards and security requirements and programs. • Provide technical support, training, and awareness materials for the security-related aspects of the human reliability program, including deployment of the human reliability program database and standard certification management system to ensure that over 10,000 individuals with access authorizations/clearances who occupy positions requiring access to special nuclear materials, nuclear explosive devices, or related facilities and information meet the highest standards of reliability and physical and mental suitability;	• Continuation of all FY 2021 activities with the addition of the inter-agency Security, Suitability and Credentialing Line of Business operating budget, which is being moved from Insider Threat.	• Funding increase primarily reflects moving support for the Security, Suitability, Credentialing Line of Business from Insider Threat to Security Operational Support.

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted

- Provide support to the security awareness special interest group for DOE and contractor safeguards and security awareness coordinators to share security awareness methods and products, solve problems, and disseminate security-related information to satisfy Presidential and other regulatory requirements.
- Operate, maintain, and perform data analysis of the electronic Safeguards and Security Information Management System, a centralized classified browser-based database that serves as the repository of current and historical DOE safeguards and security information pertaining to inspection deficiencies, corrective action status, facility clearance levels, classified addresses, and asset information.
- Provide technical support and assistance for risk communication, risk management, vulnerability assessments, and security system performance evaluations, verifications, and validations, which are used to identify and cost-effectively address and mitigate current and emerging threats to Departmental assets at the site level.
- Provide assistance to DOE programs, sites, and laboratories in the use of security technology as a means to mitigate vulnerabilities, reduce recurring costs, and lessen environmental impacts.
- Maintain corporate security-related information technology systems, such as the DOE electronic Foreign Ownership, Control, or Influence program mandated by the Federal acquisition regulations system (48 C.F.R. 904.7003, 952.204-2, 970.0404, 904.404, and 952.204-73) and by Executive Order 12829, National Industrial Security Program; the DOE foreign visits and assignments (FACTS) program that enables foreign nationals' participation in unclassified DOE work, as well as classified visits involving foreign nationals; and the Radiological Source Registry and Tracking (RSRT) database, which is used to inventory approximately 18,000 radioactive sealed sources at DOE sites in support of the Department's nonproliferation and antiterrorist programs, U.S. and DOE regulatory compliance, and international treaty obligations.
- Conduct specialized assessments and analyses of enterprise-wide security activities.
- Assess systemic issues affecting DOE safeguards and security programs and identify approaches to address them.
- Produce biennial reports to Congress on the status of Security of the

	FY 2021 Enacted	**FY 2022 Request**	**Explanation of Changes** **FY 2022 Request vs FY 2021 Enacted**
	Department's Category I and II Special Nuclear Materials.		
Classification, Declassification and Controlled Information **$13,679,000**		$13,179,000	-$500,000
	• Provide technical support in developing U.S. Government and DOE-wide policy and technical guidance to ensure that classified nuclear weapons-related information and other information critical to national security and to U.S. Governmental, commercial, or private interests is identified for proper protection. • Provide specialized technical expertise to foreign governments and to DOE and other U.S. departments and agencies regarding the national security implications of classification and declassification decisions for nuclear proliferation issues. • Provide training and certification of DOE and other agency personnel in classification and information control programs and related areas. • Provide support to the National Declassification Center for review of the remaining 3 million pages at the National Archives and follow-on record collections amounting to 24 million pages; support to NDC in its Interagency Referral Center confirming potential Restricted Data/Formerly Restricted Data in documents referred to DOE/EHSS by other agencies; • Review documents in support of DOE operations and other U.S. Government entities, such as Congress, Presidential Libraries, U.S. Patent Office, the Defense Nuclear Facilities Safety Board, the Government Accountability Office, and the Inspector General; and • Perform the final review of classified DOE documents and documents containing DOE equities from all U.S. Government departments and agencies, including DOE, when they are requested under the Freedom of Information Act and the mandatory provisions of Executive Order 13526, to ensure that DOE classified and controlled information is identified and protected from unauthorized release to the public as required by 10 C.F.R. 1004, Freedom of Information, and 10 C.F.R. 1045, Nuclear Classification and Declassification. • Continue efforts for the Advanced Computer Tools to Identify Classified Information (ACTICI) initiative.	• Continuation of all FY 2021 activities.	• No significant change.

Security Investigations $ 4,533,000	$4,000,000	-$533,000
• Provides for initial background investigations, periodic reinvestigations, and reimbursement for fingerprint and name checks. • Provide for the Defense Counterintelligence and Security Agency to conduct most background investigations of EHSS Headquarters Federal and contractor employees. Funding provides for initial single-scope background investigations, periodic reinvestigations, and initial and reinvestigation national agency checks, and continuous evaluation special agreement checks. • Research, update, and maintain existing DOE regulations, directives, and technical standards, and develop new personnel security requirements based on new or evolving threats or working conditions, when warranted. • Provide technical assistance to DOE programs, laboratories, and sites in implementing personnel security requirements and programs. • Conduct corporate-level access authorization adjudications (i.e., performing case reviews, conducting evaluations, and preparing decision packages), as necessary. • Operate and manage the electronic DOE Integrated Security System (eDISS), which consists of interrelated databases and associated client applications and web pages that automate the processing and tracking of access authorizations, access and visitor control, personal identity verification, and related personnel security processes. • Continue deployment of the personnel security case management system, as well as the integration of this system with DOE field site human resources, financial management, and access control systems to reduce overall personnel security program costs by eliminating redundant systems at DOE field sites and reduce processing time by integrating directly with other databases. • Provide for Homeland Security Presidential Directive 12 credentials for Headquarters DOE employees and contractors.	• Continuation of all FY 2021 activities.	• No significant change.
Headquarters Security Operations $43,774,000	$44,649,000	+$875,000
• Provide a protective force engaged in the physical protection of classified information, facilities, and the workforce 24 hours a day, 365 days a year at DOE Headquarters facilities and satellite facilities in Washington, DC, and Germantown, MD. • Conduct Active Shooter exercises, which include participation by state, local	• Continuation of all FY 2021 activities.	• No significant change.

and federal partners.

- Operate and maintain security alarms and access control systems, including security screening equipment, vehicle inspection scanning devices, internet protocol video, turnstiles, unmanned access/egress portals, other access control equipment; and protective force shelters.
- Conduct performance testing of information control systems to ensure the protection of sensitive and classified information vital to both national and economic security.
- Conduct technical surveillance countermeasures activities, such as surveys, inspections, in-conference monitoring, pre-construction consultation services, and threat analysis, in support of Presidential Decision Directive 61, Energy Department Counterintelligence, to detect and prevent hostile intelligence collection operations intent on penetrating DOE installations to steal technology or sensitive or classified information.
- Conduct the telecommunications security activities consisting of emission security, protected transmission systems, and communications security to ensure the protection of DOE's sensitive unclassified and classified telecommunications through various security components.
- Provide Communications Security (COMSEC) and TEMPEST support and oversight to all of the DOE/NNSA entities; develop and implement training for the various elements of the Technical Surveillance Program (TSP); perform COMSEC Audits/Inspections; and maintain DOE policy and guidance for TSP activities.
- Serve as the COMSEC Central office of record and national command and controlling authorities for classified key material.
- Provide access authorization adjudication services (i.e., case reviews and analysis, interviews, and use of court reporters and consulting physicians as needed) for DOE Headquarters personnel to assure that access to DOE classified information is permitted only after a determination that such access will not endanger the common defense and national security.
- Provide support by working with Federal partners in the development and implementation of continuous personnel evaluation and enterprise-wide access authorization adjudication workflow systems.
- Implement Homeland Security Presidential Directive 12 requirements related to the secure and reliable identification of DOE Federal and contractor employees.
- Provide technical support for the implementation of the DOE Headquarters security awareness and classified matter protection and control programs.

- Administer the DOE Headquarters facility clearance registration and foreign ownership, control, or influence programs for contractors granted access to classified information.
- Conduct safeguards and security surveys, self-assessments, and program reviews to ensure that DOE Headquarters operations comply with Departmental and national-level requirements.
- Replace and repair of Headquarters physical security systems at both the Forrestal and Germantown facilities.

Overview
Program Direction provides for Federal staffing and mission support services to provide overall direction and execution of the EHSS mission of conducting the Department's activities in environment, health, safety, and security policy, technical assistance, analysis, and corporate programs.

Technical Support Services: Defense Nuclear Facilities Safety Board (DNFSB) Liaison Activities
The Office of the Departmental Representative to the DNSFB ensures effective cross-organizational leadership and coordination to resolve DNFSB-identified technical and management issues to ensure the health, safety, and security of the workers, public, and environment.

Other Related Expenses
Other related expenses provide support required for EHSS to accomplish its mission. Support includes Working Capital Fund services; training for Federal employees; funding for information technology equipment, services, and DOE common operating environment fees; and executive protection and other security-related equipment.

Program Direction
Funding ($K)

Program Direction Summary	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Program Direction					
Salaries and Benefits	49,569	50,569	51,000	+431	+0.9%
Travel	2,700	2,700	2,700	0	0.0%
Mission Support	285	285	285	0	0.0%
Other Related Expenses	18,446	18,446	19,603	+1,157	+6.3%
Total, Program Direction	**71,000**	**72,000**	**73,588**	**+1,588**	**+2.2%**
Federal FTEs	262	262	262	0	0.0%
Support Service and Other Related Expenses					
Support Services					
Technical Support					
Defense Nuclear Facilities Safety Board Liaison Activities	285	285	285	0	0.0%
Total, Technical Support	285	285	285	0	0.0%
Total, Support Services	285	285	285	0	0.0%
Other Related Expenses					
Working Capital Fund	11,195	11,195	12,377	+1,182	+10.6%
Tuition/Training of Federal Staff	365	365	365	0	0.0%
Other Services Procured	6,886	6,886	6,861	-25	-0.4%
Total, Other Related Expenses	18,446	18,446	19,603	+1,157	+6.3%

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $72,000,000	**$73,588,000**	**+$1,588,000**
Salaries and Benefits $50,569,000	**$51,000,000**	**+$431,000**
• Funds 262 full-time equivalent employees (FTE): • Provides an Executive Protection Program in accordance with the authority of United States Code (USC) Title 42, Chapter 23, Section 161.k and 2201k (the Atomic Energy Act); 10 Code of Federal Regulation 1047; and USC Title 18, Chapter 203, Section 3053. • Manage the conduct of domestic and international health programs. • Implement physical and personnel security programs for DOE Headquarters facilities; and • Manage the U.S. Government-wide program to classify and declassify nuclear weapons-related technology and other national security information.	• Continuation of all FY 2021 activities.	• Funding change reflects an increase in Federal Salaries and Benefits, to include a pay raise of 2.7%.
Travel $2,700,000	**$2,700,000**	**$0**
• Support the management and conduct of environment, health, safety, and security programs for the Department; and • Support executive protection activities for the Secretary, Deputy Secretary, and other dignitaries as assigned.	• Continuation of all FY 2021 activities.	• No change in work scope.
Technical Mission Support $285,000	**$285,000**	**$0**
Defense Nuclear Facilities Safety Board (Board) Liaison Activities • Coordinate resolution of Board recommendations and agreed-upon defense nuclear facility safety issues. • Provide requested reports/information on defense nuclear facility safety issues. • Coordinate ready access to such defense nuclear facilities, personnel, and information as are necessary for the Board to carry out its responsibilities. • Provide technical evaluation and analysis of defense nuclear safety and management issues identified by the Board. • Provide assistance, advice and support to DOE/NNSA Program and field offices, including line management on addressing and resolving such issues; and	• Continuation of all FY 2021 activities.	• No change in work scope.

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
• Monitor Department-wide performance in addressing Board-related defense nuclear safety and management issues.			
Other Related Expenses $18,446,000		**$19,603,000**	**+$1,157,000**

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
• Working Capital Fund fees for the cost of common administrative services such as building occupancy and alterations, computer and telephone infrastructure and usage, mail service, copying, printing and graphics, procurement closeouts, supplies, online learning, computer network support, and payroll processing.	• Continuation of all FY 2021 activities.	• Funding change reflects an increase in Working Capital Fund (WCF) expenses.
• Federal employee training to obtain and/or maintain the technical competence of Federal employees.		
• The DOE common operating environment initiative that provides a single point of contact for all common information technology systems and services and brings security, service, efficiency, and scale to these projects.		
• Information technology investments that support Headquarters Federal and contractor staff with hardware, software, hotline, and other desktop computer maintenance support on per-user count and level of service.		
• Information technology systems exclusive to EHSS, such as the classified local area network that includes a Secret/Restricted Data network that supports Headquarters users and the Secret Internet Protocol Router Network that provides access to the Department of Defense classified network to effect coordination between the two departments;		
• Executive protection services to the Secretary of Energy and others designated by the Secretary; and the conduct of inquiries and investigations into significant matters of security concern.		
• Specialized security equipment and services.		

Environment, Health, Safety and Security

Safeguards and Security Crosscut
Funding ($K)

	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021 $ Chg.
Environment, Health, Safety and Security (EHSS)			
Protective Forces	33,303	35,419	+2,116
Physical Security Systems	7,379	6,138	-1,241
Information Security (Class/Declass)	13,679	13,179	-500
Cyber Security			
Identify	845	875	+30
Protect	4,144	4,184	+40
Detect	441	460	+19
Respond	73	75	+2
Recover	131	140	+9
Subtotal, Cyber Security		5,734	+100
Personnel Security	6,442	6,192	-250
Program Management (Security Operational Support)	5,940	7,341	+1, 401
Security Investigations Clearances	1,183	900	-600
Total, EHSS	**73,560**	**74,903**	**+1,343**

Artificial Intelligence & Machine Learning Crosscut ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Advanced Computer Tools to Identify Classified Information (ACTICI)	0	1,400	1,400	0
Total, Artificial Intelligence	**0**	**1,400**	**1,400**	**0**

Research and Development Crosscut ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Nuclear Safety Research Development	1,000	1,000	1,000	0
Total, Research and Development	**1,000**	**1,000**	**1,000**	**0**

Environment, Health, Safety and Security Funding by Appropriation by Site
Funding ($K)

	FY 2021 Enacted	FY 2022 Request
Environment, Health, Safety and Security		
Argonne National Laboratory	945	945
Brookhaven National Laboratory	250	250
Chicago Operations Office	50	50
Consolidated Business Center	259	259
Idaho National Laboratory	150	150
Idaho Operations Office	400	400
Kansas City Plant	10	10
Lawrence Berkeley National Laboratory	0	50
Lawrence Livermore National Laboratory	3,050	3,050
Lexington Project Office	200	200
Los Alamos National Laboratory	95	95
Nevada Site Office	15	15
NNSA Service Center	1,000	1,000
Oak Ridge Institute for Science and Education	1,305	1,255
Oak Ridge National Laboratory	1,035	1,035
Oak Ridge Operations Office	2,795	2,795
Office of Scientific and Technical Information	300	300
Ohio Field Office	5	5
Pacific Northwest National Laboratory	1,905	1,905
Pantex Plant	10	10
Richland Operations Office	1,000	1,000
Sandia National Laboratory	1,210	1,210
Savannah River Operations Office	500	500
Savannah River Site	10	10
Washington, D.C., Headquarters	189,801	189,801
Y-12 National Security Complex	20	20
Total, Environment, Health, Safety and Security	**206,320**	**206,320**

Office of Enterprise Assessments

Overview
The Office of Enterprise Assessments (EA) supports the Department's mission priorities and strategic plan for the secure, safe, and efficient operation of the nuclear weapons complex, science and energy research, and environmental cleanup activities by conducting independent assessments of security and safety performance throughout the Department, holding contractors accountable for violations of security and safety regulations, and providing training programs that institutionalize enterprise security and safety lessons learned. EA activities complement, but do not replace, the responsibility of DOE line management to ensure compliance with security and safety requirements and manage the Department's programs effectively.

Because EA is organizationally independent of the DOE entities that develop and implement security and safety policy and programs it is able to provide objective and timely information to DOE senior leadership, contractor organizations, and other stakeholders on whether national security material and information assets are appropriately protected; and whether Departmental operations ensure the safety of its employees and the public. EA activities evaluate Department's effectiveness in promoting protection strategies that are based on informed risk management decisions. EA is designated to implement congressionally authorized contractor enforcement programs pertaining to classified information security, nuclear safety, and worker safety and health. EA also operates the DOE National Training Center (NTC) in Albuquerque, New Mexico, to enhance the proficiency and competency of the Department's security and safety personnel.

EA's key activities in FY 2022 are:

- Strengthening the Department's posture and ability to protect national security assets (special nuclear material [SNM], controlled unclassified information, and classified matter), its employees and the public by:

  – Conducting comprehensive independent security performance assessments and follow-up assessments at DOE National Security / Category I SNM sites (those with high value assets); utilizing "limited notice" safeguards and security performance tests to provide accurate, up-to-date assessments of DOE site security response capabilities; and evaluating actions to detect insider threats from individuals who may seek to compromise national security and/or the ability of the Department to meet its mission;

  – Increasing the number of assessments performed and enhancing the methods and tools used to conduct comprehensive independent cybersecurity assessments, including unannounced "red team" performance testing to identify vulnerabilities in the Department's National Security, Intelligence, scientific, and other information systems to external and internal attacks;

  – Conducting nuclear safety, worker safety and health, and emergency management independent performance assessments of the Department's operations including high hazard nuclear construction projects and operations, such as those at the Los Alamos National Laboratory, Y-12 National Security Complex, Savannah River Site, Hanford Site, and Idaho National Laboratory;

  – Enhancing the effectiveness of the DOE enforcement function that holds contractor organizations accountable for noncompliance with worker safety and health, nuclear safety, and classified information security regulations;

  – Developing and providing training programs that promote the competency and proficiency of DOE federal and contractor employees and performing other related functions via the DOE National Training Center in Albuquerque, NM, that institutionalize security and safety data analytics and safety lessons learned in support of improved DOE security and safety performance; and

  – Using risk-informed and fact-based analysis to identify emerging trends in safety, security, and cybersecurity within the Department of Energy.

Office of Enterprise Assessments
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted ($)	FY 2022 Request vs. FY 2021 Enacted (%)
Office of Enterprise Assessments					
Nuclear Safety Assessments	7,621	6,892	7,621	+729	10.6%
Enforcement	435	435	435	-	0%
Security and Safety Training	16,012	17,108	19,279	+2,171	12.7%
Total, Office of Enterprise Assessments	**24,068**	**24,435**	**27,335**	+2,900	11.9%
Program Direction	**54,711**	**54,635**	**56,049**	+1,414	2.6%
Total, Office of Enterprise Assessments	**78,779**	**79,070**	**83,384**	+4,314	5.5%

Office of Enterprise Assessments
Explanation of Major Changes ($K)

	FY 2022 Request vs. FY 2021 Enacted
Office of Enterprise Assessments	
Increase for: Program funding of Nuclear Safety Assessments and Security and Safety Training reflects current operating levels of both programs; Salaries & Benefits to support subject matter experts to include a pay raise of 2.7% and for overall ongoing personnel actions to include lump sum payouts, Permanent Change of Station (PCS), and awards.	**+4,314**
Total, Office of Enterprise Assessments	**+4,314**

Description
The EA Program provides for the assessment of DOE performance in nuclear safety; implementation of the congressionally authorized contractor enforcement programs for classified information security, nuclear safety, and worker health and safety; development and administration of security and safety training that reflects the most current Departmental policy and lessons learned derived from enforcement investigations, independent assessments to enhance performance of the workforce, and data analytics in support of improved DOE security and safety performance.

Nuclear Safety Assessments
Provides for the planning and execution of independent assessments of DOE high hazard nuclear facility construction projects and nuclear facilities and operations to determine performance compared with nuclear safety requirements contained in Title 10, Code of Federal Regulations (C.F.R.) Part 830, Nuclear Safety Management, and related DOE directives. EA will continue its focus of nuclear safety performance assessments on nuclear weapons complex infrastructure projects, e.g., at the Y-12 National Security Complex; and at cleanup and related operations, e.g., construction of the Hanford Site Waste Treatment and Immobilization Plant; and pit production operations at Los Alamos National Laboratory and the Savannah River Site.

Enforcement
Provides the Department with the capability to implement the DOE contractor enforcement programs specified in 10 C.F.R. Part 824, Procedural Rules for the Assessment of Civil Penalties for Classified Information Security Violations; 10 C.F.R. Part 820, Procedural Rules for DOE Nuclear Activities; and 10 C.F.R. Part 851, Worker Safety and Health Program. These activities provide a consistent and transparent method of contractor accountability for classified information security, nuclear safety, and worker health and safety performance that complements the Department's contract management mechanisms. The goal of this activity is to ensure that DOE contractors adhere to classified information security, nuclear safety, and worker safety and health requirements, and promote proactive performance improvement through timely self-identification, reporting, and correction of noncompliant conditions that enables contractors to achieve excellence in mission accomplishment without the need for enforcement actions.

Security and Safety Training
Security and safety training activities provide the Department a means to improve security and safety performance by developing and maintaining the proficiency and competency of DOE security and safety contractor and Federal employees. These activities also improve senior executives' performance and capabilities to fulfill security and safety leadership responsibilities through standardized training for the security of critical Departmental and national security assets, the safety and health of the workforce, and the protection of the public and the environment. The DOE National Training Center (NTC), located in Albuquerque, New Mexico, serves as the primary resource for DOE security and safety training for Federal and contractor employees. Funding provides for operation and maintenance of the NTC campus and the development and presentation of various security and safety training and certification programs at the NTC, through e-learning mechanisms, and at DOE sites via mobile training teams. The NTC is also responsible for certifying training programs in accordance with DOE Policy 364.1, Health and Safety Training Reciprocity. The NTC certifies certain health and safety training programs in order for those training programs to be accepted at various DOE sites and contractor organizations, thus reducing or eliminating the need for employees to complete redundant training programs before conducting work at different DOE sites. The NTC also incorporates lessons learned and best practices identified during EA enforcement investigations and independent assessments into its training programs to increase their utility, relevancy, and effectiveness.

EA is continuing work on its data analytics program, which draws upon existing DOE reporting systems and programs, as well as other potentially useful data sources, to identify and interpret emerging security and safety trends across the DOE complex, and to evaluate their potential impact on the Department's performance. A robust data analytics program will result in improved risk-based planning for EA assessments, informed regulatory enforcement decision-making, and will help DOE programs and sites make better decisions, with the goal of improving security and safety performance.

Office of Enterprise Assessments

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs. FY 2021 Enacted
Office of Enterprise Assessments $24,435,000	**$27,335,000**	**+$2,900,000**
Nuclear Safety Assessments $6,892,000	**$7,621,000**	**+$729,000**
• Conduct independent assessments of high hazard nuclear facility construction projects to ensure performance in the implementation of nuclear safety requirements; and • Provide independent assessments of DOE nuclear facilities and operations to ensure performance in the implementation of nuclear safety requirements.	• Continuation of FY 2021 activities.	No significant change.
Enforcement $435,000	**$435,000**	**$0**
• Review and analyze information from the DOE data management system designed for noncompliance reporting, as well as reports from independent assessment activities, the DOE Occurrence Reporting and Processing System, the DOE Computerized Accident/Incident Reporting System, the DOE Safeguards and Security Information Management System, Federal accident investigations, and DOE site and program office assessments and evaluations to determine whether enforcement investigations are warranted and to identify performance trends; and • Conduct periodic outreach and training activities to communicate the Department's approach to security and safety enforcement, convey noncompliance-reporting expectations, and provide information about DOE regulatory performance.	• Continuation of FY 2021 activities.	No change.
Security and Safety Training $17,108,000	**$19,279,000**	**+$2,171,000**
• Develop and provide security and safety-related training and professional development programs at the NTC and at DOE sites through mobile training teams, Webinars, video conferencing, and synchronous distance learning to enhance performance throughout the Department; • Maintain and upgrade equipment and technologies to	• Continuation of FY 2021 activities.	Continued development and implementation of training curricula including expansion of virtual learning offerings, data analytics, activities to support a common DOE-wide Learning Management System, increased infrastructure maintenance, and information technology upgrades.

	FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs. FY 2021 Enacted

support a greater web presence and "just-in-time" online training products, such as webcasts and topical area seminars;

- Continue recent initiatives to provide expanded nuclear safety training, expanded DOE oversight training, and Nuclear Executive leadership curricula.
- Support development and implementation of the DOE Learning Nucleus platform that consolidates DOE-wide employee training resources and administration;
- Continue the implementation of the training reciprocity and collaboration program whereby certified safety training programs are recognized by other DOE contractors and sites and provide mechanisms for DOE contractors to work together to share training content and develop DOE-wide courses;
- Incorporate best practices and lessons learned from EA enforcement investigations and independent assessments as well as data analysis into NTC training programs to enhance performance of the DOE workforce; and
- Operate and maintain the facility, including classrooms, administrative offices, weapons live-fire ranges, and the Integrated Safety and Security Training and Evaluation Complex, a simulated DOE research and operational facility designed to allow for the use and evaluation of training methodologies and evolving safety and security technologies through hands-on, performance-based instruction.

Program Direction

Overview

Program Direction provides for Federal staffing and mission support services to provide overall direction and execution of the EA mission to conduct independent assessments of the Department's performance in security, safety, and other areas; implement classified information security, nuclear safety, and worker health and safety contractor enforcement programs; and develop and administer security and safety training that reflects the most current Departmental policy on security and safety issues; and perform internal analytic functions designed to optimize the prioritization and selection of specific EA activities.

Critical to achieving its vision and goals is the ability of EA to maintain a highly qualified workforce with the expertise and skills necessary to support, manage, and conduct its mission. The EA workforce is composed of security and safety professionals highly educated in science, engineering, and technology that are led by effective program and project managers with exceptional communication and leadership skills and supported by innovative resource management experts. The judicious use of contractor support continues to be a practical and cost-effective means of providing a surge pool of technical experts.

Support Services

Independent assessment activities provide high value to the Department by assessing performance and identifying gaps and vulnerabilities in physical security and cybersecurity programs, safety (worker and nuclear safety, and emergency management), and related performance. Independent assessment activities are selected based on careful consideration and analysis of risk to Departmental operations and performance trends, and tailored to the unique missions and needs of each DOE program and site / field office. Safeguards and security, information security, and cybersecurity independent performance assessment activities are designed to determine whether special nuclear materials, classified matter (parts and information), and controlled unclassified and sensitive information are adequately protected from unauthorized or inadvertent disclosure or diversion, including from the actions of malicious insiders. Independent performance assessment activities are also designed to evaluate whether the Department's overarching management and governance structure is effective in promoting robust protection strategies based on informed risk management decisions. Safety-related independent performance assessment activities determine whether workers and the public are protected from the hazards associated with the Department's operations, and identify events that could negatively impact the Department's ability to perform its mission and achieve its goals. Independent assessment activities provide accurate and timely information and analysis to the Department's senior leadership regarding the performance of the Department's security and safety programs and other functions of interest. Information is made available to Department management, congressional committees, and stakeholders, such as unions and local public interest groups, to provide confidence that the Department's operations are performed in a secure and safe manner.

Independent performance assessment activities complement but do not replace DOE line management's responsibility for security, safety, and contract performance management as required by Departmental policies. EA provides a check-and-balance function for the Department that is vital to provide assurance of its security and safety performance to its leadership, its workers, the public and Congress, and to maintain confidence in the Department's ability to be an effective self-regulator. As required by DOE Order 227.1A, Independent Oversight Program, independent assessment activities are performed by personnel who are organizationally independent of the DOE program and site / field offices that develop and implement policies and programs, and who can therefore objectively observe and report on the performance of those policies and programs as they relate to Departmental operations. Independent assessment processes are governed by documented, formal protocols that are continuously evaluated, revised, and refined based on Departmental and national events and activities that have an impact on DOE security and safety in order to provide more useful performance data and related information to DOE management.

Other Related Expenses

Support includes working capital fund services; training for Federal employees; information technology equipment and services, and the Energy Information Technology Services.

Other Defense Activities/Enterprise Assessments/
Program Direction   **FY 2022 Congressional Budget Justification**

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Program Direction
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Program Direction					
Salaries and Benefits	18,825	19,776	21,190	+1,414	7.2%
Travel	1,500	1,545	1,545	0	0%
Support Services	29,357	28,201	28,201	0	0%
Other Related Expenses	5,029	5,113	5,113	0	0%
Total, Program Direction	**54,711**	**54,635**	**56,049**	**+1,414**	**2.6%**
Federal FTEs	**94**	**94**	**94**	**0**	**0**
Support Services					
Independent Assessments	29,357	28,201	28,201	0	0%
Total, Support Services	**29,357**	**28,201**	**28,201**	**0**	**0%**
Other Related Expenses					
Working Capital Fund	2,572	2,804	2,804	0	0%
Training	113	116	116	0	0%
Other Services Procured	2,344	2,193	2,193	0	0%
Total, Other Related Expenses	**5,029**	**5,113**	**5,113**	**0**	**0%**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $54,635,000	**$56,049,000**	**+$1,414,000**
Salaries and Benefits $19,776,000	**$21,190,000**	**+$1,414,000**
• Provides for Federal staffing to manage and oversee direction and execution of the EA mission related to: independent assessments; enforcement; security and safety training; conduct enforcement investigations of DOE contractors for potential violations of security and safety requirements; develop and issue enforcement outcomes as necessary; conduct security and safety independent assessments; develop and deploy new and existing training curricula; conduct analytical activities to support EA programs; and provide infrastructure support related to EA resources and communication.	• The request will support 94 FTEs to perform core EA mission. •	Increase for Salaries and Benefits to support subject matter experts and for overall ongoing personnel actions to include pay raise of 2.7%, benefits, lump sum payouts, PCS and awards.
Travel $1,545,000	**$1,545,000**	**$0**
• Provides for Federal employee travel in support of EA enforcement, independent assessment, training, and other mission-related activities.	• Continuation of FY 2021 activities.	No change
Support Services $28,201,000	**$28,201,000**	**$0**
Independent Assessments $28,201,000 • Observe operations and conduct technical assessments and performance tests that examine the effectiveness of security and safety programs and policies, giving priority to the highest security interests, such as strategic quantities of special nuclear material, and activities that present the most significant safety risks to workers and the public, such as nuclear facilities and operations; • Conduct performance tests for critical security	*Independent Assessments $28,201,000* • Continuation of FY 2021 activities.	No change

Other Defense Activities/Enterprise Assessments/ Program Direction

interests, including protective force tests (e.g., force-on-force exercises) using weapons simulation systems and a specially trained composite adversary team to assess overall effectiveness;

- Conduct limited-notice performance testing of site protective forces to maximize response realism and broaden the spectrum of tested threat scenarios;
- Conduct performance assessments of the implementation of the Department's insider threat program to deter, detect, and mitigate potential insider threats posed by Federal and DOE contractor employees;
- Conduct announced and unannounced internal and external network penetration testing to provide a full understanding of a site's cybersecurity protection posture;
- Develop new and enhanced performance testing tools capable of detecting and countering evolving cybersecurity threats to national assets and critical infrastructure; Conduct the annual independent evaluation of DOE classified information systems security programs as required by the Federal Information Security Modernization Act;
- Conduct an annual evaluation of DOE classified information systems security programs for systems that process intelligence information on behalf of the DOE Office of Intelligence and Counterintelligence;
- Provide input to the DOE Office of Inspector General for the annual evaluation of the DOE unclassified information systems security

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted

program;

- Conduct annual "red team" cybersecurity performance assessments of the computer networks within the National Nuclear Security Administration nuclear weapons sites and laboratories;
- Undertake and/or support activities that promote accomplishing DOE Office of the Chief Information Officer and U.S. Intelligence Community strategic cybersecurity performance objectives;
- Conduct targeted reviews of selected nuclear safety functional areas across the DOE complex based on such factors as performance trends, changes to applicable requirements, and/or performance information gaps;
- Maintain the nuclear safety site lead program to monitor the status of DOE nuclear facilities and activities and facilitate the selection and execution of risk-informed assessment activities;
- Conduct risk-informed reviews of worker safety and health programs;
- Conduct reviews to assess performance of emergency planning, preparedness, and response and recovery capabilities;
- Conduct special reviews and studies of security and safety policies, programs, and implementation to identify needed program corrections;
- Develop reports to communicate security and safety performance, findings, and opportunities for improvement;
- Develop and broadly disseminate assessment report abstracts of key results to promote

Other Defense Activities/Enterprise Assessments/
Program Direction

FY 2022 Congressional Budget Justification

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
performance improvements; • Continuously analyze results, and develop periodic summary reports that identify cross-cutting issues and performance trends; • Conduct follow-up performance reviews to evaluate corrective action effectiveness; and • Provide lessons learned and trending of assessment results to the NTC to be used to develop or amend security and safety curricula to enhance performance of the DOE workforce.		
Other Related Expenses $5,113,000	$5,113,000	$0
• Working Capital Fund (WCF) fees, based on guideline estimates issued by the working capital fund manager, for the cost of common administrative services such as building occupancy and alterations, computer and telephone infrastructure and usage, mail service, copying, printing and graphics, procurement closeouts, supplies, online learning, computer network support, and payroll processing; • Federal employee training to obtain and/or maintain the technical competence of EA Federal employees, assuring that Federal personnel are fully capable of performing missions of the Department; and • The Energy Information Technology Services that provide a single point of contact for all common information technology systems and services at DOE Headquarters, promoting security, service, and efficiency.	• Continuation of FY 2021 activities.	No change.

Other Defense Activities
Facilities Maintenance and Repair

The Department'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 2020 Actual Cost	FY 2020 Planned Cost	FY 2021 Planned Cost	FY 2022 Planned Cost
National Training Center	473	1,670	1,720	1,771
Total, Direct-Funded Maintenance and Repair	**473**	**1,670**	**1,720**	**1,771**

Report on FY 2019 Expenditures for Maintenance and Repair

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 2019 to the amount planned for FY 2019, including congressionally directed changes.

Other Defense Activities
Total Costs for Maintenance and Repair ($K)

	FY 2020 Actual Cost	FY 2020 Planned Cost
National Training Center	473	1,670
Total, Maintenance and Repair	**473**	**1,670**

Funding by Appropriation by Site ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
Enterprise Assessments			
National Training Center	150	150	150
Washington Headquarters	78,629	78,920	83,234
Total, Enterprise Assessments	**78,779**	**79,070**	**83,384**

Enterprise Assessments
Safeguards and Security ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Cybersecurity	5,741	9,335	9,335	0
Total, Safeguards and Security	**5,741**	**9,335**	**9,335**	**0**

Legacy Management

FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
$162,029	$163,059	$428,730

Overview

The U.S. Department of Energy (DOE) Office of Legacy Management (LM) protects human health and the environment by providing long-term management solutions at over 100 World War II and Cold War era sites where the federal government operated, researched, produced, and tested nuclear weapons and/or conducted scientific and engineering research. Residual hazards remain at these sites after cleanup due to technical limitations of the remedial work. As a result, the U.S. Department of Energy (DOE) maintains a post closure obligation to protect human health and the environment after cleanup is completed. LM fulfills this obligation by providing long-term management of these sites. The communities where these sites are located have traditionally experienced disproportionately high human health and environmental impacts.

LM appropriations provides funding for Long-Term Surveillance and Maintenance (LTS&M) at more than 100 sites. In addition to this mission, LM evaluates the condition and addresses physical safety hazards of Defense-Related Uranium Mines (DRUM), performs Archiving and Information Management (AIM) at more than 101 sites and for LM Operations, assures post-retirement benefits to 10,000 former contractor workers (Legacy Benefits), and conducts Asset Management (AM), Environmental Justice (EJ), Education, Communication, History, and Outreach (ECHO), and Program Direction (PD) functions.

Highlights and Major Changes in the FY 2022 Budget Request

LM's FY 2022 request is a total increase of $265,671,000 from the FY 2021 enacted level. The increase includes $15,671,000 to support LM's long-term stewardship core activities. This work is performed at traditionally underserved locations and therefore has a positive impact on Environmental Justice within historically disadvantage communities. Additionally, the increase includes $250,000,000 to support the consolidation of the administration of Formerly Utilized Sites Remedial Action Program (FUSRAP) under a single agency: the Department of Energy.

LM's core activities include performing LTS&M at 103 sites, an increase of two sites from FY 2021. Further, the request implements actions to address the impact of uranium contamination on the Navajo Nation and Tribal lands through the establishment of a dedicated DRUM team to provide verification and validation of defense-related uranium mines on these lands. Other actions include assessment of defense-related uranium mines; acceleration of major maintenance & repairs at sites such as the Mexican Hat site in Utah and the Shiprock site in New Mexico. Funding also supports the provision of post-retirement benefits (health, life insurance, etc.) to almost 10,000 former contract employees and spouses; management of records and information; pursuing beneficial reuse of properties; administration of the Department's Critical Minerals Leasing Program; engaging the public; performing outreach; and executing the Department's environmental justice activities.

This request includes a proposal to consolidate the administration of FUSRAP under a single agency: the Department of Energy. Upon adoption, the proposed action will improve the FUSRAP program execution by providing consistent funding, expansion of contract capacity, and elimination of administrative layers that could negatively impact site remediation. By way of example, during the Shallow Land Disposal Site project the U.S. Army Corps of Engineers (USACE) discovered previously unidentified radioactive material. This changed site condition required procurement of a new contract with the appropriate expertise. Funding under a single agency would have allowed USACE to utilize DOE's expertise and contracting capacity. The proposal assigns administration of FUSRAP to DOE. There will be no change in the execution of the work; USACE will continue to conduct cleanup of FUSRAP sites; and LM will continue to conduct LTS&M after cleanup activities are completed. Under this request the total support for the proposal is $250,000,000, equal to FUSRAP's FY 2021 enacted level[1]. Approval of this request facilitates efficient preparation and remediation activities at FUSRAP sites such as the

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[1] FUSRAP's FY 2021 enacted level appropriated to USACE per P.L. 116-260

Niagara Falls Storage Site (NFSS) in New York and the Shallow Land Disposal Area (SLDA) in Pennsylvania. Activities at NFSS included contract acquisition for the remedial design at the Interim Waste Containment Site and preparation of the Record of Decision for the Balance of Plant Operable Unit. Activities at SLDA includes awarding the task order to remediate two trenches of contaminated material.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Legacy Management					
Legacy Management					
Long-Term Surveillance and Maintenance	60,976	66,414	327,238[1]	+260,824	+393%
Archives and Information Management	17,737	20,347	20,347	0	0%
Legacy Benefits	50,300	37,224	42,400	+5,176	+14%
Asset Management	9,824	12,196	12,196	0	0%
Education, Communication, History, and Outreach, and Environmental Justice	3,930	6,616	6,616	0	0%
Subtotal, Legacy Management	**142,767**	**142,797**	**408,797**	**+266,000**	**+189%**
Program Direction	**19,262**	**20,262**	**19,933**	**-329**	**-2%**
Total, Legacy Management	**162,029**	**163,059**	**428,730**	**+265,671**	**163%**
Federal FTEs	**75**	**80**	**80**	**0**	**N/A**

[1] Request includes $250,000,000 to administrate the Formerly Utilized Sites Remedial Action Program as authorized by Section 611 of the Energy and Water Development Appropriations Act, 2000 (P.L. 106-60; 10 U.S.C. 2701 note), as Amended.

	FY 2022 Request vs FY 2021 Enacted
• **Long-Term Surveillance and Maintenance:** The increase supports program management of FUSRAP. The increase also supports the following: Enviornmental Justice proiorties, the transfer of new sites to LM; inventorying, and safeguarding of DRUM sites on public, Navajo Nation, Tribal, and private lands; and major maintenance and repair activities at current sites in Tribal Lands such as Mexican Hat site in Utah, Shiprock site in New Mexico.	**+260,824**
• **Archives and Information Management:** The request supports the implementation of an enterprise geospatial information system to facilitate compliance with several statutes directing data access, quality and use, data sharing as well as the compliance with E.O. 13859 (Maintaining American leadership in AI) and E.O. 13960 (Promoting the use of trustworthy AI in the Federal Government) on Artificial Intelligence. Additionally, the request supports records and information management activities from the anticipated increased portfolio of sites, and restoration and modernization of records management and knowledge management systems to preserve institutional knowledge and validate LM site safety to human health and the environment.	**0**
• **Legacy Benefits (formerly Pension and Benefit Continuity):** Increase provides funding required for management of post-retirement benefits.	**+5,176**
• **Asset Management:** Request supports the aviation management program requirements; sustainablity requirements for the LM Field Support Center, and the LM Operations, and Departmental properties; management of the Critical Minerals Leasing Progrom; and stewardhip and perservation responsibilites under § 3061010 of the National Historical Preservation Act (NHPA).	**0**
• **Education, Communication, History, and Outreach, and Environmental Justice (formerly Communication, Education, Outreach, and Environmental Justice):** Request supports additional communications with stakeholders and increased press encounters (i.e. Denver, Cincinnati, and Albuquerque). Reflects an effort to proactively engage public interest and address media scrutiny of our highly sensitive mission. Request will also support additional Environmental Justice and Science, Technology, Engineering, and Mathematics (STEM) activities.	**0**
• **Program Direction:** Request supports proposed 2.7% Cost-of-living increase, salaries, benefits, travel, training, and overhead for Federal FTEs. Carryover resources from FY 2021 will support the decreases from FY 2021 Enacted levels.	**-329**
Total, Legacy Management	**+265,671**

Legacy Management

Overview

LM contains essential elements in protecting human health and the environment and ensuring a long-term solution to the Cold War's environmental legacy. LM's long-term solution includes performing Long-Term Surveillance & Maintenance (LTS&M) at closed and remediated sites; evaluating the condition and addressing physical safety hazards at Defense-Related Uranium Mines; management of legacy archives and records (Archives and Information Management); asset management of DOE's real and personal property (Asset Management); conducting preservation activities at DOE land and facilities; providing pension and post-retirement benefits to former contractor workers (Legacy Benefits); and providing education, communication, history, and outreach to the public, intergovernmental entities and tribal nations, and executing DOE's environmental justice activities (Education, Communication, History, and Outreach and Environmental Justice).

Long-Term Surveillance and Maintenance

LM protects human health and the environment by conducting LTS&M activities at remediated sites that have been closed. The overall goal of LM's LTS&M activities are to ensure that environmental remedies put in place during site cleanup continue to protect human health and the environment. Sites are remediated under the following regulatory and/or functional categories before they are transferred to LM: Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)/Resource Conservation and Recovery Act of 1976 (RCRA); Uranium Mill Tailings Radiation Control Act of 1978 (UMTRCA) Title I & II ; Formerly Utilized Sites Remedial Action Program (FUSRAP); Defense Decontamination and Decommissioning (D&D) Program; Nevada Off-Sites and the Plowshare/Vela Uniform Program; and the Nuclear Waste Policy Act (NWPA, 1984) Section 151. LM continues to conduct LTS&M activities under those regulatory and/or functional categories after sites are transferred. LM LTS&M activities include the following: isolation of radioactive and hazardous materials (often in engineered disposal cells), management and remediation of contaminated groundwater, and maintaining institutional controls (ICs), ranging from signs to legal instruments, such as deed restrictions.

The funding requested for FY 2022 will allow LM to conduct LTS&M activities and routine functions at 103 sites. Routine functions include soil, water, and air monitoring, long-term treatment of contaminants, maintenance of disposal cells, facility and infrastructure maintenance, and security. By the end of FY 2022 LM will transition the Durita, CO Disposal Site and Spilt Rock, WY Disposal Site for a total of 103 sites. Additionally, LM will be performing transition activities in 12 sites scheduled to transfer in the next five years. Some of the sites that will transfer to LM in next five years includes Ray Point Site in Texas, Bear Creek Disposal Site in Wyoming, and Hazelwood Site in Missouri. LM has major repair and maintenance projects so that sites remain protective of public health and the environment. Some of these sites that require major repair and maintenance projects include but not exclusive to the Mexican Hat site in Utah, and the Shiprock site in New Mexico.

This activity also includes verification and validation field activities and safeguarding of physical safety hazards at Defense-Related Uranium Mines (DRUM) sites. LM led the effort to produce the 2014 Defense-Related Uranium Mines Report to Congress. The report concluded there are still numerous data gaps associated with abandoned uranium mines. The initial 5-year campaign (Campaign #1) focuses on approximately 2,500 mines on public lands. These data gaps need to be addressed to fully comply with the intent of Congress. Beginning in FY 2017, DOE participated in intergovernmental coordination efforts to begin filling the data gaps and quantifying the risks. The funding for FY 2021 will support LM's continued involvement in a multi-agency effort to validate and verify existing information at 500 mines, collect site-specific data at each mine to identify possible hazards, perform risk scoring and ranking of these mine hazards, improve data quality and content of the national DRUM database, exchange information with federal, Tribal, and state governments, and work with partner agencies to mitigate physical hazards at mines. This effort will help DOE better define potential safety and environmental issues at DRUM sites. The funding request for FY 2022 will also support the transition to verification and validation field activities at DRUM sites on Navajo Nation and Tribal lands (Campaign #2) and private property (Campaign 3). More specifically, the increase will support the establishment of a dedicated DRUM team to provide verification and validation of defense-related uranium mines located on or near Navajo Nation and Tribal lands. It will also provide the ability to mitigate physical safety hazards at DRUM sites on public lands. Physical hazards are numerous and recognized as an immediate threat to public health and safety.

This activity also includes $250,000,000 to support a proposal to consolidate the administration of FUSRAP under a single agency (the Department of Energy). The proposal is jointly submitted by USACE and DOE-LM to address program challenges

from increased remediation complexities of future sites. For example, the Niagara Falls Storage Site (NFSS) in New York contains K-65 waste (similar to waste at Silos 1 &2 at DOE's Fernald Site) that is technologically challenging to remove and poses the potential for significant radiological exposure hazards. Additionally, the Shallow Land Disposal Area (SLDA) in Pennsylvania contains Uranium 235 (U235) that requires additional safety, security, and insurance measures. The approval of the FY 2022 proposal to realign the FUSRAP appropriations under one agency —U.S. Department of Energy (DOE-LM)— would provide consistent funding and remedies to challenges similar to NFSS and SLDA by giving USACE access to DOE existing expertise and contracting capacity.

The funding for FUSRAP will support cleanup activities performed by USACE at FUSRAP sites. Some of these sites include the Niagara Falls Storage Site in New York, Shallow Land Disposal Area in Pennsylvania, Hazelwood Site in Missouri, Curtis Bay Site in Maryland, and Deepwater Site in New Jersey. Per the proposal, LM will be responsible for the administration of FUSRAP, USACE will continue to conduct cleanup of FUSRAP sites, and LM will continue to conduct LTS&M after cleanup activities are completed.

Additionally, this activity includes supporting functions such as Applied Studies and Technology (AS&T) program that incorporate advances in science and technology to improve LTS&M capabilities; increase understanding of sites to design remedy repairs, and more effectively remediate and manage contaminated groundwater; enhance Environment, Safety, Health, and Quality (ESH&Q) and emergency management program that are structurally integrated into the daily operations of LM's programs and projects. ESH&Q also administers LM's science-based Environmental Management Systems (EMS) for maintaining environmental compliance and sustainably managing LM sites.

A related cost, directly supporting this activity and embedded within the total activity cost, is safeguards and security for LM properties. The costs include protective forces and physical security systems, as follows (in whole dollars): FY 2020 - $131,000; FY 2021 - $131,000; and FY 2022 - $131,000. The cost is derived from protective forces and physical security systems as planned for the Weldon Spring and Fernald sites.

Archives and Information Management (AIM)
This activity includes LM's custodianship of legacy physical and electronic records for LM sites, such as major closure sites at Fernald, Mound, Weldon Spring, and Rocky Flats as well as the records of the history of DOE and its predecessor agencies in support of the DOE Office of the Historian, recently transferred to LM. Additionally, this activity involves the management and security of LM's information technology (IT) infrastructure requirements. The major objectives of this activity include modernization of records management and geospatial information systems and continuous monitoring and enhancement of cyber security.

LM is responsible for approximately 119,000 cubic feet of physical records and approximately 4 terabytes of electronic records. LM's responsibility in this area includes management of the records and information systems (e.g., the Licensing Support Network) associated with the Yucca Mountain Project (YMP), in compliance with the Federal Records Act.

Within this activity, LM provides records management services for its active program elements and maintains legacy archives of inherited collections, including paper and electronic records and records in other media. Elements include records management policy and procedure development, planning, and development of oversight processes and actions that guide and govern physical and electronic records management operations, including preservation efforts for fragile or deteriorating records. Functions within this activity encompass operational records retention, records maintenance and use, records disposition processes, and activities to ensure proper documentation and validation of LM's environmental protection and compliance with hazardous waste disposition policies.

The activity includes responding to requests associated with the Freedom of Information Act, Privacy Act, and other information requests (e.g., DOE stakeholders processing claims associated with the Energy Employees Occupational Illness Compensation Program Act). LM currently receives approximately 1,800 information requests each year.

This activity also provides LM's environmental data, information management, and technology solutions for mission needs. This work involves the coordination of information collection, storage, preservation, dissemination, and destruction as well as managing the policies, guidelines, and standards regarding information and data management. LM maintains its IT

infrastructure – including maintaining functional equipment, operating systems, and software capable of accessing electronic records, providing planning, design, and maintenance of an IT infrastructure to effectively support automated needs (e.g., platforms, networks, servers, printers, etc.), and providing IT security for LM's unclassified computing networks. Specific accomplishments will include implementation of an enterprise geospatial information system to facilitate compliance with several statutes to include the Foundations for Evidence-based Policymaking Act of 2017 and the Geospatial Data Act of 2018. Additionally, this activity will provide database enhancements for the DRUM sites and added storage/manipulation of increasing drone-related data.

IT security involves all processes and activities pertaining to the securing of Federal data and systems through the creation and definition of security policies, procedures, and controls covering such services as identification, authentication, and non-repudiation in accordance with Federal Information Processing Standards (FIPS) and the Federal Information Security Modernization Act of 2014. The cost of the embedded cyber security and information security functions are as follows (in whole dollars): FY 2020 - $1,118,000; FY 2021 - $1,248,000, and FY 2022 - $1,132,000

Legacy Benefits (formerly Pension and Benefit Continuity)
This activity fulfills the Department's commitment to former contractor employees who previously worked at sites prior to closure. For sites that have been closed, following the end of active programs and completion of site remediation, LM is responsible for ensuring former contractor employees, their dependents, and their beneficiaries receive the pensions and post-retirement benefits (PRB) that are part of the contractual agreements for the respective sites. Dependent upon the contract provisions for the respective sites, LM funds the contractor cost of providing retirement benefits to former contractor employees. These retirement benefits include pension plans, health insurance, health reimbursement account stipends, Medicare Part B reimbursement, and life insurance.

In FY 2022, LM will continue to support the administration of PRB (healthcare and insurance) for the following sites: Fernald (OH), Grand Junction (CO), Mound (OH), Paducah (KY), Pinellas (FL), Portsmouth (OH), and Rocky Flats (CO). There are more than 10,000 participants, including spouses, covered under the retiree medical plans. The total number of participants in these plans decreases over time, due to a closed participant population and normal mortality. A one-time efficiency utilized from converting LM's last pension plan to a privatized annuity program was used to offset FY 2021 funding requirements to manage PRBs. The FY 2022 request includes funding to meet these requirements.

Asset Management (AM)
LM manages a portfolio of more than 60,000 acres of land and other assets. This activity focuses on management of those acres and other assets in support of the LM mission including the administration of fleet, personal property and aviation management; awarding and administering leases to house programmatic functions; facility management and security of owned and leased facilities; infrastructure management; emergency management, and the reuse or transfer of real and personal property to other agencies, communities or private interests. Disposition of excess assets to non-DOE ownership is a priority. Disposing land to a community or private interest allows the land to be reused productively, reduces the Department's "footprint" of the Cold War legacy, and enables resumption of local property taxes. LM has disposed of more than ten properties since being created in FY 2004 and plans to dispose of three more properties in the near future. LM continues to evaluate assets for future property disposition.

This activity also includes management of lease tracts for royalties paid to the U.S. government from production on U.S. Bureau of Land Management (BLM) managed lands in Colorado. Lease management continues to strengthen LM's ability to demonstrate responsible lifecycle mining and supports production of strategic and critical minerals. Leases include the option for reclamation in lieu of royalties, which allows lessees to perform reclamation activities of legacy or pre-law abandoned mine sites on or near lease tracts in lieu of annual royalty payments. Additionally, this activity includes stewardship and preservation responsibilities under § 3061010 of the National Historical Preservation Act (NHPA).

A related cost directly supporting this activity and embedded within the total activity cost is safeguards and security for LM properties. The costs include protective forces, physical security systems, personnel security, information security, and program management, as follows (in whole dollars): FY 2020 - $1,104,000; FY 2021 - $1,054,000; and FY 2022 - $981,000

<u>Education, Communication, History, and Outreach and Environmental Justice (formerly Communication, Education, Outreach, and Environmental Justice)</u>
This activity provides for proactive outreach to the public, intergovernmental collaboration, and effective dialogue with state and local partners, and tribal nations integral to LM's mission. This activity focuses on ensuring that stakeholders are involved and informed of LM's long-term solutions. LM will proactively engage public interest and address media scrutiny of our highly sensitive mission.

This activity also includes administration of the Department's Environmental Justice (EJ) mission in accordance with Executive Order 12898, Federal Actions to Address Environmental Justice (EJ) in Minority and Low-Income Populations. LM provides leadership and coordination of the Department's EJ program and represents the Department on the Interagency Working Group on Environmental Justice. To supplement the Department's EJ mission, LM also administers the DOE EJ Mentors for Environmental Scholars (MES) Program, a summer internship that provides exposure to laboratory research in the area of Science, Technology, Engineering, and Mathematics (STEM) education program. The MES program actively recruits qualified undergraduates from Historically Black Colleges and Universities, Tribal Colleges, Hispanic Serving Institutions, and other minority institutions for extension training that will pilot them toward gainful employment in various research and management positions within DOE.

Legacy Management
Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Long-Term Surveillance and Maintenance- $66,414,000	$327,238,000	+$260,824,000
• Accept responsibility for surveillance and maintenance of 101 sites by the end of FY 2021. • Conduct transition actions for sites prior to their transfer to LM. • Support an interagency effort to address defense-related uranium mines. • Manage the Critical Minerals Leasing Program. • Support additional intensive maintenance and repairs activities. • Support expansion of the interagency effort to address defense-related uranium mines to include Tribal lands.	• Accept responsibility for surveillance and maintenance of 103 sites by the end of FY 2022. • Conduct transition actions for sites prior to their transfer to LM. • Continue to support an interagency effort to inventory and safeguard defense-related uranium mines on public lands and Tribal lands. • Adminstration of FUSRAP. • Support major maintenance and repairs projects.	• Transfer of 2 new sites to LM. • Enhance human health and environmental protections of disadvantaged communties' by executing major maintenance and repair at LM sites such as Mexican Hat site in Utah, Shiprock site in New Mexico. • Establish a dedicated DRUM team to provide verification and validation of defense-related uranium mines located on or near Navajo Nation and Tribal lands • $250, 000,000 for the adminstration of FUSRAP. • Transition activites for serveral (12) sites schedule to transfer in the next five years.

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Archives and Information Management- $20,347,000	$20,347,000	0
• Continue records/IT management functions for all sites and activities. • Accept responsibility for records/IT for sites transferred to LM during the fiscal year. • Continue to preserve Yucca Mountain Project records and information systems in compliance with the Federal Records Act	• Continue records/IT management functions for all sites and activities. • Accept responsibility for records/IT for sites transferred to LM during the fiscal year. • Continue to preserve Yucca Mountain Project records and information systems in compliance with the Federal Records Act. • Restoration and modernization of records management systems	• No change
Legacy Benefits- $37,224,000	$42,400,000	+$5,176,000
• Continue to reimburse contractor costs for post-retirement benefits (PRB) administration for seven sites. • Continue efforts to reduce DOE's liabilities for retiree pensions and medical benefits while maintaining commitments to DOE's legacy contractor workforce.	• Continue to reimburse contractor costs for PRB administration for seven sites. • Continue efforts to reduce DOE's liabilities for retiree post-retirment benefits while maintaining commitments to DOE's legacy contractor workforce.	• One-time efficiency was realized in FY 2021. • FY 2022 increase will fund required levels for management of PRBs per the actuary recommendation.

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Asset Management- $12,196,000	$12,196,000	0
• Initiate asset management support for incoming sites. • Manage infrastructure and facilities at LM sites. • Continue to increase and manage beneficial reuse initiatives at sites available for reuse. • Establish public land withdrawals with the Department of the Interior that are associated with incoming sites. • Supports planning, designing, and scheduling activities towards DOE's stewardship and perservation responsiblites under § 3061010 of National Historical Preservation Act (NHPA). • Manage infrastructure requirements for field locations and Departmental properties.	• Initiate asset management support for incoming sites. • Continue infrastructure and facilities management at LM sites and Departmental properties. • Continue to increase and manage beneficial reuse initiatives at sites available for reuse. • Establish public land withdrawals with the Department of the Interior that are associated with incoming sites. • Management of program's aviation activites and requirements. • Management of the Critical Minerals Leasing Program (formely managed under Long-Term Surveillance and Maintenance subprogram). • Continue activities towards DOE's stewardship and perservation responsiblites under § 3061010 NHPA (formely managed under Asset Mangement subprogram).	• No change

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Education, Communications, History, and Outreach and Environmental Justice- $6,616,000	$6,616,000	0
• Continue to increase stakeholder awareness and engage the public. • Continue Environmental Justice (EJ) functions as the Departmental focus for that program element. • Promote EJ functions in the communities affected by DOE closure actions.	• Continue to increase stakeholder awareness and engage the public. • Continue EJ functions as the Departmental focus for that program element. • Promote EJ functions in the communities affected by DOE closure actions.	• No change

Program Direction

Overview
The LM mission is carried out in the field by a workforce composed mainly of contractors paid mostly from program funds. Oversight, policy, and inherently governmental functions (e.g., human capital, facility management, contract administration, and budget management) are provided by a federal workforce funded from program direction. Within the program direction, most costs are associated with Federal personnel salaries and benefits.

Highlights of the FY 2022 Budget Request
The FY 2022 request includes supporting salaries, benefits, travel, training, and overhead for 80 Federal FTEs. The overhead support for Federal FTEs includes LM's portion of DOE's Working Capital Fund (WCF) and information technology and cyber security support. The request is a decrease of $329,000 from FY 2021 Enacted level. LM will utilize efficiencies from FY 2021 to support Program Direction requirements.

Program Direction
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Washington Headquarters				
Salaries and Benefits	13,558	14,699	15,228	+529
Travel	430	230	600	+370
Support Services	2,615	2,615	1,500	-1,115
Other Related Expenses	2,659	2,718	2,605	-113
Total, Program Direction	**19,262**	**20,262**	**19,933**	**-329**
Federal FTEs	**75**	**80**	**80**	**0**
Support Services				
Technical Support	110	0	0	0
Management Support	2,505	2,615	1,500	-1,115
Total, Support Services	**2,615**	**2,615**	**1,500**	**-1,115**
Other Related Expenses				
Other Services and Supplies	703	607	487	-120
Energy IT Services	389	395	402	+7
Working Capital Fund	1,567	1,716	1,716	0
Total, Other Related Expenses	**2,659**	**2,718**	**2,605**	**-113**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction- $20,262,000	**$19,933,000**	**-$329,000**
Salaries and Benefits- $14,699,000	**$15,228,000**	**+$529,000**

• Continue functions to manage LM's activities to achieve LM's program goals.
• Increase the number of federal employees to meet the increased site management responsibility and address physical hazards posed by defense-related uranium mines.
	• Continue functions to execute LM's mission and achieve LM's program goals.
	• Maintain a level of 80 Federal FTEs to meet the increased site management responsibilities and address physical hazards posed by defense-related uranium mines.
		• Increase will support the following:
		  • Proposed 2.7% cost-of-living increase.
		  • Salaries and benefits for 80 FTEs.
		  • Performance awards.

Travel- $230,000	**$600,000**	**+$370,000**
• Continue to conduct limited travel functions under COVID-19 restrictions.	• Resume normal travel activities to support mission functions such as surveillance, maintenance, operations, and oversight at a growing number of closed sites.	• The increase will support the program resuming normal mission-related traveling and additional travel demands related increased site portfolio and field responsibilities (surveillance, monitoring, and transition responsibilities).
Support Services- $2,615,000	**$1,500,000**	**-1,115,000**
• Continue effort to prepare more analyses and reports with Federal staff.	• Continue effort to prepare more analyses and reports with Federal staff.	• Requirements will be funded with carryover from FY 2021. • Provides additional administrative support.
Other Related Expenses- $2,718,000	**$2,605,000**	**-$113,000**

• Continue with procuring services and supplies at relatively the same level except for Working Capital Fund (WCF).	• Continue supporting individual development staff training, procurement of supplies, contributions to WCF and the Department's IT support.	• Requirements will be funded with carryover from FY 2021.
		• Supports the following:
		  • Individual staff and program wide training.
		  • Annual lease agreements.
		  • Increased expenses related to WCF Departmental IT support.

Legacy Management
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 2020 Actual Cost	FY 2021 Planned Cost	FY 2022 Planned Cost
Office of Legacy Management			
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Sites	3,696	3,599	4,199
Non-CERCLA Sites	1,078	1,336	1,307
Total, Direct-Funded Maintenance and Repair	4,774	4,935	5,506

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.

Legacy Management
Safeguards and Security Crosscut ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Protective Forces	719	649	642	-7
Physical Security Systems	149	120	120	0
Information Security	21	71	71	0
Cyber Security	1,097	1,183	1,067	-116
Personnel Security	35	75	76	+1
Material Control and Accountability	0	0	0	0
Program Management	332	335	268	-67
Security Investigations	0	0	0	0
Transportation Security	0	0	0	0
Construction	0	0	0	0
Total, Safeguards and Security	2,353	2,433	2,244	-189

Highlights:

The total decrease primarily includes support services efficiencies related to personnel security and program management.

**Legacy Management
Capital Summary ($K)
(Dollars in Thousands)**

	Total	Prior Years	FY 2020 Enacted	FY 2020 Actuals	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Capital Operating Expenses Summary (including Major Items of Equipment (MIE))							
Capital Equipment > $500K (including MIE)	n/a	n/a	0	0	0	0	0
Accelerator Improvement Projects (AIP) (<$5M)	n/a	n/a	0	0	0	0	0
Minor Construction	15,000	6,000	0	0	7,000	0	0
Total, Capital Operating Expenses	**15,000**	**6,000**	**0**	**0**	**7,000**	**0**	**0**
Capital Equipment > $500K (including MIE)							
Total Non-MIE Capital Equipment	n/a	n/a	0	0	0	0	0
Total, Capital Equipment (including MIE)	**n/a**	**n/a**	**0**	**0**	**0**	**0**	**0**
Accelerator Improvement Projects (Total Estimated Cost <$5M)							
Total, Accelerator Improvement Projects	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Minor Construction Projects							
Total Direct Funded Minor Construction Projects (TEC <$5M)	n/a	n/a	0	0	0	0	0
Total Indirect Funded Minor Construction Projects (TEC <$5M)	n/a	n/a	0	0	0	0	0
Minor Construction:							
Grand Junction Infrastructure Project (DF)	4,000	0	0	0	4,000	0	0
Grand Junction Building 7 Modernization (DF)	9,000	6,000	0	0	3,000	0	0
Total, Minor Construction Projects	**15,000**	**6,000**	**0**	**0**	**7,000**	**0**	**0**
Total, Capital Summary	**15,000**	**6,000**	**0**	**0**	**7,000**	**0**	**0**

Office of Hearings and Appeals
Program Direction

Overview
The Office of Hearings and Appeals (OHA) provides adjudicatory and conflict resolution services for DOE's programs so that disputes may be resolved at the agency level in a fair, impartial and efficient manner. The bulk of OHA work is defense-related and consists of the adjudication of security clearance cases that determine the eligibility of employees to have access to special nuclear material or classified information.

Within the Other Defense Activities Appropriation, OHA operates three Divisions: the Personnel Security and Appeals Division, the Employee Protection and Exceptions Division, and the Alternative Dispute Resolution Office (ADRO).

OHA offers fair, timely, impartial, and customer-friendly processes for adjudicating matters pursuant to regulatory authority or special delegation from the Secretary. Such matters include: (i) eligibility for a security clearance, (ii) whistleblower protection for employees of DOE contractors, (iii) Freedom of Information Act and Privacy Act appeals, (iv) relief from DOE product efficiency regulations to prevent special hardship, and (v) other matters that the Secretary may delegate. With respect to alternative dispute resolution, OHA's ADRO offers mediation and other services for a variety of matters.

Highlights of the FY 2022 Budget Request
The FY 2022 Budget Request supports a staff of 22 FTEs needed to accomplish OHA's primary mission of adjudicating security clearance cases, adjudicating exception relief from DOE product efficiency regulations, and providing ADR support for the Department.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Program Direction					
Salaries and Benefits	3,300	2,700	2,838	+138	+5%
Travel	60	82	50	-32	-39%
Support Services	90	100	100	0	0%
Other Related Expenses	1,402	1,380	1,368	-12	-2%
Total, Program Direction	**4,852**	**4,262**	**4,356**	**+94**	**+2%**
Federal FTEs	**22**	**22**	**22**	**0**	**0%**
Support Services					
Legal Research Support	90	95	95	0	0%
Other Related Expenses					
Energy IT Services	205	185	150	-35	-18%
Working Capital Fund	1,197	1,100	1,123	+23	+2%
Total, Other Related Expenses	**1,402**	**1,380**	**1,368**	**-12**	**-2%**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs. FY 2021 Enacted
Program Direction $4,262,000	**$4,356,000**	**+$94,000**
Salaries and Benefits $2,700,000	**$2,838,000**	**+$138,000**
Supports staffing level of 22 FTEs.	Supports staffing level of 22 FTEs.	Increase maintains OHA staffing requirements, to include a 2.7% pay raise and cover federal employee benefits and awards.
Travel $82,000	**$50,000**	**-$32,000**
Supports travel to conduct security hearings and ADR training activities and services at DOE field locations.	Continuation of FY 2021 activities.	Decrease reflects reduction in travel costs for OHA on-site hearings and ADR training activities and services at DOE field sites. This is due to continued use/enhancement of virtual platforms to conduct hearings and trainings.
Other Related Expenses $1,380,000	**$1,368,000**	**-$12,000**
Funding supports the Working Capital Fund (WCF), which provides for shared service costs and Departmental overhead expenses; Energy IT Services; and other services.	Continuation of FY 2021 activities.	Decrease reflects reduction in overhead expenses.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Argonne National Laboratory			
Environment, Health, Safety & Security	945	945	945
Environment, Health, Safety, and Security	945	945	945
Total Argonne National Laboratory	**945**	**945**	**945**
Brookhaven National Laboratory			
Environment, Health, Safety & Security	250	250	250
Environment, Health, Safety, and Security	250	250	250
Total Brookhaven National Laboratory	**250**	**250**	**250**
Chicago Operations Office			
Environment, Health, Safety & Security	50	50	50
Environment, Health, Safety, and Security	50	50	50
Total Chicago Operations Office	**50**	**50**	**50**
Consolidated Business Center			
Environment, Health, Safety & Security	259	259	259
Environment, Health, Safety, and Security	259	259	259
Total Consolidated Business Center	**259**	**259**	**259**
Fernald Site			
Legacy Management Activities - Defense	13,791	11,902	12,497
Legacy Management	13,791	11,902	12,497
Total Fernald Site	**13,791**	**11,902**	**12,497**
Grand Junction Office			
Legacy Management Activities - Defense	40,437	40,101	52,606
Legacy Management	40,437	40,101	52,606
Total Grand Junction Office	**40,437**	**40,101**	**52,606**
Idaho National Laboratory			
Environment, Health, Safety & Security	150	150	150
Environment, Health, Safety, and Security	150	150	150
Total Idaho National Laboratory	**150**	**150**	**150**
Idaho Operations Office			
Environment, Health, Safety & Security	400	400	400
Environment, Health, Safety, and Security	400	400	400
Total Idaho Operations Office	**400**	**400**	**400**
Kansas City National Security Complex (KCNSC)			
Environment, Health, Safety & Security	10	10	10
Environment, Health, Safety, and Security	10	10	10
Total Kansas City National Security Complex (KCNSC)	**10**	**10**	**10**
Lawrence Berkeley National Laboratory			
Environment, Health, Safety & Security	0	0	50
Environment, Health, Safety, and Security	0	0	50
Total Lawrence Berkeley National Laboratory	**0**	**0**	**50**
Lawrence Livermore National Laboratory			
Environment, Health, Safety & Security	3,050	3,050	3,050
Environment, Health, Safety, and Security	3,050	3,050	3,050

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	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Total Lawrence Livermore National Laboratory	**3,050**	**3,050**	**3,050**
Lexington Office			
Environment, Health, Safety & Security	200	200	200
Environment, Health, Safety, and Security	200	200	200
Total Lexington Office	**200**	**200**	**200**
Los Alamos National Laboratory			
Environment, Health, Safety & Security	95	95	95
Environment, Health, Safety, and Security	95	95	95
Total Los Alamos National Laboratory	**95**	**95**	**95**
Miamisburg Site			
Environment, Health, Safety & Security	5	5	5
Environment, Health, Safety, and Security	5	5	5
Total Miamisburg Site	**5**	**5**	**5**
Mound Site			
Legacy Management Activities - Defense	15,297	12,738	10,149
Legacy Management	15,297	12,738	10,149
Total Mound Site	**15,297**	**12,738**	**10,149**
National Energy Technology Lab			
Legacy Management Activities - Defense	2,464	2,403	2,403
Legacy Management	2,464	2,403	2,403
Total National Energy Technology Lab	**2,464**	**2,403**	**2,403**
Nevada Field Office			
Environment, Health, Safety & Security	15	15	15
Environment, Health, Safety, and Security	15	15	15
Total Nevada Field Office	**15**	**15**	**15**
NNSA Albuquerque Complex			
Environment, Health, Safety & Security	1,000	1,000	1,000
Environment, Health, Safety, and Security	1,000	1,000	1,000
Enterprise Assessments	150	150	150
Office of Enterprise Assessments	150	150	150
Total NNSA Albuquerque Complex	**1,150**	**1,150**	**1,150**
Oak Ridge Institute for Science & Education			
Environment, Health, Safety & Security	1,305	1,305	1,255
Environment, Health, Safety, and Security	1,305	1,305	1,255
Total Oak Ridge Institute for Science & Education	**1,305**	**1,305**	**1,255**
Oak Ridge National Laboratory			
Environment, Health, Safety & Security	1,035	1,035	1,035
Environment, Health, Safety, and Security	1,035	1,035	1,035
Total Oak Ridge National Laboratory	**1,035**	**1,035**	**1,035**
Oak Ridge Office			
Environment, Health, Safety & Security	2,795	2,795	2,795
Environment, Health, Safety, and Security	2,795	2,795	2,795
Total Oak Ridge Office	**2,795**	**2,795**	**2,795**

	FY 2020	FY 2021	FY 2022
	Enacted	Enacted	Request Detail
Office of Scientific & Technical Information			
Environment, Health, Safety & Security	300	300	300
Environment, Health, Safety, and Security	300	300	300
Total Office of Scientific & Technical Information	**300**	**300**	**300**
Pacific Northwest National Laboratory			
Environment, Health, Safety & Security	1,905	1,905	1,905
Environment, Health, Safety, and Security	1,905	1,905	1,905
Total Pacific Northwest National Laboratory	**1,905**	**1,905**	**1,905**
Pantex Plant			
Environment, Health, Safety & Security	10	10	10
Environment, Health, Safety, and Security	10	10	10
Total Pantex Plant	**10**	**10**	**10**
Pinellas Site			
Legacy Management Activities - Defense	4,333	4,535	3,664
Legacy Management	4,333	4,535	3,664
Total Pinellas Site	**4,333**	**4,535**	**3,664**
Portsmouth Gaseous Diffusion Plant			
Legacy Management Activities - Defense	5,200	5,000	4,200
Legacy Management	5,200	5,000	4,200
Total Portsmouth Gaseous Diffusion Plant	**5,200**	**5,000**	**4,200**
Richland Operations Office			
Environment, Health, Safety & Security	1,000	1,000	1,000
Environment, Health, Safety, and Security	1,000	1,000	1,000
Total Richland Operations Office	**1,000**	**1,000**	**1,000**
Rocky Flats Site			
Legacy Management Activities - Defense	30,068	26,875	32,996
Legacy Management	30,068	26,875	32,996
Total Rocky Flats Site	**30,068**	**26,875**	**32,996**
Sandia National Laboratories			
Environment, Health, Safety & Security	1,210	1,210	1,210
Environment, Health, Safety, and Security	1,210	1,210	1,210
Total Sandia National Laboratories	**1,210**	**1,210**	**1,210**
Savannah River Site			
Environment, Health, Safety & Security	10	10	10
Environment, Health, Safety, and Security	10	10	10
Total Savannah River Site	**10**	**10**	**10**
Savannah River Site Office			
Environment, Health, Safety & Security	500	500	500
Environment, Health, Safety, and Security	500	500	500
Total Savannah River Site Office	**500**	**500**	**500**
Washington Headquarters			
Program Direction - Environment, Health, Safety and Security	71,000	72,000	73,588
Environment, Health, Safety & Security	120,320	117,801	116,213

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	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Environment, Health, Safety, and Security	191,320	189,801	189,801
Program Direction - Office of Enterprise Assessments	54,711	54,635	56,049
Enterprise Assessments	23,918	24,285	27,185
Office of Enterprise Assessments	78,629	78,920	83,234
Specialized Security Activities	273,409	283,500	283,500
Legacy Management Activities - Defense	47,246	55,413	305,084
Legacy Management	47,246	55,413	305,084
Office of Hearings and Appeals	4,852	4,262	4,356
Total Washington Headquarters	**595,456**	**611,896**	**865,975**
Weldon Spring Site Office			
Legacy Management Activities - Defense	3,193	4,092	5,131
Legacy Management	3,193	4,092	5,131
Total Weldon Spring Site Office	**3,193**	**4,092**	**5,131**
Y-12 Site Office			
Environment, Health, Safety & Security	20	20	20
Environment, Health, Safety, and Security	20	20	20
Total Y-12 Site Office	**20**	**20**	**20**
Total Funding by Site for TAS_0243 - Other Defense Activities	**726,908**	**736,211**	**1,006,290**

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Departmental Administration

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Departmental Administration
Proposed Appropriation Language

For salaries and expenses of the Department of Energy necessary for departmental administration in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), $422,338,000, to remain available until September 30, 2023, including the hire of passenger motor vehicles and official reception and representation expenses not to exceed $30,000, plus such additional amounts as necessary to cover increases in the estimated amount of cost of work for others notwithstanding the provisions of the Anti-Deficiency Act (31 U.S.C. 1511 et seq.): Provided, That such increases in cost of work are offset by revenue increases of the same or greater amount: Provided further, That moneys received by the Department for miscellaneous revenues estimated to total $100,578,000 in fiscal year 2022 may be retained and used for operating expenses within this account, as authorized by section 201 of Public Law 95–238, notwithstanding the provisions of 31 U.S.C. 3302: Provided further, that the sum herein appropriated shall be reduced as collections are received during the fiscal year so as to result in a final fiscal year 2022 appropriation from the general fund estimated at not more than $321,760,000.

Explanation of Change

In FY 2022, the Office of Technology Transitions is requested as a separate appropriation. The Office of Policy is expanding in size and mission scope, to include Energy Jobs and Arctic Energy Office functions. The Office of Economic Impact and Diversity is consolidating Equal Employment Opportunity functions and staff across DOE, and expanding its mission to include energy justice activities and programs across the complex. The Office of Management is requesting $16 million for electric vehicles and charging infrastructure. Vulnerabilities identified by the response to the SolarWinds intrusion incident of December 2020, will be addressed through funds specifically dedicated to cyber response and recovery management within the Office of the Chief Information Officer (OCIO). These funds, totaling approximately $93 million, will be centrally managed by the OCIO to support priority activities throughout DOE.

Departmental Administration
($K)

FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
161,000	166,000	321,760	+155,760

Overview

The Departmental Administration (DA) appropriation funds 14 management and mission support programs that have enterprise-wide responsibility for administration, accounting, budgeting, contract and project management, human resources management, congressional and intergovernmental liaison, international cooperation and coordination, information management, life-cycle asset management, legal services, energy jobs, energy justice, workforce diversity and equal employment opportunity, ombudsman services, small business advocacy, sustainability, arctic energy coordination, and public affairs.

DA supports Strategic Partnership Projects that are reimbursed by customers of the DOE laboratories; and receives Miscellaneous Revenues that that offset the costs of the overall program of work. Additionally, the DA program of work operates by executing Defense-Related Administrative Support (DRAS) funding, appropriated within Other Defense Activities (ODA). This accounts for the support DA programs provide for the Defense portion of DOE.

Highlights of the FY 2022 Budget Request

In FY 2022, the Office of Technology Transitions is being requested as a separate appropriation. The DA Budget increase of $155.8 million reflects a dedication to strengthen enterprise-wide management and mission support functions, per the Administration's priorities, as outlined below:

- **Office of the Secretary (OSE):** Funding will continue to support leadership and policy direction at the Department.

- **Office of the Chief Financial Officer (CFO):** Funding will support OCFO fully staffing to 230 FTEs; funds for corporate business systems to meet and comply with updated cyber security requirements and initiatives; migrate to and operate in a Cloud environment; and enhance systems supporting enterprise business processes and systems, including agency financial report automation and audit management projects. Funding is also requested for continued implementation of the Robotic Process Automation (RPA) initiative across the OCFO activities.

- **Economic Impact & Diversity (ED):** Funding will enable ED to assume the new responsibilities of directly overseeing Employment Equal Opportunities (EEO) complaint processing for the entire DOE enterprise (except for NNSA), as well as directly overseeing the affirmative employment and diversity and inclusion functions for the entire DOE enterprise (with the exception of the NNSA and the Power Marketing Administrations), which is in addition to providing these functions for over 31 DOE Headquarters program and staff offices. ED will also be expanding its mission to include energy justice initiatives across the DOE complex, to include data tracking and trending analyses of DOE efforts in this area. An increase of 32 FTEs is requested, 17 of which support EEO realignment efforts, and the remainder support energy justice, diversity, equity, and inclusion activities.

- **International Affairs (IA):** Funding will support IA's prioritization of initiatives and technical assistance which reflects the changing global energy environment. In FY 2022, IA will continue to pursue international climate and clean energy cooperation through key multilateral and bilateral forums with the objective to reduce global greenhouse gas emissions, create good paying American jobs, enhance U.S. competitiveness, protect those most vulnerable to climate change, and lead a transition to net-zero emissions by 2050. An increase of 10 FTEs reflects current staffing needs.

- **Office of the Chief Information Officer (OCIO):** OCIO's priority is to continue the modernization of DOE's IT infrastructure and IT services to provide the capacity, flexibility, and resiliency required of a modern and secure enterprise. The proposed modernization initiatives included in the FY 2022 Request will continue to reduce cybersecurity risk through improved cybersecurity technology and automation, scale capacity commensurate with demand, and establish IT enterprise capabilities. Specifically, the vulnerabilities identified by the SolarWinds intrusion incident of December 2020, will be addressed through funds dedicated specifically to cyber response and

recovery management in the FY 2022 budget request. These funds, totaling $93,230,000, will be centrally managed by OCIO but used for priority system needs across DOE.

- **Management (MA):** Funding will support up to 206 full time equivalent employees and MA's mission fulfillment. Funding includes $16 million for purchase of Zero Emission Vehicles (ZEVs) within agency-owned vehicles fleets or as part of a transition from GSA-leased gas-powered vehicles to GSA-leased ZEVs. This funding also includes related charging infrastructure and program management costs associated with executing this funding to further the President's goal of electrifying the Federal motor vehicle fleet.

- **Office for Human Capital (HC):** Funding will support current operational levels, maintain HC's customer service mission and ongoing initiatives related to developing more agile, cost-effective operations and a long-term vision for modernizing hiring practices, as well as improving the ability of the DOE workforce to deliver mission outcomes. This will rebuild capacity across DOE and reduce time-to-hire. This request includes funding to support improvements and enhancements of HR IT systems, including transition to a new hiring management system, USA Staffing.

- **General Counsel (GC):** Funding increase will support the 145 FTEs and current operational levels of the organization.

- **Office of Policy (OP):** Funding increase will support broadening OP's mission to include the Office of Strategic Planning and Policy (OSPP), Office of Energy Jobs, and merging the Arctic Energy Office (AEO) into OP.

- **Public Affairs (PA):** Funding increase will support the current operational levels of the organization.

Departmental Administration
Funding by Congressional Control ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Departmental Administration				
Office of the Secretary	5,119	5,582	5,582	-
Congressional & Intergovernmental Affairs	4,395	5,000	6,000	1,000
Chief Financial Officer	52,000	53,590	56,591	3,001
Economic Impact & Diversity	10,169	10,169	20,000	9,831
International Affairs	26,825	26,825	30,500	3,675
Artificial Intelligence and Technology Office	2,500	2,500	1,500	-1,000
Chief Information Officer	140,200	140,200	232,258	92,058
Subtotal, DA	**241,208**	**243,866**	**352,431**	**108,565**
Other Departmental Administration				
Management	54,358	54,358	75,358	21,000
Project Management Oversight and Assessments	12,596	13,000	13,307	307
Chief Human Capital Officer	24,316	24,918	28,250	3,332
Office of Small & Disadvantaged Business Utilization	3,337	3,386	3,752	366
General Counsel	32,575	35,000	38,000	3,000
Office of Policy	7,000	7,000	28,996	21,996
Public Affairs	4,000	4,000	5,954	1,954
Office of Technology Transitions	14,080	17,639	-	-17,639
Subtotal, Other DA	**152,262**	**159,301**	**193,617**	**34,316**
Strategic Partnership Projects (SPP)	40,000	40,000	40,000	-
Total, Departmental Administration (Gross)	**433,470**	**443,167**	**586,048**	**142,881**
Defense-Related Administrative Support (DRAS)	-179,092	-183,789	-163,710	20,079
Subtotal, Departmental Administration	**254,378**	**259,378**	**422,338**	**162,960**
Miscellaneous Revenues				
Revenues Associated with SPP	-40,000	-40,000	-40,000	-
Other Revenues	-53,378	-53,378	-60,578	-7,200
Subtotal, Miscellaneous Revenues	**-93,378**	**-93,378**	**-100,578**	**-7,200**
Total, Departmental Administration (Net)	**161,000**	**166,000**	**321,760**	**155,760**

Defense-Related Administrative Support

Overview

Beginning in FY 1999, funding has been provided within the Other Defense Activities appropriation to offset expenses that support defense-related activities. This offset addresses the significant level of administrative support performed within DA offices in support of the Department's defense-related programs. The services provided by the offices within DA are performed without distinction between defense and non-defense related activities and provide benefit for all headquarters organizations proportionally.

Defense-Related Administrative Support
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
Defense-Related Administrative Support	**-179,092**	**-183,789**	**-163,710**

Strategic Partnership Projects

Overview

The Strategic Partnership Projects (SPP) program provides funding to DOE's multi-purpose field offices and National Laboratories to finance the cost of products and services requested by non-DOE users, both foreign and domestic. The products and services provided by the Department under this program generally are not available from alternate sources and are reimbursable work for non-federal entities where the sponsor is precluded by law from providing advance funding.

The SPP program includes a portion of the Department's Foreign Research Reactor Spent Fuel Program. This program, which involves the receipt and storage of foreign research reactor spent fuel, is provided for in the SPP program only to the extent of revenues provided.

The benefits for this program are continued access to the Department's Laboratory complex, which satisfies the needs of our non-federal customers. Performance evaluation for this work is the responsibility of our customers. The success of this program is indicated by the steady influx of business from the targeted groups.

Strategic Partnership Projects
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Argonne National Laboratory	750	100	100	-
Brookhaven National Laboratory	0	275	275	-
Idaho Operations Office	1,000	1,000	1,000	-
Lawrence Berkeley Laboratory	3,500	3,308	3,308	-
National Energy Technology Laboratory	150	150	150	-
National Renewable Energy Laboratory	500	500	500	-
NNSA Complex	7,078	8,918	8,918	-
Oak Ridge National Laboratory	20,222	12,227	12,227	-
Richland Operations Office	100	100	100	-
Savannah River Ops Office	6,700	6,700	-	-6,700
Washington DC HQ Undistributed	-	6,722	13,422	+6,700
Total, Strategic Partnership Projects	**40,000**	**40,000**	**40,000**	**-**

Revenues Associated with Strategic Partnership Projects
Funding ($K)

Description of FY 2022 Activities	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request
Argonne National Laboratory	750	100	100
• Work with universities and state and local governments that are precluded by law in giving a cash advance; and cover anticipated work with Small Business Innovation Research federal awarded sponsors.			
Brookhaven National Laboratory	-	275	275
• Primarily to cover anticipated work with small businesses on Small Business Innovation Research/Small Business Technology Transfer and Research SPP. In addition, to cover work with universities and state & local governments that are precluded by law to provide a cash advance.			
Idaho Operations Office	1,000	1,000	1,000
• Work with state and local governments.			
Lawrence Berkeley National Laboratory	3,500	3,308	3,308
• Additional university support for Composite for Basic Science Research; • Independent Technical Assistance for Management and Treatment of Groundwater and Drinking Water; • Fabricate the components in the ALICE (A Large Ion Collider Experiment)-USA scope and ALICE ITS (Inner Tracking System) upgrade; • University of Washington for comprehensive Identification of Worm and Fly Transcription Factors; and • National Laboratory High Energy Physics for Particle Data Group. • 21st Century Indiana Energy Policy Development Task Force and Comprehensive Study.			
National Energy Technology Laboratory	150	150	150
• Work with state and local governments.			
National Renewable Energy Laboratory	500	500	500
• Work with state and local governments.			
NNSA Complex	7,078	8,918	8,918
• Consolidated Nuclear Solutions (CNS) National Security Complex support to long-term supply contracts with foreign governments to provide uranium fuel; • CNS - NA-23 Material Management & Minimization Nuclear Material Removal program - cost of recovery operations subsequently reimbursed by foreign customers; • Sandia National Laboratory support to state & local governments; and • Lawrence Livermore National Laboratory support to state and local governments			

Oak Ridge Operations Office	20,222	12,227	12,227
• Oak Ridge National Laboratory support for Early-Time Signatures of a Nuclear Detonation in Urban Areas; Tennessee REVV Program; Tip-Enhanced Raman Spectroscopy (TERS) as a Screening Tool; Understanding Cellular Transformation and Chemical Responses Linking Type 2 Diabetes and Amyotrophic Lateral Sclerosis; Neutron Scattering Studies of Human AChE; Computational Support for Problem Structure and Quantum Advantage; Joint Faculty Agreements; General Employee Loan Agreements; etc. • SLAC National Accelerator Laboratory support to U.S./Japan Cooperative Program in High Energy Physics; • Oak Ridge Institute for Science and Education (ORISE) support to/for Radiation Emergency Assistance Center/Training courses, and Beryllium Lymphocyte Proliferation Testing; and • Pacific Northwest National Laboratory (PNNL) work with universities and state and local governments in the areas of Biomedical, High Performance Computing, Grid Modernization, Security and Incident Response, Nuclear and Reactor Technologies, Advance Material Development, and Advance Manufacturing.			
Richland Operations Office	100	100	100
• Work with Universities, State, and Local governments for training in support of disaster recovery, emergency response, fire protection, transportation, law enforcement, military readiness, technology deployment.			
Savannah River Operations	6,700	6,700	860
• Savannah River National Laboratory support to universities & institutions, state and local governments, and non-profit organizations; and • South Carolina Institute of Archaeology and Anthropology cooperative agreement to comply with archaeological regulatory requirements needed to support the U.S. Forest Service Savannah River timber program. • Savannah River site support for the receipt and management of foreign research reactor spent nuclear fuel			
Washington DC HQ Undistributed	-	6,722	12,562
• Funding kept in reserve to support SPP activities			
Total, Revenues Associated with Strategic Partnership Projects	**40,000**	**40,000**	**40,000**

Miscellaneous Revenues

Overview

The Departmental Administration account receives Miscellaneous Revenues from the following:

- Revenues received from the sale of by-products that have no cost associated with the Departmental Administration program of work. These items are by-products of activities funded by other on-going Departmental programs and are collected as Miscellaneous Revenues. Included in this estimate are revenues collected from the Reimbursable Work program for Federal Administrative Charges.
    - Federal Administrative Charges – Revenues collected from other federal agencies as well as non-federal entities for reimbursable activity conducted by the Department in accordance with full-cost recovery policy.
    - Nuclear Production Office – Revenues generated from shipment of surplus Highly Enriched Uranium and Low Enriched Uranium for use in foreign research and test reactors.
    - Pittsburgh Naval Reactors Office – The Department of Navy reimburses the Pittsburgh Naval Reactors Office for the nuclear material burn-up while the core is in operation and when residual nuclear material is removed during refueling and defueling of the core. While nuclear material burn-up is relatively consistent across years, major fluctuations in this line item are attributable to the refueling and defueling schedules, which are based on ship availability and quantity of nuclear material left in the cores.
    - Other Revenues, including Timber Sales – Estimate based on current rate of collections for various miscellaneous revenues collected at all Department sites, including timber sales at Savannah River Site.

Miscellaneous Revenues
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Revenues Associated with Strategic Partnership Projects	**-40,000**	**-40,000**	**-40,000**	**-**
Other Revenues	**-53,378**	**-53,378**	**-60,578**	**-7,200**
Federal Administrative Charges*	-30,613	-29,467	-36,667	-7,200
Nuclear Production Office	-4,044	-4,044	-4,044	-
Pittsburgh Naval Reactors Office	-14,221	-15,167	-15,167	-
Other Revenues, including Timber Sales	-4,500	-4,700	-4,700	-
Total, Miscellaneous Revenues	**-93,378**	**-93,378**	**-100,578**	**-7,200**

*The increase projected for Federal Administrative Charges in FY 2022 Request was based on the average of FY 2020 actuals and projected 2021 collections.

Overview

The Office of the Secretary (OSE) provides leadership and policy direction to the Department of Energy (DOE) in its commitment to advance U.S. national security and economic growth through transformative science and technology innovation that promotes affordable and reliable energy through market solutions and meets our nuclear security and environmental cleanup challenges. The funding supports OSE staff in achieving the Department's priorities of Combating the Climate Crisis, Creating Clean Energy Union Jobs, and Promoting Energy Justice. The Department also plans to continue to make progress in achieving each of its strategic goals through continued investments in scientific research, technology innovation, nuclear security, and environmental cleanup.

Office of the Secretary
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	4,495	4,952	4,952	0	0
Travel	529	529	529	0	0
Support Services	0	0	0	0	0
Other Related Expenses	95	101	101	0	0
Total, Program Direction	**5,119**	**5,582**	**5,582**	**0**	**0**
Federal FTEs	**32**	**33**	**33**	**0**	**0**
Other Related Expenses					
Training	0	6	6	0	0
Other Services	95	95	95	0	0
Total, Other Related Expenses	**95**	**101**	**101**	**0**	**0**

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $5,582	**$5,582**	**$0**
Salaries and Benefits $4,952	**$4,952**	**$0**
Funding supports up to 33 FTEs in the Office of the Secretary, Deputy Secretary, Office of the Under Secretary, and the Office of the Under Secretary for Science and Energy. Includes a new FTE to support an arctic energy coordinator position. Increase for within grades, promotions, awards allocation, and COLA impact on the payroll costs for existing staff. Assumes 1 percent pay increase in civilian salaries, FERS increase, and supplemental funds for performance award pool increase in FY 2021	Continued funding supports up to 33 FTEs in the Office of the Secretary, Deputy Secretary, Office of the Under Secretary, and the Office of the Under Secretary for Science and Energy.	No change
Travel $529	**$529**	**$0**
Funding for the Office of the Secretary, Deputy Secretary, Under Secretary, Under Secretary for Science and Energy, and Special Assistants to travel in support of the Department's mission.	Continuation of FY 2021 activities.	No change
Other Related Expenses $101	**$101**	**$0**
Funding supports training and course registration cost for OSE employees for essential training activities and support for security clearance investigations	Continuation of FY 2021 activities.	No change

Overview

The Office of the Chief Financial Officer (OCFO) is responsible for the management and financial integrity of Department of Energy (DOE) programs, activities and resources by developing, implementing, and monitoring DOE-wide policies and systems for budget formulation and execution, finance and accounting, internal controls and financial policy, corporate financial systems, and strategic planning. The OCFO:

- Serves as the principal advisor to the Secretary and other DOE officials on matters relating to the Department's financial resources and performance management.
- Oversees the formulation, execution, analysis, and financial integrity of the Department's annual and multi-year budget.
- Develops and maintains an integrated agency-wide financial accounting system.
- Prepares reports including a description and analysis of the status of financial management in the annual financial statements, audit reports, the Digital Accountability and Transparency Act of 2014 (DATA Act) reporting, and internal accounting and administrative controls systems at DOE.
- Manages the activities and execution of DOE's Working Capital Fund (WCF) and prepare annual budget documentation.
- Serves as the enterprise risk management office to provide data for risk by systematically identifying, assessing and managing strategic, financial, and programmatic risks across the DOE.
- Develops program performance measures, manages the performance tracking system, and serves as the Performance Improvement Officer, the Department's principal advocate for improved performance and management.
- Coordinates and leads the development and implementation of the DOE Strategic Plan, Agency Priority Goals (APGs), and the requirements of the GPRA Modernization Act, including quarterly assessment meetings.
- Leads the DOE's evaluation efforts to implement the *Foundations for Evidence-Based Policymaking Act of 2018*.
- Manages and supports the administration and the operations and maintenance of the Department-wide enterprise corporate business systems (e.g., Foreign Travel Management System, Data Warehouse).
- Leads the implementation of program management policies and strategies for developing highly qualified program managers required by the *Program Management Improvement Accountability Act of 2016 (PMIAA)*.

Highlights of the FY 2022 Budget

The Fiscal Year (FY) 2022 Request is $56,591,000, an increase of $3,001,000 from the FY 2021 Enacted budget. It maintains the FY 2021 level of full time equivalent (FTE) employees at 230 including the 2.7% pay raise for federal employees and Federal Employees Retirement Systems (FERS) benefits. With the additional funding, OCFO will continue to support the effective management and financial integrity of DOE programs, activities and resources by developing, implementing, and monitoring DOE-wide policies and systems in budget formulation and execution, finance and accounting, internal controls and financial policy, corporate financial systems, and strategic planning.

In FY 2022, OCFO is requesting additional funds for corporate business systems to meet and comply with updated cyber security requirements and initiatives; migrate to and operate in a Cloud environment; and enhance systems supporting enterprise business processes and systems, including agency financial report automation and audit management projects. The requested funding will permit continued implementation of the Robotic Process Automation (RPA) initiative.

In FY 2022, the Program Management Improvement Officer (PMIO) continues implementation of OMB's five-year PMIAA Strategy to develop a strategy for enhancing the role of program managers, including training and educational opportunities, improved career paths and career opportunities, a plan to recruit and retain highly qualified individuals, and collecting and disseminating best practices and lessons learned, and common templates and tools to support improved data collection and analysis for project and program management and oversight purposes. The OCFO will implement program/portfolio review methodology established in DOE Program Management Directives, which includes scheduling/participating in portfolio reviews and performing independent assessments of program performance. These will

be integrated with Agency/OMB Strategic review meetings and budget formulation processes for long-term planning and budgeting.

Departmental Administration/
Office of the Chief Financial Officer   **FY 2022 Congressional Budget Justification**

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Program Direction
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	31,377	32,770	33,797	+1,027	+3%
Travel	335	100	150	+50	+50%
Support Services	10,653	9,724	11,698	+1,974	+20%
Other Related Expenses	9,635	10,996	10,946	-50	0%
Total, Program Direction	**52,000**	**53,590**	**56,591**	**+3,001**	**+6%**
Federal FTEs - OCFO	**222**	**230**	**230**	**-**	**0%**
Federal FTEs - WCF	**22**	**22**	**22**	**-**	**0%**
Support Services					
Management Support					
Corporate Business Systems	4,152	4,300	5,606	+1,306	+30%
System Support/Other Support Services	6,501	5,424	6,092	+668	+12%
Total, Support Services	**10,653**	**9,724**	**11,698**	**+1,974**	**+20%**
Other Related Expenses					
Energy IT Services	2,000	2,100	2,100	-	0%
Security Clearance Investigations	108	100	100	-	0%
Training	292	300	225	-75	-25%
Interagency Agreements	345	345	370	+25	+7%
Working Capital Fund	6,890	8,151	8,151	-	0%
Total, Other Related Expenses	**9,635**	**10,996**	**10,946**	**-50**	**0%**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Salaries and Benefits $32,770,000	**$33,797,000**	**+$1,027,000**
Funds 230 full-time equivalent employees (FTE).	Funds 230 FTEs.	Increase reflects a 2.7% pay raise for federal employees and FERS benefits increase in FY 2022.
Travel $100,000	**$150,000**	**+$50,000**
Supports travel requirements for 230 FTE and minimally projected Congressional travel.	Supports travel requirements for 230 FTE and estimated Congressional travel.	Increase reflects travel requirements for the CFO, Deputy CFO and Congressional staff.
Support Services $9,724,000	**$11,698,000**	**+$1,974,000**
The FY 2021 Corporate Business Systems (CBS) budget funds the operation and maintenance, and cyber security requirements of the DOE enterprise financial, procurement, and human capital business systems, including the Data Warehouse, Foreign Travel Management System, automaton of the agency financial report, Robotic Processing Automation (to meet the PMA Cross-Agency Priority (CAP) goal), and the Audit automation tasking system. Funding is also provided for technical system support and other services (to include PMIAA).	The FY 2022 Corporate Business Systems (CBS) budget funds the operation and maintenance, and cyber security requirements of the DOE enterprise financial, procurement, and human capital business systems, including the Data Warehouse, Foreign Travel Management System, automaton of the agency financial report, Robotic Processing Automation (to meet the PMA CAP goal), and the Audit automation tasking system. Funding is also provided for technical system support and other services (to include PMIAA).	Increase reflects implementation of the remaining requirements for the next phase of the enterprise business processes for the agency financial report automation and audit management projects; the Robotic Processing Automation; the automation of budget formulation; and the completion of the IT cloud migration.
Other Related Expenses $10,996,000	**$10,946,000**	**-$50,000**
Funding supports employee training, interagency agreements, IT desktop technical support requirements, security clearance investigations, and WCF.	Funding supports IT desktop technical support requirements, employee training, interagency agreements, security clearance investigations, and WCF.	Decrease reflects changes to staff training for FY 2022.

Chief Financial Officer
Safeguards and Security ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Cybersecurity	1,300	1,410	1,550	+140
Total, Safeguards and Security	**1,300**	**1,410**	**1,550**	**+140**

Office of Management
Program Direction

Overview

The Office of Management (MA) provides the Department of Energy (DOE) with centralized direction and oversight for the full range of management, acquisition, administrative services, and conference management support. These services are critical to the mission of the Department and its program offices, as well as keeping the Headquarters (HQ) operational. MA's activities include policy development and oversight, and delivery of procurement services to DOE HQ organizations, and the management of HQ facilities. MA also fulfills the statutory and Executive Order responsibilities of the Senior Real Property Officer, Senior Procurement Executive, Chief Sustainability Officer (CSO) and the Department's Advisory Committee Management Officer.

In FY 2022, MA accomplishes its mission through its program offices as follows:

- Acquisition Management – Provides corporate oversight, leadership, and develops and assists in the implementation of DOE-wide policies, procedures, programs, and management systems pertaining to procurement and financial assistance, contract management, professional development, and related activities to provide procurement services to Headquarters elements. The Director, Office of Acquisition Management serves as the Senior Procurement Executive.
- Administration – Manages HQ facilities and support services, including operations management, leased and office space management, supply management, travel (domestic and international), transportation/courier services, concession services (through the General Services Administration), exchange visitor program, mail/printing service, and the Department's Freedom of Information Act (FOIA) program.
- Asset Management – Develops and maintains DOE policies, regulations, standards, and procedures while tracking performance pertaining to real estate, facilities and infrastructure management, and personal property to include motor vehicle fleet management. Assists senior leadership with planning and execution decisions related to the acquisition, utilization, condition, maintenance, and disposition as they relate to real and personal property. Manages DOE's real property database and excess screening process. Manages the professional development, training, and certification of personal property and realty specialists. Ensures implementation of statutory and executive requirements across the Department. Coordinates data collection, reporting, and analysis of DOE's sustainability data, including energy, water, petroleum, and resource use. Manages and implements DOE's Strategic Sustainability Performance Plan and provides oversight of energy, water, sustainable buildings, and resource assessments at DOE sites and National Laboratories. Manages electric vehicle activities to further the President's goal of electrifying the Federal motor vehicle fleet (additional details below). The Director of the Office of Management serves as the Chief Sustainability Officer. Additionally, the Director of Asset Management serves as the Senior Real Property Officer, and the Head of the Contracting Activity for Real Estate.
- Aviation Management – Manages all DOE-owned aircraft, manned and unmanned, and contract aviation services world-wide by developing and implementing policies and procedures; provides technical and management assistance to program leaders and field elements with aviation responsibilities; and conducts oversight over all DOE elements that own or use aviation as a part of their mission.
- Directives Program – Manages the Department's Directive System, the primary system for establishing, promulgating, and maintaining long-term, crosscutting, departmental policies and procedures. Support the Department's Secretarial Delegations of Authority system.
- Executive Secretariat – Facilitates quality document management of executive correspondence, departmental actions, and decisions; ensures timely delivery of Congressional reporting requirements, executive commitments and information; serves as the Department's Advisory Committee Management Officer and manages the Department's Advisory Committee Management Program.
- Ombudsman – Provides independent, confidential, and informal option for all DOE federal employees to address any workplace issues and help the Department's senior leaders, managers, and supervisors minimize unwarranted distractions; increase employee engagement; and expeditiously address individual and organization matters.
- Secretary of Energy Advisory Board (SEAB) – Administers and coordinates the activities of the Board and its subcommittees for the Secretary to obtain timely, balanced, and independent external advice on issues of national importance related to the missions of the Department.
- Scheduling and Advance – Manages scheduling, logistical, and advance preparations for the Office of the Secretary.

Highlights of the FY 2022 Budget Request

The FY 2022 Budget Request of $75,358,000 is a $21,000,000 increase above the FY 2021 Enacted Budget, and it supports up to 206 full time equivalent employees. The additional funding provides critical support for MA's mission fulfillment as follows:

- Adds $16,000,000 for purchase or lease of Zero Emission Vehicles (ZEVs) within agency-owned vehicles fleets or as part of a transition from GSA-leased gas-powered vehicles to GSA-leased ZEVs. This funding will also be used for related charging infrastructure and program management costs associated with executing this funding to further the President's goal of electrifying the Federal motor vehicle fleet.
- $13,743,000 (+$1,471,000) for Working Capital Fund (WCF) estimated expenses that support program operations, staff operations, staff benefits, as well as provide agency mission support.
- $2,689,000 (+1,537,000) for Energy Information Technology Services (EITS) expenses to cover laptops, software, support services, and other essential IT equipment/services.
- $1,324,000 (+$400,000) for the Freedom of Information Act (FOIA) contractual support services in support of processing costs for inquiries and other contractual support services inflationary costs.
- $891,000 (+$811,000) for Asset Management in support of the Sustainability Performance Dashboard (SPD) to achieve and maintain sustainability goals in accordance with statutory and executive order requirements through data collection, analysis, reporting, and outreach. This funding also helps improve the capabilities and functions of the Dashboard, which will reduce the reporting burden, enhance data quality, and allow programs to leverage the information for strategic operational decisions.
- $450,000 for the Strategic Integrated Procurement Enterprise System (STRIPES) Development, Modernization, and Enhancements (DME) Plan to increase efficiencies using Robotic Process Automation (RPA) and Artificial Intelligence (AI) for the DOE Acquisition and Financial Community**.**

Electric Vehicles and Charging Stations

In support of the President's goal of transitioning to a fully Zero Emission Vehicle Federal fleet, the DOE budget includes $16 million for zero emission vehicle (ZEV - battery electric, plug-in electric hybrid, and hydrogen fuel cell vehicles) acquisitions and deploying necessary vehicle charging and refueling infrastructure. These acquisitions are a significant step towards eliminating tailpipe emissions of greenhouse gases (GHG) from the DOE fleet and aligning the DOE fleet operations with the goal of achieving a fully ZEV Federal fleet. This action is important because tailpipe emissions are currently the leading source of GHG emissions that threaten the planet and harm U.S. communities.

The DOE ZEV acquisitions may include vehicles for both its agency-owned and GSA-leased segments of its vehicle fleet, including incremental costs of leased vehicles and lease payments to GSA for conversion of agency-owned vehicles to GSA's leased fleet where appropriate. To ensure effective and efficient deployment of ZEVs, DOE will undertake preparation and planning for arriving ZEVs at its facilities, properly prioritizing transition to ZEVs where it is simplest and allow time for additional planning where mission demands pose a challenge to transitioning based on current technologies. Integral to this preparation is growth in the number of agency-accessible re-fueling points (vehicle charging stations). In installing this infrastructure on-site to support acquired ZEVs, DOE will take the long-term view to ensure efficiencies and thereby ensure wise infrastructure decisions that limit total expenditures. Using its experienced personnel and lessons learned in the fleet arena, DOE will undertake a process that relies on a cross-functional team of staff from fleets, operations, facilities, finance, and acquisition departments with executive leadership support. The collaboration will not stop with initial deployment, as the DOE fleet and facility managers will work closely and employ existing training and tools to control utility costs by managing the overall charging load and thereby ensuring a seamless operation that now will involve building systems and vehicles together. Further, DOE will ensure proper training of personnel to address any initial shortcomings in terms of any necessary ZEV knowledge and operations as the advanced vehicle technologies roll into the DOE fleet.

The Agency is coordinating all of these efforts to meet or exceed the ZEV-related goals set forth in the comprehensive plan developed pursuant to E.O. 14008, Section 205(a). Funds for these DOE ZEV activities are part of a $600 million request in the President's Budget for ZEVs and charging infrastructure that is contained within the individual budgets of 18 Federal agencies, including ZEV Federal fleet dedicated funds at the General Services Administration. This investment will be

complemented by Department of Energy funding to provide technical assistance to agencies through the Federal Energy Management Program as DOE builds and grows its ZEV infrastructure. This investment serves as a down payment to support a multiyear, whole-of-government transformation to convert the Federal motor vehicle fleet to ZEVs and thereby reduce carbon emissions.

Office of Management
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted ($)	FY 2022 Request vs. FY 2021 Enacted (%)
Salaries and Benefits	34,069	34,287	34,287	0	0
Travel	867	867	867	0	0
Support Services	4,173	3,955	5,947	1,992	50%
Other Related Expenses	15,249	15,249	18,257	3,008	20%
Electric Vehicles	0	0	16,000	16,000	0
Total, Program Direction	**54,358**	**54,358**	**75,358**	**21,000**	**39%**
Federal FTEs—MA	**206**	**206**	**206**	**0**	**0**
Federal FTEs—WCF	**40**	**40**	**38**	**-2**	**-5%**
Support Services					
Management Support	1,691	1,834	3,465	1,631	89%
Other Support Services	2,482	2,121	2,482	361	17%
Total, Support Services	**4,173**	**3,955**	**5,947**	**1,992**	**50%**
Other Related Expenses					
Training	151	151	151	0	0
Energy IT Services (EITS)	1,152	1,152	2,689	1,537	133%
Working Capital Fund (WCF)	12,272	12,272	13,743	1,471	12%
Other Services	1,674	1,674	1,674	0	0
Total, Other Related Expenses	**15,249**	**15,249**	**18,257**	**3,008**	**20%**

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
$54,358	$75,358	+$21,000
$34,287	$34,287	$0
Funding in support of up to 206 FTEs. Funding provides for salaries/benefits, overtime, lump sum leave, awards allocations and performance awards.	Continued funding supports up to 206 FTEs. Funding provides for salaries/benefits, overtime, lump sum leave, awards allocations and performance awards.	No change
$867	$867	$0
Funding in support of MA/SEAB staff travel; all travel associated with scheduling and logistics for Secretarial trips, travel associated with program oversight and evaluation, and procurement management activities. Includes the rental of vehicles from the General Services Administration motor pool and the DOE fleet.	Funding in support of MA/SEAB staff travel; all travel associated with scheduling and logistics for Secretarial trips, travel associated with program oversight and evaluation, and procurement management activities. Includes the rental of vehicles from the General Services Administration motor pool and the DOE fleet.	No change.
$3,955	$5,947	+$1,992
Funding supports MA activities including ACMP, Cross Agency Priority Goals/Council Payment, SPD contractual requirements, FOIA processing costs and contractual requirements.	Funding supports continuation of MA activities including ACMP, Cross Agency Priority Goals/Council Payment, SPD contractual requirements, FOIA processing costs and contractual requirements. Additional funding supports FOIA, SPD, STRIPES DME, and contractual support services cost escalations.	+$811 for SPD Dashboard maintenance. +$400 for FOIA cases processing costs. +$450 for STRIPES DME RPA and IA initiative. +$331 for contractual support services cost escalations.
$15,249	$18,257	+$3,008
Other related expenses funding to cover EITS, WCF, training and other services necessary for organizational mission support.	Other related expenses funding supports continuation of EITS, WCF, training and other services necessary for organizational mission support. Additional funding covers operational expenses for WCF and EITS.	+$1,537 for EITS costs to cover laptops, software, support services, and other essential equipment/services. +$1,471 for WCF activities/services costs.
$0	$16,000	+$16,000
N/A	Funding for purchase and lease of electric vehicles to further the President's goal of electrifying the Federal motor vehicle fleet, in collaboration with GSA.	+$16,000 for purchase and lease of electric vehicles, in collaboration with GSA.

Overview

The Office of the Chief Human Capital Officer (HC) supports the Department of Energy's (DOE) mission through workforce services and solutions. In support of the Department, HC strives to provide the most efficient and effective human resources (HR) services and human capital programs and meet its fundamental deliverable to customers—enhancing their ability to fill vacant positions in a timely manner with quality hires. This is accomplished through collaborative and responsive partnerships, proactive problem identification and resolution, and innovative and sound human capital management services. HC advises and assists the Secretary and Deputy Secretary of Energy (and other agency officials) in recruiting, staffing, developing, training, and managing a highly skilled, productive, and diverse workforce, in accordance with merit system principles and all applicable statutory requirements.

Highlights of the FY 2022 Budget Request

The Department requests $28,250,000 in FY 2022 for HC to support current operational levels and maintain its vital customer service mission. This request will provide sufficient resources to support ongoing initiatives related to developing more agile, cost-effective operations and a long-term vision for modernizing hiring practices, as well as improving the ability of the DOE workforce to deliver mission outcomes. This includes rebuilding capacity across DOE and reducing time-to-hire. Additionally, it will enable HC to maintain its operational capacity to carry out personnel actions and conduct strategic workforce planning related to proposed Departmental programmatic changes in the FY 2022 budget. HC is strategically positioned to provide oversight of human capital matters that pertain to DOE programmatic priorities, changes to skill requirements of existing personnel, and fluctuating staffing levels—this includes an emphasis on workforce planning and development of effective talent management strategies to ensure DOE can successfully perform its mission.

HR Oak Ridge Shared Service Center

DOE's Consolidated Human Resources (HR) Oak Ridge Shared Service Center (ORSSC) provides the full range of human capital management operational functions to support Federal employees (non-executives). The ORSSC provides HR transactional services and oversees the HR Advisory Offices to ensure consistent and seamless HR operational services are provided to their assigned servicing populations. Responsibilities include staffing, classification, administering benefits, processing personnel actions, entering and maintaining employee data to DOE's Corporate Human Resources Information System (CHRIS) and other personnel systems, establishing and maintaining employees' electronic Official Personnel Folder (eOPF) in accordance with OPM regulations, and supporting personnel data requests from DOE and OPM. The request includes funds ($4,050,886) for HC for 23 FTEs that support the ORSSC. In addition, HC directs user funded human capital work ($15,532,499) for about 89 FTEs provided by Memoranda of Agreement with: Environmental Management (30 FTEs), Energy Efficiency and Renewable Energy (12 FTEs), Energy Information Administration (2 FTEs), Fossil Energy and Carbon Management (15 FTEs), Nuclear Energy (5 FTEs) and Science (25 FTEs).

HR Information Technology Enhancements
The Department requests the following IT enhancements in support of shifting from low- to high-value work. These investments will enable the Department to leverage data as a strategic asset for workforce management. HC will continue to explore DOE integrated IT solutions that reduce labor intensive data integration from multiple systems, improve data analytics, and automate recurring Human Capital processes. This includes the purchase of licenses for use of Office 365 Suite tools: Power Platform, Customized SharePoint, and Power Business Intelligence and Visualization. Additionally, HC is using database development to create integrated data reporting from multiple data sources and researching other technologies to better match the recruitment needs of DOE Hiring Managers. HC will host virtual recruitment events to better target mission critical talent. Recruitment will include use of the Pathways Program and Corporate Recruitment and Placement of Disabled Veterans eligible for noncompetitive hiring. HC will ensure that the development and implementation of these events are in compliance with management of recruitment, referral, and placement of Compensable Disability Preference (CPS) Disabled Veterans in accordance with 5 U.S.C. 3312, 5 CFR Part 307, 5 CFR 213.3102(u) and the Office of Personnel Management (OPM) Vet Guide.

Transition from Monster to USA Staffing
HC requests $700,000 to offset the Working Capital Funded portion of *USA Staffing,* which replaced *Monster Hiring Manager* in FY 2021. The decision to move to USA Staffing, the industry standard in federal hiring systems, was based on the Department's ongoing investment in modernizing its HC Management Systems.

The USA Staffing system increases HR professionals' efficiency and accuracy, streamlines the onboarding experience, improves the quality of candidates, and provides a user-friendly interface. It houses the recruitment process end-to-end within one system, thereby reducing the need for external databases and tracking. During onboarding, it auto populates forms and templates to save applicants time and rework. It also advances the communication flow between managers and HR. It innovates our assessment process and improves the candidates we attract, using proven assessment tools and tests developed by Office of Personnel Management (OPM) Industrial & Organizational (I/O) Psychologists.

Additionally, USA Staffing allows DOE to utilize USA Hire in the future. USA Hire is OPM's innovative and interactive assessment tools built by I/O Psychologists and will allow DOE to innovate its assessment process and change the candidate pool that it receives. USA Staffing offers significant capabilities not available in our current system configuration, which we would otherwise need to purchase or design separately in a fragmented-systems approach. It also offers increased efficiencies, and enhanced compliance and accuracy. Cost savings will be realized with the extensive training and routine upgrades that are included in the USA Staffing subscription. Estimated worker-hours efficiency savings are estimated at $506,270 annually.

HR Information Technology Platform
HC requests $600,000 to support collaboration with DOE's Chief Financial Officer (CFO) and Chief Information Officer (CIO) to study and identify Agency solutions for our HR IT platform to expand technological capabilities to improve personnel processing/recruiting efficiencies through metrics and data analytics. This will enable HC to produce quantitative and qualitative analyses that help drive human capital business decisions and reduce labor intensive, ineffective, and costly methods for triangulating workforce information.

HR Dashboard
HC requests $700,000 to study alternative solutions to Human Capital Management (HCM) systems that support integration, enhanced dashboard capabilities, and real-time data access to assist DOE senior leaders and front-line managers' decision making aligned with a workforce of the 21st century. HC, in conjunction with CFO and OCIO, is sponsoring a project team and HCM System Replacement Charter consisting of cross-cutting program representation to study and make recommendations on options that will best meet DOE's future HCM service delivery needs. The upgrade to PeopleSoft v9.2, expected to be completed by first quarter FY 2022, is an interim measure and the first phase of a multi-phase approach to establish the unified DOE enterprise HCM system.

HR Service Delivery
Aligned with the Department's reform efforts, HC will continue to evaluate human capital functions to identify opportunities to improve the people, processes, and technologies of the HR line of business to ensure the success of the Shared Service Center (SSC) structure. This includes the implementation of competency-based learning and development tools for HR professionals, establishment of standard operating procedures and processes followed by each SSC, and use of the following tools:

- Transition from *Monster Hiring Manager* to OPM's *USA Staffing,* which is more efficient and offers expanded capabilities, to include streamlined onboarding process; data analytics; a modern, user-friendly interface; dashboard view of workload management and tracking; and mobile-friendly applicant and new hire interfaces for the post-COVID-19 remote work environment.
- Augmentation of services for HR surge work via contractor support due to variability of staffing within the Department (i.e., separations, retirements, and onboards). Surge hiring activity is a required back-up plan to support the various HR activities that arise due to program shifts, budget uncertainty, and attrition in HR staff.
- Development of a standardized library of job analyses via contractor support. This library will link to the recently developed library of pre-classified position descriptions. The combined use of these is anticipated to significantly improve time-to-hire metrics.

- Upgrade of HC's current version of the Corporate HR Information System (CHRIS) to introduce a suite of HR tools to improve personnel action processing and recruitment through metrics and data analytics. Simultaneously, HC will establish a long-term HR IT strategy for the Department in collaboration with major DOE stakeholders.
- Improvement of user functionality within the Corporate Learning Management System (Learning Nucleus), executed through an interagency agreement with OPM. Integrate training-related functions (e.g., classroom registrations, online learning, Individual Development Plans) in Learning Nucleus to gain efficiencies in sharing training course catalogs and employee development resources across the Department.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	19,229	18,716	20,079	+1,363	+7%
Travel	135	150	150	-	0%
Support Services	200	653	709	+56	+9%
Other Related Expenses	4,752	5,399	7,312	+1,913	+35%
Total, Program Direction	**24,316**	**24,918**	**28,250**	**+3,332**	**+13%**
Federal FTEs*	**134**	**134**	**134**	**0**	**0%**
Oak Ridge Shared Service Center (ORSSC) FTEs**	**89**	**89**	**89**	**0**	**0%**
Support Services					
Management Support					
Training and Education	100	100	100	-	0%
Other Support	100	553	609	+56	+10%
Total, Support Services	**200**	**653**	**709**	**+56**	**+9%**
Other Related Expenses					
Other Services	100	607	2,394	+1,787	+294%
Energy IT Services	716	739	865	+126	+17%
Working Capital Fund	3,936	4,053	4,053	-	0%
Total, Other Related Expenses	**4,752**	**5,399**	**7,312**	**+1,913**	**+35%**

*HC's FTE level of 134 includes funding for 23 FTEs supporting the ORSSC.
**ORSSC Operations and FTES are funded separately through Memoranda of Agreements from six programs outside of HC (Energy Efficiency and Renewable Energy, Environmental Management, Energy Information Administration, Fossil Energy and Carbon Management, Nuclear Energy, and Science)

Activities and Explanation of Changes

FY2021 Enacted	FY2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $24,918,000	**$28,250,000**	**+$3,332,000**
Salaries and Benefits $18,716,000	**$20,079,000**	**+$1,363,000**
Provides for 134 full time equivalents (FTEs). In addition to salaries and benefits, funding is also provided for workers' compensation payments on behalf of all employees funded through the HQ Departmental Administration appropriation and two former employees receiving workers' compensation from the now closed Alaska Power Administration (APA). FTEs support core HC mission functions of policy development, oversight and automation; learning and development; HR operations and services (including executive resources, staffing/classification, benefits and labor management relations); strategic alignment and measurement of human capital management; and internal business management.	Continuation of 134 FTE level, which supports core HC mission functions as well as workers' compensation payments.	Includes 2.7% increase in civilian salaries, FERS increase, and supplemental funds for performance awards in FY 2022.
Travel $150,000	**$150,000**	**$0**
HC staff travel includes program oversight, program evaluation, recruitment, and permanent change of station moves. Primary travel need is associated with OPM-mandated accountability audits critical to maintaining agency-delegated HR authority.	Continuation of required HC staff travel activities and DC HQ visits of remote staff. HC uses WebEx and Teams for internal meetings and partners with other internal organizations and web and video conference as feasible.	
Support Services $653,000	**$709,000**	**+$56,000**
Includes funding for: HC staff training; HC core contractors and services for the Oak Ridge Shared Service Center (ORSSC); HC share of DOE Consolidated HR Service Support (retirement calculator, Employee Assistance Program - Worklife); other HC Licenses subscriptions; and other HR tools (Partnership for Public Service, CHCO Council, survey tool, CyberFeds).	Continuation of HC core contract support, and augmentation of service for HR surge work from contractor support due to variability of staffing within the department (separation, retirements, onboards).	Contract escalation increase and back-up augmentation of contractor support to perform surge staffing actions and HR staff attrition.

Other Related Expenses $5,399,000	$7,312,000	+$1,913,000
Other Related Expenses (ORE) provides for Working Capital Fund (WCF) and Energy IT Services (EITS). Includes funding for HC-internal office administration needs (e.g., software and hardware, Council fees, small automation system support, rent for HR Oak Ridge Shared Service Center (ORSSC) and HC's duty station facility in Albuquerque). HC's Albuquerque duty station partners with the Office of Health Safety and Security to utilize existing space, reduce rent, and offset other increases.	Continuation of WCF and EITS services, as well as HC Headquarters Security Investigations. Includes funds to offset Working Capital funded portion of HR IT Hiring Management system - FY21 transition from Monster to OPM's USA Staffing. Also funds modernizing HR IT systems/tools, data analytic tools, workforce forecasting models, centralized DOE Corporate Recruitment initiatives, and Office 365 Office Suite customized tools to improve/automate manual HR processes (e.g., licenses for SharePoint, Business Intelligence, and Dashboard Designer).	Increase supports 53% of total cost of Hiring Management System (transition from Monster to USA Staffing – 47% of total cost is covered by WCF); CFO/CIO/HC collaborative study of HR IT Platform and Office 365 Suite licenses for customized tools.

Overview
The Office of the Chief Information Officer (OCIO) leads information technology (IT) and cybersecurity coordination across the entire DOE enterprise.

Highlights of the FY 2022 Budget Request
The FY 2022 Request is $232,258,000 which is an increase of $92 million, or 66 percent from the FY 2021 Enacted amount. Included in the FY 2022 Request is a cyber reserve of $93.230 million to address immediate incident response and recovery needs resulting from the December 2020 SolarWinds incident. The funding request targets critical cybersecurity needs across DOE, prioritizing cybersecurity enhancements, including: cloud security, Security Operations Center (SOC) enhancements, encryption, Multi-Factor Authentication (MFA), increased logging functions, and enhanced monitoring tools. DOE's maturation levels were reviewed to determine the most critical gaps that require additional funding.

The FY 2022 Request continues to support the President's Management Agenda priorities of IT Modernization and Cybersecurity initiatives that leverage process improvements focused on digital services. OCIO's priority is to continue the modernization of DOE's IT infrastructure and IT services to provide the capacity, flexibility, and resiliency required of a modern and secure enterprise. In FY 2020, the OCIO received $28 million in supplemental funding through the Coronavirus Aid, Relief, and Economic Security (CARES) Act to support expanded capabilities Department-wide for telework and migration to the cloud. The proposed modernization initiatives included in the FY 2022 Request will continue to reduce the threat of cyber attacks through technology and automation, scale capacity commensurate with demand, and establish enabling IT enterprise capabilities. This will allow for commercial/managed IT service implementation with engineered and inherent cybersecurity capabilities and provide foundational requirements for enhanced cybersecurity tools, products, and capabilities.

The OCIO will focus on opportunities to increase DOE enterprise-wide visibility through real-time information availability, integrated incident reporting data and metrics, and tool modernization to increase data integration; strengthen enterprise risk management practices and execution of enterprise-wide assessments and risk register reporting; and deliver improved cybersecurity training, education, and awareness.

Office of the Chief Information Officer

($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Chief Information Officer					
Cybersecurity					
Protecting Networks and Information (Protect)	27,958	31,370	25,725	-5,645	-18%
Detect, Analyze, and Mitigate Intrusions (Detect and Respond)	30,278	26,950	24,700	-2,250	-8%
Shaping the Cybersecurity Environment (Identify and Recover)	13,951	13,480	20,665	+7,185	+53%
Total, Cybersecurity	**72,187**	**71,800**	**71,090**	**-710**	**-1%**
Cyber Reserve - SolarWinds Incident	**0**	**0**	**93,230**	**+93,230**	**n/a**
Corporate IT Program Support					
IT Portfolio Summary	18,276	17,529	17,271	-258	-1%
IT Infrastructure	3,250	3,781	2,970	-811	-21%
End User-Energy Information Technology Services (EITS)	3,472	3,996	3,996	0	0
Total, Corporate IT Program Support	**24,997**	**25,306**	**24,237**	**-1,069**	**-4%**
Program Direction					
Salaries and Benefits	24,370	25,232	25,663	+431	+2%
Travel	304	304	330	+26	+9%
Support Services	3,325	3,325	3,325	-	0%
Other Related Expenses	15,017	14,233	14,383	+150	+1%
Total, Program Direction	**43,016**	**43,094**	**43,701**	**+607**	**+1%**
Total, Chief Information Officer	**140,200**	**140,200**	**232,258**	**+92,058**	**+66%**
Federal FTEs	124	124	124	0	0%

OCIO Sources for Funding Activities	FY 2022 Request	WCF	Customer (EITS)	Total
CYBERSECURITY				
Protecting Networks and Information (Protect)[1]	25,725	3,000	2,552	31,277
Detect, Analyze, and Mitigate Intrusions (Detect and Respond)	24,700	0	4,153	28,853
Shaping the Cybersecurity Environment (Identify and Recover)	20,665	0	7,156	27,821
TOTAL, CYBERSECURITY	**71,090**	**3,000**	**13,861**	**87,951**
CYBER RESERVE – SOLARWINDS INCIDENT	**93,230**	**-**	**-**	**93,230**
CORPORATE IT PROGRAM SUPPORT				
IT Portfolio Summary[2]	17,271	9,821	-	27,092
IT Infrastructure	2,970	-	-	2,970
End User –Energy Information Technology Services (EITS)	3,996	34,169	73,017	111,182
TOTAL, CORPORATE IT PROGRAM SUPPORT	**24,237**	**43,990**	**73,017**	**141,244**
PROGRAM DIRECTION				
Federal Salaries & Benefits	25,663	-	-	25,663
Travel	330	-	-	330
Support Services	3,325	-	-	3,325
Other Related Expenses	14,383	-	-	14,383
TOTAL, PROGRAM DIRECTION	**43,701**	**-**	**-**	**43,701**
OCIO payments into Shared Services and WCF[3]		(2,973)	(6,295)	(9,268)
Total, Chief Information Officer	**232,258**	**44,017**	**80,583**	**356,858**
Federal FTEs	**124**	**3**	**-**	**127**

[1] The WCF Cybersecurity estimate reflects the WCF request of $3,000,000 for OPM credit monitoring under the Inter-Agency Transfers business line.

[2] The WCF Corporate IT Program Support reflects the WCF request for $43,990,000 which is comprised of $5,821,000 for the Inter-Agency Transfers business line and $4,000,000 for Telecommunications business line under IT Portfolio Summary and $34,169,000 is for End User – EITS Telecommunications business line.

[3] OCIO provides funds to Shared Services and WCF as a customer as well as the rest of the contributing program offices. In order to not double count those payments in the totals available, a bottom line adjustment was made.

Cybersecurity

Overview

The OCIO leads the Department's Cybersecurity program on behalf of the Secretary and in accordance with the Federal Information Security Modernization Act of 2014; and unclassified network services to DOE Headquarters and participating field sites. This includes protecting DOE networks and information; detecting, analyzing, and mitigating intrusions; providing continuous monitoring of the network and infrastructure; and managing the DOE cybersecurity environment. of the following summarizes the Cybersecurity portfolio of work and provides information on the anticipated activities.

Highlights of the FY 2022 Budget Request

- Increase enterprise-wide visibility of the Department through increased real-time information availability, integrated incident reporting data and metrics, and tool modernization to increase data integration. (Protect, Detect, and Respond)

- Strengthen enterprise risk management practices to support defensible business decisions through sustainment of the Enterprise Cybersecurity Risk Management program, Supply Chain Risk Management program, and execution of enterprise-wide assessments and risk register reporting. (Identify and Recover)

- Deliver improved cybersecurity training, education, and awareness through enriched cybersecurity training curriculums, awareness and learning opportunities, and collaboration with internal and external cybersecurity communities of interest. (Protect)

- Continue migration of data center applications to the cloud and optimization of multi-cloud (the distribution of cloud resources over a number of clouds) operations and application workloads. (Identify and Recover)

- Continue implementation of Trusted Internet Connection (TIC) 3.0 and Zero-Trust Networking capabilities. (Protect)

- Deploy new capabilities in Customer Relationship Management (CRM), Workforce Enablement, Digital Worker Services, Identity Management, Infrastructure Services, and IT Service Management. (Protect)

Funding Breakout and Analysis

This section summarizes the program and activities associated with the overall projected OCIO cybersecurity budget. It captures activities under three budget lines aligned to the NIST Cyber Security Framework (CSF):

- Protect – Awareness and Training, Information Protection Processes, and Protective Technology
- Detect and Respond – Response Planning, Detection, Analysis, Mitigation, and Improved Communication
- Identify and Recover – Continuous Monitoring, Risk Assessment/Management, Business Processes, Governance, Asset Management, Recovery Planning, and Improvements

Budget Line: Protecting Networks and Information - Protect ($25,725,000 – Request; $3,000,000 – WCF; $2,552,072 – Customer) (TOTAL = $31,277,072)

Provide programs to protect DOE networks and the information which resides on them.

Activity: Data Center Modernization ($2,700,000)
Funding is being requested to continue the migration of on-premises data center workloads to the DOE enterprise cloud Infrastructure as a Service (IaaS), Software as a Service (SaaS), Platform as a Service (PaaS) environments in Amazon AWS and Microsoft Azure. Funding will also support the optimization of poly-cloud operations and applications within the cloud environments to include deployment of additional PaaS and SaaS solutions within the AWS and Azure environments. This initiative also supports and is aligned with the federal Data Center Optimization Initiative (DCOI) and will assist in driving the Department towards compliance while driving down Total Cost of Ownership (TCO) by leveraging cloud native solutions to automate workflow.

Activity: Infrastructure IT Modernization ($2,500,000)
Modernizing DOE's IT infrastructure, services, and operations to a level consistent with the needed capacity, flexibility, and resiliency of a modern secure enterprise remains a key priority. This funding will support continued identification and implementation of new technologies, managed services, and commercial cloud services solutions to improve cybersecurity, scale capacity commensurate with demand, and establish IT enterprise capabilities in support of DOE enterprise users and the DOE mission. This initiative will focus on new capabilities in the focus areas of Customer Relationship Management (CRM), Workforce Enablement, Digital Worker Services, Identity Management, Infrastructure Services, and IT Service Management as part of the overall DOE IT Modernization.

Activity: Design and Engineering (ICC) (Previously Policy and Development- IT Modernization) ($1,133,000)
This funding will support design and engineering modernization initiatives for the Department through our Innovation Community Center (ICC). These activities will include policy development for applied data science; and human centered design and advanced data analytics enabling mission-focused innovation. Data Scientists, Designers and Engineers analyze requirements, evaluate alternatives, develop models and feature sets; engineer and test solutions. They directly interface with stakeholders and architects to build cyber compliant solutions.

Activity: Network Modernization - DOEnet/ESnet (Energy Sciences Network) & Trusted Internet Connection (TIC) 3.0 ($2,395,000)
The Department maintains a corporate business Wide Area Network (WAN), DOEnet, supporting enterprise business services. DOE continues to evolve from a decentralized entity to one focused on integration and collaboration, which requires modernization of the DOE wide area network. This funding will continue efforts to improve operational performance, security, and resiliency, while expanding opportunity for multi-site collaborations through modernization of the Department's wide area network architecture. This funding will support DOE's efforts to transition to Internet Protocol Version 6 (IPv6). Identify and implement additional Trusted Internet Connection (TIC) 3.0 and Zero-Trust Network (ZTN) capabilities and solutions aligned with DHS guidance in support of the continued shift from on-premises TIC infrastructure to commercially-managed services and solutions to deliver an improved mobile/remote access experience for DOE users and support the expanded use of cloud services.

Activity: Identity, Credential, and Access Management (ICAM) ($3,990,000)
Funding supports the increased requirement for PIV or equivalent Identity Assurance Level (IAL)/Federation Assurance Level (FAL)/Authenticator Assurance Level (AAL) credentials for network access for privileged and un-privileged accounts. DOE has achieved the OMB goal to require PIV or equivalent to access un-privileged network user accounts

and will focus efforts on the OMB goal for privileged network user accounts. Funding will enable expansion of the digital identity repository of DOE sites. The DOE identity management service supports 364,879 identities of which 210,211 are current active identities. Funding will expand authentication services directly supporting a current total of 78 DOE production applications with 31 in process as well as federated to four authentication hubs and expansion of authentication services to DOE sites which will result in raising the requirement for use of the proper credential based on a role-based risk assessment. Funding also supports continued federation services with MAX.gov and Login.gov, ongoing cloud infrastructure costs, enterprise service support for the DOE-wide global address list including exchange of encryption certificates and physical access for a number of sites, and enterprise licensing of identity and access management commercial products.

Activity: Managing DOE Spectrum Program ($1,553,000)
The DOE Spectrum Program is mandated under Title 47, U.S. Code of Federal Regulations, 901, et. seq., and manages DOE radio frequency spectrum-dependent resources for NNSA, Power Marketing Administrations (PMAs), Office of Secure Transportation, and National Laboratory spectrum-dependent assets. As the 9th largest holder of radio frequencies with more than 7,300 individual radio assignments, the DOE Office of Spectrum Management (OSM) provides technical, logistical, and administrative support, as well as ongoing oversight and advocacy at an inter-agency level in the National Capital Region. There are 34 sites receiving services from OSM including Headquarters, the National Labs, the PMAs, and NNSA sites. Critical DOE missions and essential functions utilizing Spectrum services include the National Power Grid, Interstate Electricity Transmission, Satellite Missions, Nuclear Emergency Search, Radiological Assistance, Secure Transportation and Safeguards, and Protective Force Communications.

Activity: Coordinated Cyber Response and Cybersecurity Training and Awareness and Role Based Training ($4,600,000)
CyberFire develops cyber incident responder specialized skills needed to defend information technology (IT) and operational technology (OT) infrastructure to mitigate cyber threats through extensive training and develops advanced teams of incident responders for escalated cyber incidents. This funding provides for two events per year, bringing together incident responders from across DOE, the public sector, private sector, and international partners. Smaller events are held with members of the private sector and academia. Funding in this activity is to develop and improve cybersecurity training and awareness by:
- Developing world-class cyber leadership and workforce to improve recruitment and retention;
- Building a cybersecurity community within DOE and externally through partnerships with other Federal stakeholders;
- Improving Authorizing Official (AO) and risk-based investment training for DOE leader enablement;
- Improving cyber professional workforce through education and training opportunities via community moderated forums, cloud-based technology, and hands-on education channels; and
- Enhancing workforce engagement through enriched cybersecurity training curriculums; awareness and learning opportunities; and collaboration with internal and external cybersecurity communities of interest.

Activity: Operations Technology (OT)/ Control Systems (CS) Technology ($1,000,000)
As a member of DHS CISA-led Control Systems Interagency Working Group and the owner of a large fleet of industrial control systems which provide electrical grid management, DOE is expected to engage and act on Executive Order (EO) 3920, "Securing the United States Bulk-Power System." DOE has commissioned an internal Control Systems Working Group to define the DOE control systems environment and execute a strategy to remediate cyber security control gaps and institute process improvements to ensure the security of the nation's Bulk-Power System while maintaining compliance with the North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards. This funding will support testing of new processes and piloting of technologies that improve the Department's ability to monitor and protect these critical systems.

Activity: Control Systems (CS) and Operational Technology (OT) Modernization ($2,158,000)
Improving Control System (CS) and Operational Technology (OT) system security requires increased monitoring and shared situational awareness between traditional information technology network/security operations centers and their operational technology counterparts. Improved visibility, shared situational awareness and collaboration will rely on cloud based data storage and analytics platforms, communications links to move data, sensors and analytical tools designed for CS/OT and training from industry experts in the field of control systems and operational technology.

Activity: Emerging Technologies ($490,000)
Funding will support strategy and architecture activities for the Department through the Innovation Community Center (ICC). The Emerging Technology architects gather and analyze business opportunities; establish and validate risk mitigation strategies; identify use cases; develop architecture designs that show efficiencies in areas such as business processes, decision making, and cost reductions; and pass technical specifications to ICC build teams. The effort will help the agency align with the objectives outlined in Executive Order 13859 and will assist in the adoption of new technologies. This activity includes the following:
- Provide technical evaluations and recommendations
- Identify promising technologies for possible Departmental integration
- Recommend ways to integrate products and services into an operational environment

Activity: Cybersecurity Program Management Support ($581,000)
Provide support for OCIO leadership in the areas of cybersecurity program management and administrative support for cybersecurity projects to include tracking, monitoring, and reporting project status and providing strategic guidance and recommendations to OCIO leadership to accomplish the strategic goals of the organization.

Activity: Program Management Oversight for Cybersecurity ($2,625,000)
This activity will provide program integration and innovation support for managing IT Support Services strategic sourcing vehicle for OCIO contracts in the areas of Cybersecurity:
- Provides program management in support of projects, including tracking, monitoring, and reporting project status and providing strategic guidance and recommendations to OCIO leadership to support evidence-based and data-driven decision-making to accomplish strategic goals of the organization.
- Supports IT projects assessing and shaping the demand pipeline for services across the agency to enable the OCIO to streamline the investment decision process for new IT products and services.
- Provides strategic design and innovation in order to clearly define and map issues, uncovering the customer pain points at project onset and developing an understanding of customer needs, preferences, and behaviors to design future state operations and enhance service delivery.
- Provides organizational change management in support of IT projects in order to account for the impact new initiatives have on operations, culture, and employees; and ensures the capability to sustain continual IT refresh and innovation.

Summary of Funding from Working Capital Fund – Interagency business line ($3,000,000)*
Credit Monitoring
Funds credit monitoring services for all DOE employees following the Office of Personnel Management (OPM) Personally Identifiable Information (PII) data breach.

Customer funding provided as part of Energy Information Technology Services (EITS) ($2,552,072)*
Cyber for EITS Protect ($2,552,072)
Funds secure data transmissions to include credentialing and access management, data safeguarding, secure data transmission, and system security testing and analysis for EITS customers.

* WCF and customer fund dollars include OCIO contributions

Budget Line: Detect, Analyze, and Mitigate Intrusions – Detect and Respond ($24,700,000 – Request; $4,153,002 Customer) (TOTAL= $28,853,002)

Expand operational visibility of the DOE complex through increased real-time information availability, integrated incident reporting data and metrics, and tool modernization to increase data integration. Visibility into cybersecurity operations across the DOE sites, labs, and offices is a critical component of ensuring strong cybersecurity. Oversight into current processes will help identify gaps and vulnerabilities in our systems. Programs being able to create this visibility and plug those gaps will be critical in the Department's cybersecurity strategy moving forward.

Activity: SOC Assessment /Pursuit/Hunt ($250,000)
Establishing a standardized SOC assessment model to evaluate SOC maturity across the DOE enterprise and enable better visibility of gaps and prioritization of requirements across the enterprise. Establish and test concepts for cybersecurity incident response Pursuit/Hunt teams which will significantly enhance our ability to proactively defeat and respond to a wide range of cybersecurity threats.

Activity: Integrated Joint Cybersecurity Coordination Center (iJC3) ($12,724,000)
Enhancing and maturing the iJC3 will lead to greater enterprise visibility to stay ahead of adversaries and cyber threats. iJC3 leads coordination of all cyber information for the Department, identifies trends, and gains significant insight into cyber operations, helping to inform critical decision making and enhance situational awareness. This will enable stronger stakeholder awareness and cross-collaboration amongst the various department elements, ensuring that resources are being allocated efficiently across the DOE complex.

Activity: Automated Indicator Sharing Modernization ($900,000)
Funding for this activity enables sustainment of a commercial off-the-shelf solution supporting machine-to-machine sharing of cyber threat intelligence, speeding up proactive defense and distributed detection for the DOE enterprise. This will provide automated signature delivery and indicators of compromise to automatically update cyber defenses, such as intrusion detection systems, intrusion prevention systems, and firewalls.

Activity: Big Data Platform ($7,026,000)
Continuing maturation of Big Data Platform (BDP) and incremental planned growth for Amazon Web Services GovCloud storage and compute will enable improved data analytics and visualization of Department-wide trends. This will allow OCIO to be more accountable to the Department and the broader federal government through performance metrics and improved reporting.

Activity: Cybersecurity Tools and Licensing ($3,750,000)
Funding supports sustainment, modernization, and operationalization of cybersecurity products or services, such as hardware, software, applications, and equipment designed to protect the DOE IT infrastructure and improve the iJC3's ability to detect, report, respond, and recover. Operationalizing cybersecurity products and services will enable more timely access to critical data and automated process support.

Activity: Deployable Incident Response Teams, Network Modeling, and Enhanced Exercise Program ($50,000)
Funding supports the identification, exercising, and equipping of incident responders across the DOE enterprise that can support crisis action planning and virtual or on-site incident response support during a major cybersecurity incident. Provides enhanced tools to perform on-site network modeling of effected networks.

Customer funding provided as part of EITS ($4,153,002)*
Cyber for EITS Detect ($4,153,002)
Funding anti-phishing and malware defense, intrusion prevention and incident management and response for EITS customers.
   * *WCF and customer fund dollars include OCIO contributions*

Budget Line: Shaping the Cybersecurity Environment – Identify and Recover Other Than CDM ($20,665,000 – Request; $7,155,824 Customer) (TOTAL = $27,820,824)

To enable DOE to identify, assess, select, monitor, and report on risks, DOE will continue to mature its cybersecurity risk methodology to blend qualitative and quantitative risk management principles and demonstrate business use cases to answer tough questions. DOE will sustain and improve its supply chain as a service program, continue to improve business processes, streamline the security authorization process, and continue to emphasize operational risk versus compliance gaps.

Activity: Vulnerability Disclosure Program/Crowdsourced Penetration Testing (Sustain Bug Bounty) ($2,500,000)
In accordance with DHS/OMB requirements, the Department will implement its Vulnerability Disclosure Program (VDP) policy across all public facing systems and websites. This funding will sustain the existing contract to manage the DOE

VDP solution providing the portal for responsible vulnerability disclosure, triage of submissions, coordination of remediation and communication with researchers and sustain crowd source pen testing.

Activity: Cybersecurity Modernization ($2,700,000)
Funding supports modernizing DOE's infrastructure and cloud based security through a secure, robust, and capable infrastructure and network, built on interoperable standards and architecture principles. Projects that make up the initiative, when completed, will support continued maturation and automation of the EITS Site Security Operations Center (SOC) capabilities in alignment with the overall DOE Enterprise. Specifically, FY 2022 funding will support continued modernization and automation of cybersecurity operations capabilities, including the transition from legacy on-premises capabilities and technologies to cloud native tools and capabilities, deployment of Artificial Intelligence (using Machine Learning) solutions to support automated log correlation activites, implementation of controls and methodologies to align with the DOE Controlled Unclassified Information (CUI) Order, support for enterprise initiatives, such as Metadata Taxonomy and Risk Management dashboards.

Activity: Supply Chain Risk Management as a Service ($3,235,000)
Sustain the enterprise Supply Chain Risk Management (SCRM) program that provides proactive, defense-in-depth supply chain security support for the DOE Enterprise. The program also provides capabilities that guide, educate, and manage supply chain risks to National Security Systems and Information and Communications Technology (ICT) components and includes shared services, a common lexicon, and best practice procedures in procurement, delivery, and deployment of IT products and services that are used across the enterprise and select Federal Departments/Agencies.

Activity: Strategy and Program Management, Security Authorization, and Contractor Personnel Security Support and Enterprise Risk Management Program ($9,960,000)
Funding will provide contractor support to cybersecurity business operations, planning and project management support to DOE enterprise level cybersecurity strategy, policy, Information Management Governance, assessments, and authorizations. Additionally, it will provide contractor support for OCIO Personnel, Information, Physical, and Communications Security requirements. This activity supports organizing and capturing enterprise cyber risk management goals to make informed, risk-based cybersecurity decisions. It includes providing policy, guidance, strategies, and implementation plans through an exclusive Department Enterprise Risk Management - Cybersecurity (ERM-CS) initiative. OCIO works closely with Department programs and sites to develop, document, and deploy fundamental approaches to cybersecurity and enterprise risk management. OCIO will adhere to guidance set forth by Executive Order 13800, "Strengthening the Cybersecurity of Federal Networks and Critical Infrastructure," which requires Federal agencies to use NIST Cybersecurity Framework to manage their risks.

Activity: Enterprise Architecture (Previously Requirements Analysis and Integration) ($1,450,000)
This activity supports maturing the DOE Enterprise Architecture Program initially focusing on management of the Technical Reference Model initially focused on commercial off the shelf (COTS) software and expansion. Activity will continue furthering Business Architecture though DOE Business Reference Modeling, defining and integrating the Application Reference Model and defining a DOE Security Reference Model. A major objective of the Enterprise Architecture program is to commence application rationalization to incrementally consolidate and disposition systems and applications performing similar functions. The goal of the Enterprise Architecture program is to have a clear line of sight from the business and mission drivers to applications supported by COTS products captured in the Technical Reference Model. Funding will also support the expansion of the Enterprise Architecture repository tools to the broader DOE community.

Activity: Cybersecurity Strategic Communication Support ($470,000)
This activity provides cybersecurity strategic communications support to OCIO leadership in advancing the Department's cybersecurity missions through policy, standards, and services for the enterprise information system.

Activity: Cybersecurity Emergency Management Support ($300,000)
This activity provides emergency management support and reporting project status to OCIO leadership to accomplish strategic goals of the organization.

Budget Line: Shaping the Cybersecurity Environment – Identify and Recover Request; $50,000) (TOTAL = $50,000)

<u>Activity: Continuous Diagnostics and Mitigation (CDM) Modernization CM License Lifecycle Maintenance of Enterprise Renewals ($50,000)</u>

Improving operational visibility and continuous monitoring rely heavily on our ability to know what is on our networks and the attack surfaces associated with those networks. The Department of Energy, in partnership with the Department of Homeland Security and their CDM program office, has made major investments in hardware and software asset management, continuous monitoring and reporting capabilities for the Department. The CDM program helps ensure DOE compliance with federal monitoring and reporting requirements through capability deployments and centralized data.

<u>Customer funding provided as part of EITS ($7,155,824)*</u>
Cyber for EITS ($7,155,824)*
Funding provides for authorization and policy and continuous diagnostics and mitigation (CDM) for EITS customers.

 * WCF and customer fund dollars include OCIO contributions

Cybersecurity

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Cybersecurity $71,800,000	**$71,090,000**	**-$710,000**
Protecting Networks and Information (Protect) $31,370,000	**$25,725,000**	**-$5,645,000**
Funds will support a Coordinated Cyber Response, Network Security Modernization- Infrastructure IT Modernization, Network Security Modernization-Data Center Modernization, Network Security Modernization- DOEnet/Esnet (Energy Sciences Network) & Trusted Internet Connections (TIC)/ Independent Assessment, Identity Credential and Access Management (ICAM), IT Modernization Support, Cybersecurity Training and Awareness, Bug Bounty, Program Management Oversight Emerging Technologies, Spectrum, and Cybersecurity Program Management are the planned initiatives.	Continue FY 2021 program activities with new requests for FY 2022 Control Systems and Operational Technology Modernization (+$2,158,000) and Operations Technology/ Control Systems ($1,000,000).	Decrease reflects an adjustment for Data Center Modernization (-$4,107,000) the reduced funding reflects completion of work to migrate existing on-premises application workloads to the cloud. Bug Bounty Crowdsourced Penetration Testing (-$2,500,000) realigned to incorporate Vulnerability Disclosure Program/ Crowd Source Pen Testing and moved to Identify and Recover. Coordinated Cyber Response (-$3,100,000); and Network Security Modernization-DOEnet/Esnet & TIC 3.0/ Independent Assessment (-$1,913,000); and Cybersecurity Training and Awareness and Role Based Training (-$1,500,000); Network Security Modernization- Infrastructure IT Modernization (-1,807,000). Request is offset with new initiatives of Control Systems and Operational Technology Modernization (+$2,158,000) and Operations Technology/ Control Systems (+$1,000,000) along with increases for: ICAM (+$161,000); Design and Engineering (ICC) (+$623,000); and Emerging Technologies (+$490,000) and Coordinated Cyber Response/Cyber Training and Awareness (previously two separate lines prior to FY22) (+$4,600,000) and Managing DOE Spectrum Program (prior to FY21 this was under CP) (+$250,000) . In addition the ,budget lines for Coordinated Cyber Response and Cybersecurity Training and Awareness were consolidated to one line with no changes in amounts.

Activities and Explanation of Changes Continued

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Detect, Analyze, and Mitigate Intrusions (Detect and Respond) $26,950,000	**$24,700,000**	**-$2,250,000**
Funds will support the following initiatives: Integrated Joint Cybersecurity Center**,** Big Data Platform, Cybersecurity Tools and Licensing, Deployable Incident Response Teams, and Automated Indicator Sharing Modernization.	Continue FY 2021 program activities with new initiatives in FY 2022 include the following: SOC Assessment/Pursuit/Hunt ($250,000); Big Data Platform (+$1,026,000)	Decrease reflects adjustments for Integrated Joint Cybersecurity Center (-$1,676,000) to realign a portion of activities to Strategy and Program Management under Identify and Recover, Automated Indicator Sharing (-$600,000), Deployable Incident Response Teams (-$500,000) that were moved to other Cyber priorities. Cybersecurity Tools and Licensing (-750,000) This decrease is offset with a new initiative for SOC Assessment/Pursuit/Hunt (+$250,000) and Big Data Platform (+$1,026,000) to increase the pace of development, add additional Splunk license support for the DOE enterprise and add storage capacity.

Activities and Explanation of Changes Continued

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Shaping the Cybersecurity Environment (Identify and Recover) $13,480,000	$20,665,000	+$7,185,000
Funds will support the following initiatives: Planning, Policy and Enterprise Risk Management; Cyber Supply Chain, MEGABYTE Act Tool, Requirements Analysis and Integration; iJC3 Cyber Operational Technology (OT) Protection; Strategy and Program Management; Security Authorization and Physical/Personnel Security Support; Data Center Optimization Initiative; 21st Century IDEA Act; Cybersecurity Strategic Communication; and Cybersecurity Emergency Management.	Continues FY 2021 program activities in addition to Cybersecurity Modernization and a realignment of activities previously under Detect and Respond. Includes funding for new initiatives: • Cybersecurity Modernization (+$2,700,000) • Vulnerability Disclosure Program/ Crowd Source Pen Testing (+$2,500,000) • Strategy and Program Management, Security Authorization, and Contractor Personnel Support (+$9,960,000)	Overall decrease reflects adjustments to Enterprise Architecture (EA) (-$550,000); and EA support and technical support for the EA tool and Cybersecurity Strategic Communication Support (-$250,000); and Planning, Policy and Enterprise Risk Management (-$1,000,000); and Strategy and Program Management, Security Authorization and Physical/Personnel Security Support (-$6,460,000) Request is offset by additions for Cybersecurity Modernization (+$2,700,000), Vulnerability Disclosure Program/ Crowd Source Pen Testing (+$2,500,000) realigned to add Vulnerability Disclosure Program to the request previously titled Bug Bounty and move from Protect, Supply Chain Risk Management (+$285,000) and a total increase for Strategy and Program Management, Security Authorization, and Contractor Personnel Support (+$9,960,000).

Cyber Reserve - SolarWinds Incident

Overview

The FY 2022 discretionary request identified a cyber reserve of $750 million. The FY 2022 President's Budget allocates these resources to nine agencies that were significantly impacted by the SolarWinds incident, one of which is the Department of Energy. The purpose of the funding is to address immediate response needs and does not focus on wholesale replacement of IT systems at this time. The funding request targets critical cybersecurity needs at these nine agencies which prioritizes basic cybersecurity enhancements, including: cloud security, Security Operations Center (SOC) enhancements, encryption, Multi-Factor Authentication (MFA), increased logging functions, and enhanced monitoring tools. Each agency's maturation levels were reviewed in these areas to determine the most critical gaps that require additional funding.

The FY 2022 President's Budget requests $93.230 million to address the impacts of the SolarWinds incident at the Department of Energy.

Activities and Explanation of Changes Continued

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
SolarWinds Incident – Cyber Reserve $0	**SolarWinds Incident – Cyber Reserve $93,230,000**	**+$93,230,000**
No funding provided in FY 2021.	• Funding will be targeted to support cloud security, Security Operations Center (SOC) enhancements, encryption, multifactor authentication, increased logging functions, and enhanced monitoring tools.	• Funding increase supports cyber response and recovery needs at the Department and enhances DOE's security posture to ensure protective measures are in place to prevent further incidents like SolarWinds.

Corporate IT Program Support

Overview
OCIO is requesting $24,237,000 for Corporate IT Program Support, which provides capital planning guidance, robust privacy and records management, IT products and services, and an efficient and effective IT platform. This request is a decrease of $1,069,000 from the FY 2021 Enacted.

Highlights of the FY 2022 Budget Request
- Enhanced services and automation in Enterprise Governance and FITARA operations
- Increased support for information technology service management platforms and engineering skills for new projects
- Preparation of cloud based tools and FedRamp sponsorship for expanded enterprise use of EITS Cloud Network
- Increased support for building business architecture models and Innovation Community Center (ICC) Development
- Additional funding for professional services for sandbox subscriptions, tools, and advanced configurations

Budget Line: IT Portfolio Summary ($17,271,000 – Request; $9,821,000 – WCF) (TOTAL = $27,092,000)

Activity: IT Investments for Mission Delivery and Management Support ($800,000)
Funding supports enterprise wide solution delivery and transformation with improved data ingestion, curation, usage and sharing of solutions ensuring compliance with the Federal Data Strategy, Geospatial Data Act, and Foundations for Evidence-Based Policymaking Act. Outcomes include agile methodology and assist with transitioning from legacy practices through approaches, such as Learning Agendas. The Innovations Community Center (ICC) will help DOE entities to adopt new ways of doing business through both technology and processes. This funding supports product management and enterprise-wide adoption and transformation of products and services, provides online capabilities such as knowledge bases, communities of interest, and exchanges that allow for information to be shared across the agency.

Activity: Program Management Oversight ($4,875,000)
Funds will provide Program Integration and Innovation support for managing IT Support Services (ITSS) strategic sourcing vehicle for OCIO contracts in the areas of IT Management; Systems Development and Engineering; and IT Service Operations. Specifically, funds will support:
- Providing program management on projects, including tracking, monitoring, contractor oversight, and reporting project status and providing strategic guidance and recommendations to OCIO leadership to support evidence-based and data-driven decision-making to accomplish strategic goals of the OCIO.
- Supporting IT projects assessing and shaping the demand pipeline for IT services across the agency, which will enable the OCIO to streamline the investment decision process for new IT products and services.
- Providing strategic design and innovation in order to clearly define and map issues, uncovering the root cause of customer pain points at project onset and developing an understanding of customer needs, preferences, and behaviors to design future state operations and enhance service delivery.
- Providing organizational change management in support of IT projects in order to account for the impact new initiatives have on operations, culture, and employees; and ensuring the capability to sustain continual IT refresh and innovation.

Activity: Proof of Concepts and Pilots ($557,000)
Funding supports resources to stand up and administer cloud platforms for development of proof of concepts, rapid prototypes and pilots through the ICC. The environment will be used by ICC teams and stakeholders to assess functionality, cost, and cyber compliance, and also be used as a provisioning area for production deployments. The capability is essential to showcase next generation IT solutions to the DOE enterprise.

Activity: IT Investments for Governance, Federal Information Technology Acquisition Reform Act (FITARA), Capital Planning, and OCIO Functions ($5,528,000)

This activity supports the following:
- Managing governance of DOE strategic IT investment portfolio to ensure alignment with DOE missions; overseeing Capital Planning and Investment Control programs and implementing Technology Business Management (TBM); managing FITARA requirements and conducting portfolio analyses to drive IT investment decision-making.

- Leading IT planning, policy, and performance evaluation and managing strategic and tactical IT policy development, maintenance, and implementation through coordination with internal and external governance groups; and ensuring DOE compliance with e-Government requirements.

- Providing DOE enterprise oversight, support, and coordination on cybersecurity and information management issues; and providing technical and administrative services for governance organizations to yield effective, efficient, and secure application of information and IT for mission enhancement, operational excellence, and risk management.

Activity: Policy and Performance Management ($4,045,000)
Funding will support the DOE Enterprise Records Management Program and enterprise Privacy Programs, as described in the sub-activities below.

Sub-Activity: Records Management ($2,280,000)
Activity provides records management activities in accordance with National Archives and Records Administration (NARA) and other Federal agency requirements. Additional funds requested for stand up of an Enterprise-wide electronic records management solution, as mandated by NARA and OMB. The solution will enable the Department to manage all permanent electronic records, including e-mail, in an automated manner. Funding is needed to continue supporting the deployment of the selected records management solution to cover all e-mail users that are provisioned by EITS, the Headquarters-based IT service provider. The records management solution will support Departmental elements, both as they currently operate and as they participate in the consolidation to Office 365. The end result will be a secure and scalable enterprise-wide solution, providing a consistent, accessible, and automated approach to electronic document and records management requirements.

Sub- Activity: Privacy Information Management ($1,765,000)
Funding supports HQ-driven enterprise-wide privacy information management activities in accordance with Privacy Act, E-Government Act, and OMB Privacy directives to ensure compliance with federal laws, regulations, and standards, under the direction of the DOE Senior Agency Official for Privacy (SAOP), who is also the CIO. Additional funds are requested to procure an automated privacy compliance workflow management solution that will service the DOE enterprise. An automated solution is necessary to ensure that privacy documentation is compliant with federal requirements for the creation and management of electronic information and forms. In addition, the SAOP established the Department's Privacy Compliance Monitoring Program (PCMP) to review and assess DOE Element compliance with DOE Order 206.1 and other applicable Federal privacy laws and OMB privacy requirements. The PCMP will use site visits to meet with key field personnel, provide training, and conduct preliminary compliance evaluations.

Activity: FedRAMP ($650,000)
Funding will support FedRAMP preparation, compliance and sponsorship for expanded enterprise use on EITS Cloud Network of cloud based tools.

Activity: ePMO Tools ($486,000)
Funding supports resources to perform tool assessments and pilot Project Management tools. Funding will also support developing and maintaining the IT Project Management Dashboard and project analysis and prioritization.

Activity: Folio/eCPIC Tools ($330,000)
Funding supports the Folio tool, the eCPIC IT Portfolio Management transition, Technology Business Management (TBM) implementation, IT Portfolio assessments, and financial analysis and prioritization.

Summary of Funding from Working Capital Fund – Interagency Transfers business line ($5,821,000)*
Records Storage at NARA
Funding supports the annual agreement with NARA to provide records services and storage consistent with approved records schedules.

- *Integrated Acquisition Environment*
  Provides for Interagency Agreement with the General Services Administration (GSA) to provide packaged services.

- *E- Government initiatives*
  Initiatives include consolidation studies of lines of businesses and other intergovernmental systems.

Summary of Funding from Working Capital Fund – Telecommunications- Network Refresh ($4,000,000)*
Provides for the annual network technology refresh as part of lifecycle management, which is necessary to address current risks in the areas of security and availability in the core and distribution layers of existing DOE network infrastructure. By investing in a more modern network infrastructure, the Department will enhance network cybersecurity controls and will further support the collaboration capabilities being requested within the Department.

*WCF and customer fund dollars include OCIO contributions

Budget Line: End User – IT Infrastructure ($2,970,000 – Request) (TOTAL = $2,970,000)

Activity: MEGABYTE Act Tool ($250,000)
This activity supports tools to aggregate software deployed across DOE into the enterprise architecture repository for real time access by elements across DOE. The resulting data is consumed into the enterprise architecture tool to form the DOE-wide Technical Reference Model containing COTS software products deployed across DOE. Software contained in the Technical Reference Model is reviewed for conformance to the DOE enterprise architecture policies to assure COTS software no longer supported by the vendor is removed from the environment. The Technical Reference Model informs the DOE Enterprise-wide Agreement program to achieve the objectives of the MEGABYTE Act to consolidate software acquisitions to achieve savings from aggregated acquisitions using DOE, GSA, and other Government-wide acquisition vehicles. The DOE Enterprise Architecture Governance Board (EAGB) reviews candidate software for addition to the Enterprise-Wide Agreement program on a bi-monthly basis.

Activity: 21st Century IDEA Act ($820,000)
This activity includes the sub-activities listed below:

Sub-Activity: Web Modernization Enterprise Tool to perform 508 compliance across the Agency ($300,000)
In order to ensure the agency is compliant with the 21st Century IDEA Act, this tool will be run against the 61 domains and 5,200 subdomains across the agency.

Sub-Activity: Digitization of Paper-based Forms ($420,000)
Funding supports cloud infrastructure as well as provide the professional services to document and automate workflows and approvals in order to continue support of paper-based forms to digital.

Sub-Activity: Electronic Signature ($100,000)
In support of M-19-17 and M-00-15, this funding will support the infrastructure needed to provide electronic signatures to the public domain. This will include the information technology service management platform licenses and staff that will provide helpdesk support, maintenance, and operations support of the platform.

Activity: Data Center Optimization Initiative (DCOI) Program ($1,900,000)
To help with meeting the mandates set forth in OMB -19-19 and Federal Information Technology Acquisition Reform Act (FITARA), it is important to fund software licensing of the Data Center Infrastructure Management tools to help keep the facilities more energy efficient by monitoring the heating and cooling of the building and further the efforts for application rationalization inside the data centers. This activity also supports the automated reporting and

development work of the Enterprise Data Analytics Repository System (eDARS). These funds will support enterprise efforts to centralize the data across the agencies' data centers. This funding will help fund critical skill sets with supporting Data Centers and information technology service management cloud platforms.

Budget Line: End User - EITS ($3,996,000 – Request; $34,169,000 – WCF; $73,017,100 Customer) (TOTAL = $111,182,100)

Activity: EITS Payment ($3,996,000)
Funds desktop services for the EITS business line.

Summary of Funding from Working Capital Fund – Telecommunications business line ($34,169,000)*
Provides connectivity for DOE Headquarters and field operations through Local and Wide Area Networks and telecommunications (telephone) services. LAN connections provide access to the EITS application host systems and cybersecurity for the internet, e-mail, and other applications.

Summary of Funding from Customers – Shared Services direct billing ($73,017,100)*
Provides for End User Services, including asset management, help desk and deskside support, and information technology service management platform application support.

WCF and customer fund dollars include OCIO contributions

Corporate IT Program Support

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Corporate IT Program Support $25,306,000	**$24,237,000**	**-$1,069,000**
IT Portfolio Summary $17,529,000	**$17,271,000**	**-$258,000**
Funding will support the following activities: IT Investments for Mission Delivery and Management Support; Program Management Oversight; Proof of Concepts; IT Investments for Governance, Federal Information Technology Acquisition Reform Act (FITARA), Capital Planning, and OCIO Functions; Policy and Performance Management; Enterprise Project Management Office(ePMO) Tools; and Folio/ Electronic Capital Planning and Investment Control (CPIC) Tools.	Funding will continue FY 2021 activities and a new initiative for FedRAMP. Funding increases within base are provided for the following areas: Capital Planning and CIO Functions Data Collection and FISMA Reporting for enhanced services and automation; Proofs of Concepts Pilot; Policy and Performance Management Privacy.	Overall increase reflect adjustments for: IT Investments for Mission Delivery and Management Support (-$166,000); IT Investments for Mission Delivery Emerging Technology (-$299,000) consolidated with previous item; IT Investments for Enterprise Assessment (EA), Capital Planning and CIO Functions Portfolio and Analysis (-$171,000); IT Investment for EA Capital Planning and CIO Functions Policy and Performance Management(-$523,000); and IT Investments for EA, Capital Planning and CIO functions IM Governance (-$507,000); Policy and Performance Records Management (-$1,150,00) reflects integration of activity into EITS; ePMO Tools (-$14,000); and Folio/ Electronic Capital Planning and Investment Control(CPIC) Tools (-$170,000); Emerging and Disruptive Technologies (-$500,000). The request is offset by increases in the following areas: IT Investments for EA, Capital Planning and CIO Functions Data Collection and FISMA Reporting (+$1,685,000) for enhanced services and automation; Proof of Concepts Pilot (+$157,000); Policy and Performance Management Privacy (+$750,000); and new initiative for FedRAMP (+$650,000).

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
IT Infrastructure $3,781,000	**$2,970,000**	**-$811,000**
Funding will support MEGABYTE Act Tool; Data Center Optimization Initiative; and 21st Century IDEA Act that were moved from Cybersecurity funding.	Funding will support MEGABYTE Act Tool; Data Center Optimization Initiative; and 21st Century IDEA Act that were moved from Cybersecurity funding in the FY 2022 request.	Decrease of funding for 21st Century IDEA Act for (-$1,180,000). Increase in funding for Data Center Optimization Initaitive (+$369,000).
End User - EITS $3,996,000	**$3,996,000**	**$0**
This is funding for the EITS services that EITS itself consumes – it is a customer of its own services.	Continuation of FY 2021 activities.	No Change.

Overview

Program Direction provides $43,951,000 for 124 FTEs and associated costs for the overall management of OCIO activities.

Highlights of the FY 2022 Budget Request

Request funds OCIO corporate program management and operations, acquisitions/contract administration, human capital management and budget support, as well as Working Capital Fund requirements.

Program Direction
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Headquarters					
Salaries and Benefits	24,370	25,232	25,663	+431	+2%
Travel	304	304	330	+26	+9%
Support Services	3,325	3,325	3,325	-	0%
Other Related Expenses	15,017	14,233	14,383	+150	+1%
Total, Program Direction	**43,016**	**43,094**	**43,701**	**+607**	**+1%**
Federal FTEs- Program Direction Funded	124	124	124	-	0%
Federal FTEs- WCF Funded	3	3	3	-	0%
Support Services					
Technical Support Services	1,515	1,515	1,515	-	0%
Business, Finance, and Procurement	1,810	1,810	1,810	-	0%
Total, Support Services	**3,325**	**3,325**	**3,325**	**-**	**0%**
Other Related Expenses					
Training	123	160	160	-	0%
Working Capital Fund (WCF)	12,228	11,228	11,228	-	0%
Desktop Services	2,333	2,333	2,483	+150	+1%
Security Investigations	333	512	512	-	0%
Total, Other Related Expenses	**15,017**	**14,233**	**14,383**	**+150**	**+1%**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $43,094,000	**$43,701,000**	**+$607,000**
Salaries and Benefits $25,232,000	**$25,663,000**	**+$431,000**
Funding supports federal staff salaries and related benefits for 124 FTEs.	Funding supports federal staff salaries and related benefits for 124 FTEs.	This increase provides for 2.7% pay raise for federal staff in FY 2022.
Travel $304,000	**$330,000**	**+$26,000**
Funding supports mission-critical travel for federal staff.	Funding supports mission-critical travel for federal staff.	Increase outreach activities to collaborate with field sites on technology enhancements and OCIO priorities.
Support Services $3,325,000	**$3,325,000**	**0**
($1,515,000) Funding sustains operations within the front office of the CIO. Funds support contractor activities and memberships/subscription services for the CIO and senior staff.	($1,515,000) Continuation of activities.	($0) No change from FY 2021 Request.
($1,810,000) Funding used to maintain contractor activities in the areas of Financial Management, Budget and Internal Controls; Acquisitions; and Human Capital. These activities are critical to programmatic operations and accomplishment of program goals.	($1,810,000) Continuation of activities.	($0) No change from FY 2021 Request.
Other Related Expenses $14,233,000	**$14,383,000**	**+$150,000**
($160,000) Training costs to ensure all FTEs are appropriately trained to perform their duties, and development opportunities are available to CIO's federal staff.	($160,000) Continuation of activities.	($0) No change from FY 2021 Request.
($11,228,000) WCF funding level accounts for estimated OCIO overhead expenses.	($11,228,000) Continuation of activities.	($0) No change from FY 2021 Request.
($2,333,000) Desktop Services funds are used to provide IT services and hardware to employees.	($2,483,000) Continuation of activities.	(+$150,000) Increase to cover anticipated increase in EITS costs.
($512,000) Security Investigations	($512,000) Continuation of activities.	($0) No change from FY 2021 Request.

Congressional and Intergovernmental Affairs
Program Direction

Overview
The Office of Congressional and Intergovernmental Affairs (CI) delivers accurate and timely communication of Administration and Departmental objectives and activities with Congress, state, local, and Tribal governments, and other stakeholder organizations.

In FY 2022, CI will direct, manage, and ensure timely coordination between Departmental organizations and their external stakeholders. This includes timely notifications to Members of Congress, Governors, Mayors, and Tribal officials on Department of Energy (DOE) matters of specific interest including pending awards/grants/contracts that may affect the state, Tribal, congressional districts, and other constituencies. CI will ensure the Department provides timely and complete responses to inquiries and requests for information. In addition, CI will engage with Governors, staff, local elected and appointed officials, and Tribal leaders on DOE activities and decisions; and to elicit concerns and interests for consideration in DOE decision processes.

CI will recommend legislative strategies and engagements in alignment with Administration policy and DOE program initiatives. This includes both monitoring and developing legislative activity on behalf of the Department, as well as working with Congress to define and advance the Administration's position on pending legislation. CI will prepare Departmental officials for Congressional hearings, briefings and meetings, as well as gubernatorial and Tribal events. This includes directing and coordinating the preparation of congressional testimony, transcripts, pre- and post-hearing questions and answers, and other information provided for the record.

Highlights of the FY 2022 Budget Request
The Department requests $6,000,000 in FY 2022 for CI to maintain operational levels consistent with Departmental needs and Secretarial priorities. Funding will ensure CI can continue to provide accurate and timely communications of Administration and Departmental activities and objectives to Congress, State, local and tribal governments and external organizations.

Departmental Administration/Congressional and Intergovernmental Affairs/Program Direction   **FY 2022 Congressional Budget Justification**

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<p style="text-align:center">**Program Direction**
Funding ($K)</p>

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	3005	3500	4410	+910	26%
Travel	42	30	42	+12	40%
Support Services	181	181	230	+49	27%
Other Related Expenses	1167	1289	1318	+29	2%
Subtotal, Washington Headquarters	**4,395**	**5,000**	**6,000**	**+1,000**	**20%**
Total, Program Direction	**4,395**	**5,000**	**6,000**	**+1,000**	**20%**
Federal FTEs	**24**	**24**	**29**	**+5**	**38%**
Support Services					
Management Support					
Print and electronic subscription services	66	46	46	-	-
Contractor Support	110	130	184	+54	42%
Other Support Services	5	5	0	-5	-100%
Total, Support Services	**181**	**181**	**230**	**+49**	**27%**
Other Related Expenses					
Training	0	0	0	0	-
Energy IT Services	195	254	283	+29	-
Working Capital Fund	972	1035	1,035	-	-
Other Services	0	0	0	-	-
Total, Other Related Expenses	**1167**	**1,289**	**1,318**	**+29**	**2%**

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $5,000,000	**$6,000,000**	**+$1,000,000**
Salaries and Benefits $3,500,000	**$4,410,000**	**+$910,000**
Provides funding for 24 FTEs to include salaries and benefits.	Provides funding for 29 FTEs to include salaries and benefits.	FY 2022 Request increases FTE level closer to historic level required to adequately perform mission and objectives. Assumes 2.7 percent pay increase in civilian salaries, FERS increase, and supplemental funds for performance award pool increase in FY 2022.
Travel $30,000	**$42,000**	**+$12,000**
Funding for travel requirements to support the Department's engagements with congressional, intergovernmental and other stakeholders.	Travel activities needed to support Departmental engagements.	FY 2022 travel costs anticipated to increase after COVID-19 restrictions are lifted.
Support Services $181,000	**$230,000**	**+$49,000**
Most costs are related to the acquisition of annual subscriptions to information sources essential to ensure staff is well-informed of congressional and intergovernmental activities and interests, and contractors required for support roles.	Task order for essential administrative and executive support services, and costs associated with background investigation costs.	Increase due to need for additional contractor support.
Other Related Expenses $1,289,000	**$1,318,000**	**+$29,000**
Funds support business costs associated with the Department's Working Capital Fund; IT equipment and support.	Continuation of FY 2022 activities.	Increase due to EITS estimates.

Office of Small and Disadvantaged Business Utilization
Program Direction

Overview

The Office of Small and Disadvantaged Business Utilization (OSDBU) was established by the Small Business Act of 1953, as amended by Public Law 95-507. The OSDBU is responsible for advocating the use of small businesses, including Small Disadvantaged Businesses (SDB), certified 8(a) businesses, small businesses from Historically Underutilized Business Zones (HUBZone), Service-Disabled Veteran-Owned Small Businesses (SDVOSB), and Women-Owned Small Businesses (WOSB). This involves promoting small business prime and subcontracting opportunities in accordance with Federal laws, regulations, and policies and reporting to Congress on DOE utilization of small businesses.

The Biden Administration has issued several Executive Orders[1] whose objectives align with the OSDBU mission. The goals of the OSDBU are to institutionalize the use of small businesses and to fully integrate them into the U.S. Department of Energy's (DOE) base of contractors and to help the Department of Energy meet statutory goals for small business utilization. To accomplish this goal, the OSDBU has established and executes its mission through three strategic objectives: 1) making it easier for small businesses to do business with DOE; 2) maximizing small business opportunities by cultivating more productive and collaborative relationships with internal DOE Stakeholders; and 3) maximizing small business awards and improving performance in the four SBA socioeconomic categories.

The OSDBU is organizationally structured to accomplish this through four enabling activities:

1) Availing the technical advice and expertise of the OSDBU staff and the cadre of Departmental Small Business Program Managers (matrixed to OSDBU) to both DOE programs officials and small businesses;

2) Promulgating educational resources such as the DOE Acquisition Forecast, trainings and informational exchanges;

3) Adhering to OSDBU compliance requirements such as the 15 U.S. Code § 644(k), also known as the SBA Act, establishing a cadre of Small Business Technical Advisors within the agency to support the implementation of small business procurements, Form-4220 Reporting, Category Management considerations, threshold reviews; and

4) Planning and execution of outreach activities such as networking and matchmaking at DOE's Annual Small Business Forum and Expo, and targeted outreach events focused on socioeconomic categories. Administering and providing information and counseling concerning DOE's Mentor-Protégé Program, as well as customer support to small businesses.

The OSDBU serves as a liaison between the small business community and the DOE procurement offices.

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[1] Executive Order 13985, *Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*; Executive Order 13988, *Executive Order on Preventing and Combating Discrimination on the Basis of Gender Identity or Sexual Orientation*; and Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad.*

Program Direction
Appropriation Level and Program Level
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted ($)	FY 2022 Request vs. FY 2021 Enacted (%)
Washington Headquarters					
Salary & Benefits	$2,465	$2,554	$2,880	$326	13%
Travel	$50	$10	$10	$0	0%
Support Services	$300	$300	$35	-$265	-88%
Other Related Expenses	$522	$522	$827	$305	58%
Total, Program Direction	**$3,337**	**$3,386**	**$3,752**	**$366**	**11%**
Federal FTEs	**17**	**17**	**17**	**0**	**0%**
Other Related Expenses					
EITS	$57	$57	$222	$165	289%
Working Capital Fund	$450	$450	$585	$135	30%
Training	$15	$15	$20	$5	33%
Total, Other Related Expenses	**$522**	**$522**	**$827**	**$305**	**58%**

Program Direction
Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request Level	Explanation of Changes FY 2022 Request Level vs. FY 2021 Enacted
Program Direction $3,386,000	**$3,752,000**	**$366,000**
Salaries and Benefits $2,554,000	**$2,880,000**	**$326,000**
Provides funding for 17 FTEs.	Provides funding for 17 FTEs.	Includes 2.7% increase in civilian salaries and performance awards.
Travel $10,000	**$10,000**	**$0**
Funding for participation in outreach events, training, and counseling, as well as one-on-one meeting with small businesses.	Continuation of FY21 activities.	
Support Services $300,000	**$35,000**	**-$265,000**
Funding for contractor support for management support services and subscription services.	Funding for contractor support for management support services, data analysis, event marketing, document creation, maintenance, and subscription services.	Reduction in contractor support and subscription services.
Other Related Expenses $522,000	**$827,000**	**$305,000**
Funding for Working Capital Fund, IT services, and staff training and development, and other services.	Continuation of FY21 activities.	Increased funding for projected increases in Departmental IT, EITS and cybersecurity costs.

Economic Impact and Diversity

Overview
Established in 1979, the Office of Economic Impact and Diversity (ED) is tasked with increasing minority participation in energy sector programs, pursuant to Section 641, Title VI, Part 3 of the National Energy Conservation Policy Act (NECPA) of 1978. ED also ensures compliance with Titles VI and VII of the Civil Rights Act of 1964; Title IX of the Education Amendments Act of 1972; and other anti-discrimination statutes.

Pursuant to its legislative mandate, ED advises the Secretary on (1) the effect of energy policies, regulations, and other actions of the Department of Energy (DOE) and its components on minorities and minority business enterprises, and on ways to ensure that minorities are afforded an opportunity to participate fully in the energy programs of the Department; and (2) Departmental compliance with civil rights and equal employment opportunity (EEO) laws, regulations, and related directives and Executive Orders (EOs) that prohibit workplace discrimination and discrimination in programs receiving federal financial assistance from DOE, ensuring integration of EEO into DOE policies and decisions, overseeing intake and processing of complaints of discrimination; and (3) promoting a diverse DOE workforce and inclusive work environment.

Highlights of the FY 2022 Budget Request
The Biden Administration has issued several Executive Orders[1] whose subjects fall within the ED portfolio. The efforts that will be undertaken by ED to fulfill the Administration's priorities, as set out in the EOs, will elevate ED's profile and increase its workload significantly. In brief, ED will drive new initiatives to achieve energy equity and environmental justice across the DOE complex and labs; ensure 40% of the overall benefits of DOE investments in specific areas are targeted to help disadvantaged communities (Justice40 Initiative); help to create climate and clean energy jobs and accelerate clean energy business creation in historically marginalized and overburdened communities that have been systemically denied a full opportunity to participate in America's prosperity; expand outreach to Historically Black Colleges and Universities and other Minority Serving Institutions; bolster our Minority Business Enterprise and Workforce Development Programs targeted at our minority stakeholders; augment training programs geared towards helping historically disadvantaged populations, including the formerly incarcerated, those in impoverished communities and minority stakeholders; and identify and eradicate system barriers to opportunities and benefits for people of color and other underserved groups. In addition, DOE is spearheading the energy justice initiative, which will be the driver for Administration priorities articulated in the EO's noted in the footnote.

In FY 2022, ED will reorganize to: (1) better advise the Secretary on energy policies; (2) ensure minorities full participation in DOE programs; and (3) provide dedicated DOE-wide support on Executive Orders 13985, 13988, and 14008. ED's planned reorganization includes the creation and staffing of a new Office of Energy Justice Policy and Analysis and a new Office of Diversity, Equity, and Inclusion. As proposed, ED's staff would increase from 37 as budgeted in FY 2021 to 69 full-time equivalent (FTE) employees.

The expansion of the office will include: 1 Deputy Director for Energy Justice; 1 senior advisor to support outreach with partner agencies and increased workloads; 7 new employees within ED's Office of Energy Justice Policy and Analysis, and 6 new employees within ED's Office of Diversity, Equity, & Inclusion. The office expansion also includes the planned migration of the EEO field operations to ED, which will require the addition of 1 Chief of EEO Field Operations, and the salaries and benefits for 16 FTEs associated with realigning designated field site EEO complaint processing, affirmative employment, and diversity and inclusion functions under ED leadership.

In FY 2022, ED's Office of Energy Justice Policy and Analysis will develop a research, policy, and technical assistance program to advance the Justice40 Initiative across the DOE complex. Research will include the identification of the socio-economic and environmental effects of DOE and state-level energy programs, policies, and regulations on minority communities and disadvantaged individuals. Consistent with ED's mandate, this office will conduct research on relevant DOE and other federal policies that lessen energy burdens for disadvantaged individuals and communities and increase access to clean energy

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[1] Executive Order 13985, *Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government*; Executive Order 13988, *Executive Order on Preventing and Combating Discrimination on the Basis of Gender Identity or Sexual Orientation*; and Executive Order 14008, *Tackling the Climate Crisis at Home and Abroad.*

technology. Policy and technical assistance efforts will include collaboration with DOE program offices to develop programs that accelerate the adoption of clean energy technologies in historically marginalized populations. The office will provide technical assistance and support across DOE in accordance with ED's congressional mandate and the Agency implementation of EO 13985, EO 13988, and EO 14008. In FY 2022, ED's Office of Diversity, Equity, & Inclusion (DEI) will, in coordination with relevant stakeholders, develop a DOE-wide diversity, equity, inclusion, and accessibility strategic plan following guidance from the Office of Personnel Management; develop competencies for and training modules on diversity and inclusion, including unconscious bias; for employees and supervisors/managers. The new DEI office will also support any additional diversity and inclusion priorities of the Administration.

In FY 2022, ED will continue leading DOE's Equity in Energy initiative to expand the inclusion and participation of minorities, women, veterans, and formerly incarcerated persons, across all department programs. DOE supports this national initiative through Minority Education (STEM enhancement), Workforce Development, and Training (MEWT) related projects and by creating partnerships with federal, state, non-profit, and private agencies engaged in sustaining our Nation's energy sector. ED will engage with stakeholders to increase awareness of and commitment to the principles of equity and diversity as they relate to the DOE workplace and to recipients of DOE financial assistance.

In FY 2022, ED's Office of Minority Programs (OMP) will continue coordination with other federal and state agencies to foster collaboration among Minority Serving Institutions (MSIs), minority business enterprises (MBEs), industry, state and local government agencies, and other federal agencies to increase engagement with and expand capabilities of underserved communities within STEM and energy fields. FY 2022 funding will allow the continuation and expansion of MEWT projects that currently serve communities and disadvantaged individuals in Qualified Opportunity Zones (QOZs) and supports hundreds of minority students and faculty members in Historically Black Colleges and Universities (HBCUs), Hispanic-Serving Institutions (HSIs), Asian American and Native American Pacific Islander-Serving Institutions (AANAPISI), and Tribal Colleges and Universities. As in FY 2020, OMP will propose a second round of competitive Funding Opportunity Announcements (FOAs) in FY 2022 to accelerate achievement of the Justice40 Initiative. This FOA may be issued in collaboration with other DOE program offices to maximize overall impact. Additionally, in FY 2022, ED plans to expand the Workforce Development mission area to coordinate initiatives and activities more effectively with DOE program offices. The funding request of $500K would support data analysis, reporting requirements, best practices, and other similar activities.

In FY 2022, ED's Office of Office of Civil Rights and Diversity (OCRD) will assume new responsibilities of directly overseeing EEO complaint processing for the entire DOE enterprise (except for NNSA),[2] as well as directly overseeing the affirmative employment and diversity and inclusion functions for the entire DOE enterprise (with the exception of the NNSA and the Power Marketing Administrations), which is in addition to providing these functions for over 31 DOE Headquarters Program and Staff Offices. OCRD implements the statutory requirement of administering departmental policies, practices, and procedures under Title VI and VII of the Civil Rights Act of 1964, Title IX of the Education Amendments of 1972, and related statutes and Executive Orders which prohibit discrimination, including those that prohibit discrimination in programs and activities that receive a portion of the approximately $1 billion in annual federal financial assistance from DOE.

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[2] The Department notes that NNSA's Office of Civil Rights processes their own EEO complaints.

**Program Direction
Funding ($K)**

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Economic Impact and Diversity					
Salaries and Benefits	6,353	6,031	13,011	+6,980	115.7%
Travel	140	190	270	+80	42.1%
Support Services	2,220	2,310	3,784	+1,474	63.8%
Other Related Expenses	1,456	1,638	2,935	+1,297	79.2%
Total, Program Direction	**10,169**	**10,169**	**20,000**	**+9,831**	**96.7%**
Federal FTEs	**37**	**37**	**69**	**+32**	**86.5%**
Contractor Headcount		**4**	**4**	**0**	**0**
Support Services					
Energy Justice40	0	0	340	+340	100%
Office of Minority Economic Impact (OMEI)	1,500	0	0	0	0%
Office of Civil Rights & Diversity (OCRD)	720	868	921	+53	6.1%
EEO Support Contract	0	0	383	+383	100%
MEWT	0	1,442	1,640	+198	13.7%
Workforce Development	0	0	500	+500	100%
Total Support Services	**2,220**	**2,310**	**3,784**	**+1,474**	**63.8%**
Other Related Expenses					
Working Capital Fund	1,100	1,038	1,999	+961	92.6%
Energy Information Technology System	281	600	861	+261	43.5%
Training	75	0	75	+75	100%
Total, Other Related Expenses	**1,456**	**1,638**	**2,935**	**+1,297**	**79.2%**

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
$10,169,000 Program Direction	**$20,000,000**	**+$9,831,000**
$6,031,000 Salaries and Benefits	**$13,011,000**	**+$6,980,000**
Provides funding for 37 FTEs who directly support the ED mission.	Provides funding for 69 total FTEs (53 of these FTEs directly support ED's mission; 16 FTEs are those that have been consolidated from DOE field sites to ED in support of the EEO realignment).	ED's staffing increase includes (1) Deputy Director for Energy Justice, (1) senior advisor, (1) Chief of EEO Field Operations, (7) FTEs to support ED's new Office of Energy Justice Policy and Analysis, and (6) FTEs to support ED's new Office of Diversity, Equity, & Inclusion. ED's staffing increase also includes the salaries and benefits for 16 FTEs, associated with the EEO field site realignment under ED leadership.
$190,000 Travel	**$270,000**	**+$80,000**
Provides funding for travel associated with outreach activities related to the launch of the national Equity in Energy initiative and increase in compliance/enforcement activities of the Office of Civil Rights and Diversity. Mission outreach and regulatory activities undertaken with increased coordination with Agency programmatic activities.	Request includes all outreach activities, including Energy Justice, and travel associated with EEO consolidation. ED will leverage virtual technology to support compliance activities.	Travel increase reflects travel needs that are associated with additional staff at the EEO field site locations and any necessary travel to Headquarters.
$2,310,000 Support Services	**$3,784,000**	**+$1,474,000**
Energy Justice40 - No funding provided in FY 2021.	($340,000) Support services of DOE's new Energy Justice40 Dashboard and other activities related to referenced Executive Orders.	(+$340,000) Estimated costs of sustaining and enhancing this new public Dashboard.
($868,000) Office of Civil Rights and Diversity provides funding for EEO support services contracts for DOE Headquarters related to EEO investigative services and draft final agency decisions, as well as EEO docket control and administrative services. In addition, supports diversity and inclusion training.	($921,000) Continuation of FY 2021 activities.	(+$53,000) Funding increase focuses on equity initiatives.

EEO field sites support services. No funding provided in FY 2021.	($383,000) Support services to support added EEO functions at the field sites being consolidated into ED.	(+$383,000) Estimated support services contract needs for EEO field sites.
($1,442,000) Funding supports OMP's Minority Education and Workforce Development Training program (MEWT) focused on, but not limited to: o Minority Education: Increasing the participation of students enrolled in MSIs across the Nation in STEM. o Workforce/Analysis: research project to identify and quantify energy related economic opportunities, challenges, and recommendations for increased minority access and inclusion. o Workforce Development: providing formerly incarcerated individuals with knowledge, skills and training to improve their opportunities for employment in the energy sector. o Technical Assistance/Workforce Training: technical assistance for innovative projects that support educational/business activities which complements and/or enhances workforce training to meet the Nation's need for job creation in diverse communities in the high-energy growth sector. o Capacity Building: Strengthening the STEM capabilities of MSIs by collaborating with the Department's national laboratories and scientific facilities.	($1,640,000) Sustain Minority Education and Workforce Development Training program (MEWT).	(+$198,000) Funding increase provides for additional dollars needed to execute a funding opportunity announcement in FY 2022 for the MEWT program. [Note: Prior year dollars will supplement the FY 2022 request.]
Workforce Development - No funding provided in FY 2021.	($500,000) Expand activities in minority Workforce Development with focus on clean energy jobs.	+$500,000 for expansion of minority Workforce Development initiatives
$1,638,000 Other Related Expenses	**$2,935,000**	**+$1,297,000**
Funds Working Capital Fund (WCF), Energy IT Services (EITS), and staff training and development, and other services for 37 FTEs.	Continuation of FY 2021 support for WCF, EITS, and staff training, including additional +32 FTEs.	Additional funding to support WCF & EITS estimates for 69 FTE staffing level.

Overview

The Office of the General Counsel (GC) is responsible for providing legal services to all Department of Energy offices, and for determining the Department's authoritative position on any question of law with respect to all Department offices and programs, except for those belonging exclusively to the Federal Energy Regulatory Commission. GC's responsibilities include the provision of legal opinions, advice, and services to administrative and program offices, and participation in or management of both administrative and judicial litigation. GC is responsible for the coordination and clearance of proposed legislation affecting energy policy and Department activities. The General Counsel serves as the Department's Regulatory Policy Officer under Executive Order 12866 and is responsible for ensuring consistency and legal sufficiency of the Department's regulations. GC administers and monitors standards of conduct requirements, conducts patent program and intellectual property activities, and coordinates rulemaking actions of the Department with other federal agencies.

GC includes the Office of NEPA (National Environmental Policy Act) Policy and Compliance, which monitors the efficiency and effectiveness of DOE's implementation of the NEPA process. GC also includes the Office of Standard Contract management, which manages the Standard Contracts for Disposal of Spent Nuclear Fuel and/or High-Level Radioactive Waste between the Department and the nuclear industry under the Nuclear Waste Policy Act and manages the Department's Nuclear Waste Fund activities.

Highlights of the FY 2022 Budget Request

The Office of the General Counsel's request supports 145 FTEs ($3 million over FY 2021 Enacted); the increase in funding is due to the 2.7% pay raise, and the diminished availability of prior year carryover to support the requisite level of legal services for the Department. The FY 2022 Request does not include funds to support 23 FTEs paid for by Nuclear Waste Fund (oversight activities), 13 FTEs paid for by EERE (litigation, rulemaking, and enforcement activities), and 1 FTE by EM (support complex procurements and defending bid protests). Budget tables have been re-organized to more accurately reflect OGC activities.

GC's FY 2023 request will seek full funding to support appropriate staffing levels to ensure the quality, availability and expertise of legal support required to confidently meet the Administration's new and expanded priorities, in addition to satisfying continuing program missions and needs.

The new Intellectual Property System (IP), funded in FY 2021, will see a reduction in FY 2022 and out-years to an annual cost of $350,000 due to the system transitioning to maintenance mode. In FY 2020, GC received Cares Act funding to fund an Electronic Financial Disclosure System (e-450). FY 2022 and out years will see an increase of $251,000 for annual subscription costs related to this system. The e-450 system will allow for a completely secure, paperless, filing and approving of financial disclosure requirements.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	22,110	23,482	26,389	2,907	12%
Travel and Training	150	150	150	-	0%
Support Services	1,325	1,825	1,751	-74	-4%
Other Related Expenses	8,990	9,543	9,710	167	2%
Total, Program Direction	**32,575**	**35,000**	**38,000**	**3,000**	9%
Federal FTEs Paid by GC DA Funds	145	145	145	-	0%
Federal FTEs Paid by other sources	37	37	37	-	0%
Total GC FTE's	**182**	**182**	**182**	**-**	**0%**
Support Services					
Administrative Support	825	825	825	-	0%
Technical Support	500	500	525	25	5%
Intellectual Property System	0	500	150	-350	-70%
Financial Disclosure System	0	0	251	251	100%
Total, Support Services	**1,325**	**1,825**	**1,751**	**-74**	**-4%**
Other Related Expenses					
Energy IT Services	1,300	1,400	1,500	100	7%
Working Capital Fund	6,424	6,801	6,801	-	0%
Other Services	1,266	1,342	1,409	67	5%
Total, Other Related Expenses	**8,990**	**9,543**	**9,710**	**167**	**2%**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY22 Request vs FY 2021 Enacted
Program Direction $35,000,000	**$38,000,000**	**+$3,000,000**
Salaries and Benefits $23,482,000 Provides funding support for 145 FTE to include salaries, benefits, overtime, etc.	$26,389,000 Provides funding support for 145 FTE to include salaries, benefits, overtime, etc.	+$2,907,000 Increase reflects a 2.7% pay raise and diminished prior year carryover balances in the organization.
Travel & Training $150,000 Provides for travel to attend court proceedings, site visits, conferences, and training.	$150,000 Provides for travel to attend court proceedings, site visits, conferences, and training.	$0 No change in activity
Support Services $1,825,000	**$1,751,000**	**-$74,000**
Provides for Administrative & Technical support and includes IP & Financial Disclosure Systems	Provides for Administrative & Technical support and includes IP & Financial Disclosure Systems	(-$74K) Slight increase in support costs, increase with addition of Financial Disclosure System O&M and decrease to IP Systems now operating in O&M status.
Other Related Expenses $9,543,000	**$9,710,000**	**+$167,000**
Energy IT Services $1,400,000 Provides GC IT service including workstations and on-site support, FISMA reviews and reporting, etc.	$1,500,000 Provides GC IT service including workstations and on-site support, FISMA reviews and reporting, etc.	+$100,000 No change in service, slight inflation for anticipated cost increases in FY 2022.
Working Capital Fund $6,801,000 Provides for rent, telecommunications, I-Manage, supplies, copiers, printing, etc.	$6,801,000 Provides for rent, telecommunications, I-Manage, supplies, copiers, printing, etc.	$0 No change in service
Other Services $1,340,000 Provides for Online Legal subscription, Law Library Materials, US Patent Office charges for DOE patents, E-Gov, office furniture, etc.	$1,401,000 Provides for Online Legal subscription, Law Library Materials, US Patent Office charges for DOE patents, E-Gov, office furniture, etc.	+$67,000 No change in activities; slight anticipated cost increases.

Office of Policy
Program Direction

Overview
The Office of Policy serves as the principal advisor to the Secretary, Deputy Secretary, and Under Secretary on domestic energy policy and related integration of energy systems. The Office of Policy (OP) and the Office of Strategic Planning and Policy (OSPP) will be merged into one staff office. The Office of Energy Jobs is part of the Office of Policy. Funding for the Arctic Energy Office (AEO) comes from the Office of Policy.

The Office serves as a focal point for policy coordination within the Department on the analysis, formulation, development, and advancement of Secretarial and Administrative priorities; and related programmatic options and initiatives that support the transition to a zero-carbon, equitable, and secure energy economy. OP coordinates policy and strategic cross-cutting functions across DOE elements and shapes strategy and policy consistent with the Secretary's vision for DOE. Much of OP's work is connected to expertise or information in the various program offices across the Department, and OP works closely with other offices to harmonize activities, maximize results, and avoid duplication.

The increased request from FY 2021 to FY 2022 reestablishes energy policy work as an essential function to support urgently needed technology, economic, job creation, and emissions reduction goals. OP is staffed by an interdisciplinary team of experts, with the technical and communications skills to formulate policy pathways to achieve the Secretary's strategic vision within the full breadth of DOE's statutory mission. OP carries out strategic studies and policy analysis, and maintains and coordinates a supporting set of analytical capabilities. This work spans:
- technology policy, including energy decarbonization pathways and impacts analysis,
- deployment and infrastructure policy, including systems analysis,
- state, local, and tribal policy analysis, including integrated approaches to technical assistance,
- and energy jobs.

The Office of Energy Jobs is a significant FY 2022 priority, with goals of supporting the creation of good-paying jobs with a free and fair chance to join a union and bargain collectively in the clean energy space, while creating pathways for energy transitioning communities. This work includes a focus on workforce development standards to ensure equitable and good job creation that pays family-sustaining wages, while engaging the larger labor community on energy issues through the DOE Labor Working Group. The Director of Energy Jobs will lead a review of DOE's procurement policies to assess whether products and services are purchased from entities that meet certain labor standards. The Office of Energy Jobs will guide the DOE Jobs Strategy Council and publish the United States Energy and Employment Report. The Office of Policy provides significant support to interagency working groups on several topics, including the Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization, as well as job creation analysis and union stakeholder engagement. This jobs-oriented approach will provide strategic management and guide implementation of the Building Clean Energy Projects and Workforce Initiative to ensure the Department is investing in clean energy job creation and training, and re-invigorating regional economies through place-based initiatives. FY 2022 efforts will be aligned with the needs, opportunities and priorities set forth in the Office of Energy Jobs framework, which is currently under development.

The Arctic Energy Office (AEO), supported out of the OP budget, brings together assets from across DOE to work together in collaborative and innovative ways to meet the energy, science, and national security needs of the United States and its allies. AEO serves as the front door for DOE in Alaska and the global Arctic. AEO is focused on energy transitions in the context of climate changes – natural, political, economic – that are rapid and trans-regional. To accomplish its mission, AEO collaborates with the Office of the Secretary, relevant DOE program and staff offices, National Laboratories, other federal agencies, universities, non-profits and the private sector. FY 2022 efforts will be aligned with the needs, opportunities and priorities set forth in the multi-year/multi-organization arctic research agenda under development in FY 2021.

Highlights of the FY 2022 Budget Request

The FY 2022 Budget Request of $28,996,000 is a $21,996,000 increase above the FY 2021 Enacted Budget which supports up to 43 full time equivalent employees - an increase of 26 FTEs. The additional funding provides critical support for OP's mission fulfillment to include the Energy Jobs Office and funding for the Arctic of Energy Office.

Program Direction
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	3,526	3,144	8,675	5,531	176%
Travel	42	42	328	286	681%
Support Services	2,259	2,183	17,263	15,080	691%
Other Related Expenses	1,173	1,631	2,730	1,099	67%
Total, Program Direction	**7,000**	**7,000**	**28,996**	**21,996**	**314%**
Federal FTEs	**20**	**17**	**43**	**26**	**153%**
Support Services					
Other Support Services	2,259	2,183	17,263	15,080	691%
Total, Support Services	**2,259**	**2,183**	**17,263**	**15,080**	**691%**
Other Related Expenses					
Working Capital Fund	741	1,358	1,880	522	38%
Training	42	75	100	25	33%
Energy IT Services	365	206	680	474	230%
Other Expenses	25	25	70	45	180%
Total, Other Related Expenses	**1,173**	**1,631**	**2,730**	**1,066**	**65%**

Office of Strategic Planning and Policy
Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $7,000,000	**$28,996,000**	**+$21,996,000**
Salaries and Benefits $3,144,302	**$8,675,000**	**+$5,330,698**
Provides funding for 17 FTEs to include salaries and benefits.	Funding for salaries and benefits for the 43 FTEs to support increased workload. Includes funds for Arctic Energy Office.	• Funding provides for salaries/benefits, overtime, lump sum leave, awards allocations and performance awards. Increase covers 2.7% civilian pay raise; funding for additional salaries and benefits for FTEs.
Travel $42,000	**$328,000**	**+$283,000**
Provides funding to support travel by staff, including travel to accompany the Secretary and DOE senior leadership.	Continuation of FY 2021 activities and travel to support Arctic Energy office in Fairbanks, Alaska and Energy jobs.	• Funding to support travel by staff, including travel to accompany the Secretary and DOE senior leadership.
Support Services $2,183,000	**$17,263,000**	**+$15,080,000**
Provides support services needed for FY 2021 technical analysis and administrative requirements including the U.S. Energy Employment Report (USEER).	Continuation and expansion of FY 2021 activities. Additionally, supports ability to obtain research tools, annual subscriptions, other contractor support used for analysis activities. Analysis activities include data processing, systems modeling, forecasting, strategic planning, evaluation, and other approaches.	• Funding will support ability to obtain research tools, such as subscriptions, other contractor support used for analysis activities including workshops, other reports, and the USEER. Significant clean energy policy analysis work is required to meet ambitious technology, economics, jobs, and emissions goals.
Other Related Expenses $1,630,698	**$2,730,000**	**+$1,099,302**
Provides funding to support business costs associated with the Department's Working Capital Fund; IT equipment and support.	Continuation of FY 2021 activities and increased services and equipment related to working capital, IT, to support increase of 21 FTEs.	• +$522K WCF increase • +$474K IT services/equipment • +$70K Training and other expenses

Public Affairs
Program Direction

Overview

The mission of the Office of Public Affairs (PA) is to communicate information about DOE's work in a timely, accurate, and accessible way to the news media and the general public.

PA directly supports the DOE mission by developing and implementing strategies for communicating the Department's mission, policies, initiatives, and information to the news media and the general public. PA is also responsible for managing and coordinating public affairs activities for DOE headquarters, field offices, and laboratories; serving as DOE's primary spokesperson in the news media; responding to requests for information from the public and the news media; arranging interviews with Department officials; providing speechwriting and media support services to the Secretary, Deputy Secretary and Under Secretaries; and preparing written press releases, fact sheets, electronic media and other products that communicate Departmental activities.

Through its Digital Strategy and Communications Office, PA continues to effect cost savings at the Department by consolidating website platforms, reducing duplication, and improving accessibility of information. The Digital Strategy and Communications Office drives the Department's mission online via the Energy.gov website, social networking tools, blog outreach, citizen engagement tools, and other emerging online communication technologies. Digital Strategy and Communications is an innovative and growing part of the mission, as PA seeks to serve the public in more efficient and effective ways online. It is through the Digital Strategy Office that PA is making government more collaborative and participatory.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted ($)	FY 2022 Request vs. FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	2,068	2,068	3,922	+1,854	90%
Travel	190	190	190	0	0
Support Services	911	911	1,011	0	0
Other Related Expenses	831	831	831	0	0
Total, Program Direction	**4,000**	**4,000**	**5,954**	**+1,954**	**49%**
Federal FTEs	30	27	27	0	0
Other Related Expenses					
Energy IT Services	113	113	154	+41	36%
Working Capital Fund	718	718	677	-41	-6%
Total, Other Related Expenses	**831**	**831**	**831**	**0**	**0**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs. FY 2021 Enacted
Program Direction $4,000,000	**$5,954,000**	**$1,954,000**
Salaries and Benefits $2,068,000	**$3,922,000**	**$1,854,000**
Provides funding for 27 full time employees (FTE). This includes DOE's team of media spokespersons, a New Media team managing digital communications and website efforts, the speechwriting team that supports the Secretary and other senior officials and program offices, and the administrative staff required to support DOE's mission.	Continuation FY 2021 activities which provides funding for 27 FTE.	Increase to fully fund staff and 2.7 percent pay increase. In FY 2021, relied on $2M prior year funds to sustain staffing levels to maintain operational level.
Travel $190,000	**$190,000**	**$0**
Travel expenses support the office's ability to provide appropriate staffing to the Secretary and Deputy Secretary; Staff travel for video production and presentations at conferences to enhance the DOE mission; enhanced video projects across complex; and other media projects.	Continuation of FY 2021 activities.	No change.
Support Services $1,011,000	**$1,011,000**	**$100,000**
Support services include continued contractor support to upgrade and maintain the Department's digital communications and website efforts. Funding also supports initiation of contractor services.	Support services include continued contractor support to maintain and upgrade the Department's digital communications and website efforts.	The increase accounts for contractor support to maintain the Department's upgrade and website efforts
Other Related Expenses $831,000	**$831,000**	**$0**
Funding of Working Capital Fund and Energy IT services for 27 FTEs.	Funding of Working Capital Fund and Energy IT services for 27 FTEs.	No change.

Overview

The Office of Project Management (PM) provides the Department of Energy (DOE) leadership and assistance in developing and implementing DOE-wide policies, procedures, programs, and management systems pertaining to project management. It manages the Department's project management career development program for DOE's Federal Project Directors. PM is directly accountable to and supports the Deputy Secretary as the Executive Secretariat of the Department's Energy Systems Acquisition Advisory Board (ESAAB) and the Project Management Risk Committee (PMRC). The Deputy Secretary chairs the ESAAB.

In FY 2022, PM will accomplish its mission through its program office functions:

- **Energy Systems Acquisition Advisory Board (ESAAB).** The PM Director serves as Executive Secretariat (and member) of the ESAAB and the PMRC for the Deputy Secretary. The PMRC reviews all capital asset projects with a Total Project Cost (TPC) of $100,000,000 or greater. The ESAAB focuses on projects at risk of not meeting their performance baselines and on making critical decisions for capital asset projects with a TPC of $750,000,000 or greater. The ESAAB is a standing board that meets at least once a quarter and is supported by the PMRC, which meets at least monthly. Additional ESAAB and PMRC meetings are scheduled as necessary to support departmental objectives and Program Office and project team schedules.
- **Project Management Policy and Systems.** PM provides DOE-wide policy, guidance and oversight for project management. PM provides senior leaders with a monthly project status report with independent assessments of all capital asset projects with a TPC greater than $50,000,000 with a goal of driving improvements in project management and project delivery outcomes. PM maintains the Project Assessment and Reporting System (PARS), the Department's independent central repository for project performance data, project management metrics and key project documentation.
- **Independent Cost Reviews/Estimates.** PM conducts independent cost reviews (ICRs) or prepares statutorily required independent cost estimates (ICEs) at critical decisions including re-baselining, as required by DOE Order 413.3B for capital asset projects with a TPC of $100,000,000 or greater. All costs associated with the conduct of ICRs/ICEs, are funded by the Program Office/Project requiring it.
- **Project Oversight.** PM conducts External Independent Reviews (EIRs) to validate the project performance baselines (scope, cost, and schedule) of all capital asset projects with a TPC of $100,000,000 or greater. Additionally, PM ensures projects are ready to be brought forward to the appropriate Project Management Executive (PME) for authorization to proceed prior to each critical decision.
- **Project Assessments.** PM conducts annual independent Project Peer Reviews (PPRs) of all active capital asset projects with a TPC of $100,000,000 or greater under the purview of the Under Secretary of Energy. All costs associated with conducting PPRs, to include PM federal staff travel, are funded by the appropriate Program Office.
- **Earned Value Management System (EVMS) Certification.** PM conducts initial certification and periodic surveillance reviews to ensure contractors' EVMS, for capital asset projects, comply with industry standards. All costs associated with the conduct of Reviews for Cause (RFC) and recertification of a contractor's system that had its certification withdrawn, to include PM federal staff travel, are funded by the Program Office/Project requiring the RFC or recertification reviews.
- **Project Management Support Office.** PM serves as the Project Management Support Office (PMSO) for all energy programs, to include NE, FE, OE and EERE. In collaboration with the Program Offices, PM performs all PMSO functions in accordance with DOE Order 413.3B, as appropriate.
- **Professional Development.** PM manages the Department's Project Management Career Development Program (PMCDP) to include the professional development, training, and certification of Federal Project Directors (FPDs). The PM Director serves as co-chair and Executive Secretariat for the FPD Certification Review Board (CRB).

- **Cost Estimating**. PM develops DOE-wide cost estimating policy and practices for the acquisition of capital assets, including cost-effectiveness and alternatives, in accordance with Government Accountability Office (GAO) and industry best practices; develops and maintains cost and schedule estimating relationships and benchmarks; and performs independent cost estimation for the Department's acquisition of capital assets over $100M.

Highlights of the FY 2022 Budget Request

The Department requests $13,307,000 in FY 2022 for PM. This Office is accountable to and serves the Deputy Secretary as the Executive Secretariat for the Department's Energy Systems Acquisition Advisory Board (ESAAB) and the Project Management Risk Committee (PMRC). PM also executes other critical Department-wide functions to include preparing statutorily-required independent cost estimates, performing external independent reviews to validate performance baselines, conducting earned value management system certification and surveillance reviews, providing project management policy, guidance and oversight of all capital asset projects, and overseeing the Project Management Career Development Program (PMCDP) for the Department's Federal Project Directors (FPDs).

Program Direction
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs. FY 2021 Enacted (%)
Program Direction					
Salaries and Benefits	5,850	6,008	6,188	+180	+3%
Travel	274	274	274	0	0%
Support Services	4,961	5,177	5,273	+96	+2%
Other Related Expenses	1,511	1,541	1,572	+31	+2%
Total, Program Direction	**12,596**	**13,000**	**13,307**	**+307**	**2%**
Federal FTEs	**30**	**30**	**30**	**0**	**0%**
Support Services					
External Independent Reviews (EIRs)	1,557	1,773	1,869	+96	+5%
Earned Value Management System (EVMS) Certification	1,247	1,247	1,247	0	0%
Project Assessment and Reporting System (PARS)	2,000	2,000	2,000	0	0%
Cost Estimating	0	0	0	0	0%
Other Support Services	157	157	157	0	0%
Total, Support Services	**4,961**	**5,177**	**5,273**	+96	2%
Other Related Expenses					
Training	20	20	20	0	0%
Energy IT Services	480	480	480	0	0%
Working Capital Fund (WCF)	1,011	1,041	1,072	+31	+3%
Total, Other Related Expenses	**1,511**	**1,541**	**1,572**	**+31**	**2%**

Program Direction

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Unfunded vs FY 2021 Request
Program Direction $13,000,000	**$13,307,000**	**+$307,000**
Salaries and Benefits $6,008,000	**$6,188,000**	**+$180,000**
Funding in support of 30 FTEs.	Continuation of FY2021 activities.	Funding provides for 2.7% increase in civilian salaries, lump sum leave, and performance awards.
Travel $274,000	**$274,000**	**$0**
Funding in support of PM staff travel. Travel is necessary to support review activities (excluding Baseline Change Proposals (BCPs), Reviews for Cause (RFC), and Earned Value Management System (EVMS) recertification reviews) of program/project activities in the field.	Continuation of FY2021 activities.	No Change.
Support Services $5,177,000	**$5,273,000**	**+$96,000**
Funding in support of contractual requirements, including External Independent Reviews (EIRs), Project Peer Reviews (PPRs), Earned Value Management System (EVMS) certification and surveillance reviews, Project Assessment and Reporting System (PARS).	Funding supports the continuation of FY2021 activities.	Increase in EIRs scheduled.
Other Related Expenses $1,541,000	**$1,572,000**	**$31,000**
Other related expenses to cover Energy IT Services (EITS), Working Capital Fund (WCF) and other services.	Continuation of FY2021 activities.	Increase for WCF contract annual adjustments, space, and computer support for estimated FTEs.

Overview

In September 2019, DOE established AITO to serve as the Department's hub for the development, coordination, and execution of the agency's efforts as a world-leading enterprise in scientific and technological discovery, and to accelerate the development, delivery, and adoption of AI and related technologies. AITO will assist DOE's diverse program and functional offices, sites and associated National Laboratories on identifying and enhancing vital applications to core missions across the Department, while building on current Federal investments, and breaking new ground in Science and Technology (S&T) innovation. As a supplement to AI coordination activities, AITO will conduct strategic AI portfolio alignment and partner to support addressing the high demands for AI support to Program Offices and National Laboratories in the areas of: 1) Applying AI for DOE-wide efficiencies that will address the department goals to include the climate crisis; 2) AI training to cultivate an AI-ready workforce; 3) Providing insights, advisory services and AI business translation for trusted AI outcomes, risk management, ethical outcomes and data management to be applied towards improving AI and machine learning portfolio management; 4) Leading select, complex, multi-organizational AI programs and/or products for DOE.

AITO accelerates the development, delivery, and adoption of AI by coordinating and conducting strategic portfolio alignment, efforts across DOE, and implements the Secretary's vision for cross-cutting, mission-relevant AI projects that are aligned with the Office of Science AI strategic priorities. AITO will engage programs, functional offices, sites, and associated National Laboratories for development and oversight of funded AI projects for transparency, shared learning, and to ensure that DOE's AI efforts align and fulfil the priorities outlined in the National Artificial Intelligence Research and Development Strategic Plan.

Highlights of the FY 2022 Budget Request
The FY 2022 Program Direction request for AITO is $1,500,000 and includes salary, travel, support services, and other related expenses for 4 FTEs. This funding is necessary to:

Support AITO as the Department's hub for coordinating the agency's efforts as a world-leading enterprise in scientific and technological discovery and accelerate the development, delivery, and adoption of AI. Funding will strengthen DOE AI capabilities and applications, invest in AI systems R&D, and build multi-sector collaboration that will maintain American AI leadership.

Program Direction
Funding ($K)

(Dollars in Thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	2,000	2,000	1,000	-1,000	-50%
Travel	100	100	50	-50	-50%
Support Services	200	200	200	0	0%
Other Related Expenses	200	200	250	50	25%
Total, Program Direction	**2,500**	**2,500**	**1,500**	**-1,000**	**-40%**
Total FTEs	**7**	**7**	**4**	**-3**	**-43%**

Artificial Intelligence and Technology Office

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $2,500,000	$1,500,000	-$1,000,000
Salaries and Benefits $2,000,000	$1,000,000	-$1,000,000
• Funding supports 7 FTEs to manage AITO, including AI strategic outreach for partnership development and new program pilots. • AITO will organize and lead working groups and committees, in partnership with other entities, to determine DOE AI priority issues. • AITO will identify and facilitate partnerships with the private sector, academia, national laboratories, other agencies, international partners and entities to support US competitiveness in AI. • The request reflects a 1% pay raise for federal staff, FERS increase, and awards pool funding increase in FY 2021.	• Funding supports 4 FTEs to manage AITO, including AI strategic outreach for partnership development and new program pilots. • AITO FTEs determine the priority needs of the DOE in AI through workshops, inter-agency coordination and private sector engagement. • AITO partners with the private sector, academia, national laboratories, other agencies, international partners and entities to support US competitiveness in AI. • AITO FTEs organize and lead, via working groups and committees, DOE AI priority issues in partnership with other entities and agencies.	• The decrease in FY 2022 is due to less FTEs.
Travel $100,000	$50,000	-$50,000

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
• Funding supports travel requirements associated with DOE's Artificial Intelligence and Technology Office, such as AITO's engagement with the labs, meetings, international collaborations, outreach at industry events, workshops and conferences, and AITO's participation in lab events.	• Funding supports travel requirements associated with DOE's Artificial Intelligence and Technology Office, such as AITO's engagement with the labs, meetings, international collaborations, outreach at industry events, workshops and conferences, and AITO's participation in lab events.	• The decrease is due to less FTEs.
Support Services $200,000	**$200,000**	**+$0**
• Funding supports contractor and consulting support services to assist Federal staff in the coordination of AI activities between DOE and the national labs for the development of tools and information to advance AI. • Funding advances the integration and co-design of AI memory and hardware technologies. • Funding supports coordination of data resources and AI testbeds across the national laboratories. • Funding supports periodic AI related workshops to determine priority needs of DOE in AI and expand strategic multi-sector partnerships with the private sector, academia, national laboratories, other agencies, international partners and entities to support US competitiveness in AI.	• Funding supports contractor and consulting support services to assist Federal staff in the coordination of Artificial Intelligence activities between DOE and the national labs for the development of tools and information to advance AI. • Funding advances the integration and co-design of AI memory and hardware technologies. • Funding supports coordination of data resources and AI testbeds across the national laboratories. • Funding supports periodic AI related workshops to determine priority needs of DOE in AI and expand strategic multi-sector partnerships with the private sector, academia, national laboratories, other agencies, international partners and entities to support US competitiveness in AI.	• No change.
Other Related Expenses $200,000	**$250,000**	**+$50,000**

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
• Funding supports the costs associated with the DOE's Working Capital Fund (office space, infrastructure, phones, utilities, supplies etc.); Energy IT Services (IT equipment and support); specialized software licensing; and security investigations. • Funding includes formulating AI training modules for the education and training of DOE staff in AI and opportunities created by AI related technologies. • Additional expenses for staff development, recruiting, succession planning, and training to maintain and enhance AI work related skills and capabilities.	• Funding supports the costs associated with the DOE's Working Capital Fund (office space, infrastructure, phones, utilities, supplies etc.); Energy IT Services (IT equipment and support); specialized software licensing; and security investigations. • Funding includes formulating AI training modules for the education and training of DOE staff in AI and opportunities created by AI related technologies. • Additional expenses for staff development, recruiting, succession planning, and training to maintain and enhance AI work related skills and capabilities.	• The increase is due to previous advance contributions to office operational expenses such as working capital and information technology support, as well as security clearances.

Office of International Affairs

Overview

The Department of Energy's (DOE) Office of International Affairs (IA) supports DOE's mission to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through innovative science and technology solutions. IA has primary responsibility for developing U.S. international energy policy, leading all DOE bilateral and multilateral energy and science and technology collaboration, connecting DOE's program offices to advantageous bilateral and multilateral relationships, and tracking and investigating all foreign investment in U.S. energy companies or other firms with energy interests, as well as foreign contracts with the national labs. DOE IA pursues international climate and clean energy cooperation through key multilateral and bilateral forums with the objective to reduce global greenhouse gas emissions, create good paying American jobs, enhance U.S. competitiveness, protect those most vulnerable to climate change, and lead a transition to net-zero emissions by 2050.

IA is responsible for investigating foreign investment transactions and processing and approving foreign engagements with the National Labs. IA serves as the DOE lead for the Committee on Foreign Investment in the U.S. (CFIUS), which is authorized by statute to review investments between foreign entities and U.S. businesses, to determine the effect of such transactions on national security. IA works with program offices to provide advice and analysis on international negotiations and other nations' policies involving energy resources, energy production, energy technologies, and nuclear energy. IA supports our allies' national security through the sharing of technical and analytical expertise, and assessments of foreign investments to deter malign actor investment schemes.

IA pursues its mission by leveraging DOE's vast knowledge of energy policy, science, technology, and markets to develop international policies and programs that advance U.S. energy, climate, and economic priorities. IA coordinates all international work conducted at DOE to ensure consistency with policy objectives and to maintain awareness of the Department's international engagements.

Highlights of the FY 2022 Budget Request
IA's FY 2022 Budget Request of $30,500,000, which is $3,675,000 more than the FY 2021 Enacted, reflects IA's prioritization of clean energy initiatives, technical assistance, and support for 85 FTEs.

IA's priorities for the coming year are, 1) strengthening DOE's key bilateral relationships and regional platforms to enhance or create new platforms for clean energy cooperation and expand market opportunities; 2) Re-engage and improve key multilateral platforms; 3) tracking and investigating foreign investment in the U.S. and contracts with national labs; and 4) increasing DOE capacity for multilateral engagement and market development.

For FY 2022 IA requests ten (10) additional FTEs to 1) lead the increasing number of multilateral engagements, 2) develop markets for U.S. goods and services abroad with a proven job creation potential at home, and 3) provide exacting, rigorous, quantitative analysis of the domestic economic benefits of bilateral and multilateral engagement in energy markets for achieving a global clean energy transition.

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	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Energy Security and Clean Energy Initiatives	**3,247**	**1,025**	**1,025**	**-**	**0%**
Technical Assistance	**987**	**1,485**	**1,485**	**-**	**0%**
U.S.-Israel Energy Center of Excellence	**4,000**	**4,000**	**4,000**	**-**	**0%**
BIRD Energy Program	**2,000**	**2,000**	**2,000**	**-**	**0%**
Salaries and Benefits	**11,416**	**13,530**	**16,200**	**+2,670**	**+20%**
Travel	**324**	**400**	**925**	**+525**	**+131%**
Support Services					
Subscriptions/Publications	66	100	125	+25	+25%
Management Support Services	111	85	100	+15	+18%
Total, Support Services	**177**	**185**	**225**	**+40**	**+22%**
Other Related Expenses					
Working Capital Fund	2,750	3,000	3,375	+375	+13%
Energy IT and Other Services	1,919	1,170	1,235	+65	+6%
Training	5	30	30	-	0%
Total, Other Related Expenses	**4,674**	**4,200**	**4,640**	**+440**	**+10%**
Total, International Affairs	**26,825**	**26,825**	**30,500**	**+3,675**	**+14%**
Federal FTEs	**75**	**75**	**85**	**+10**	**+13%**

Description

IA requests approximately $8.5 million to fund Energy Security and Clean Energy Initiatives ($1.025 million); Technical Assistance ($1.485 million); the United States-Israel Energy Center of Excellence ($4 million); and the BIRD Energy Program ($2 million). These activities are implemented through the National Laboratories or Headquarters contracts. In addition, IA requests approximately $22 million to fund the salary, benefits, travel, support services, and other related expenses for 85 federal staff to develop, coordinate, and implement the Administration's international energy policy objectives. This increase of 10 federal staff from FY 2021 Enacted will support bilateral and multilateral relationships, market development and international economic opportunities, especially for American-made clean energy technologies.

Energy Security and Clean Energy Initiatives

Energy Security and Clean Energy Initiatives enhance the prosperity and security of strategic U.S. partners around the world through activities that advance shared energy sector priorities. These initiatives pursue a variety of activities through the National Laboratories and other contracts that are tailored to specific technology or policy objectives. Initiatives are designed to decarbonize and improve resiliency of energy systems, protect energy infrastructure, reduce vulnerability in the supply of critical materials, secure markets for clean energy resources, build cooperation among regional trading partners in the Arctic, Americas, Africa, Middle East, Europe and Eurasia, and the Pacific. IA requests $1.025 million for continued support of these initiatives in FY 2022.

Technical Assistance

IA serves as DOE's focal point to promote and advance U.S. clean energy policy priorities around the globe through multilateral institutions. In FY 2022, IA requests $1.485 million for technical assistance to key multi-lateral organizations to grow U.S. presence and leadership internationally, ensure the strategy and objectives of multilateral institutions align with our own, and reduce unnecessary duplication of efforts or lost opportunities to maximize the responsible and efficient use of U.S. energy investments in these institutions.

BIRD Energy Program

The Binational Industrial Research and Development Foundation (BIRD Foundation) was established by the U.S. and Israel governments in 1977 to generate mutually beneficial cooperation between U. S. and Israeli companies. IA requests $2 million for the BIRD Energy Program, which is an offshoot of the endowed parent BIRD Foundation and was authorized in 2007 and first appropriated funds in 2009. Since 2009, the BIRD Energy Program has resulted in commercialization of 7 new clean energy technologies and attracted more than $700 million in venture capital and other follow-on investments to commercialize clean energy technologies.

United States-Israel Energy Center of Excellence

IA requests $4 million to contribute as matching funds to the United States – Israel Energy Center of Excellence (Energy Center) on behalf of the United States Government. Matching contributions are also provided by the Israeli Government and private partners from the United States and Israel. The goal of the Energy Center is to promote energy security and economic development through the research and development (R&D) of innovative energy technologies, while facilitating cooperation between U.S. and Israeli companies, research institutes and universities. The Energy Center will facilitate joint R&D activities on energy areas by teams of scientists and engineers from the U.S. and Israel. The Energy Center is actively facilitating long-term institutional and commercial relationships. The Implementation Agreement signed by former Energy Secretary Rick Perry and the Israeli Energy Minister in June 2018 identified four priority topic areas: energy storage, energy cybersecurity, fossil energy, and energy-water nexus. On behalf of the U.S. and Israeli governments, the BIRD Foundation (administrative manager for the Center) issued a call for proposals in April 2019 for 5-year awards (subject to appropriation) in each of these priority areas. In May 2020, winning consortia in three of the four categories were announced: Energy-Water, Energy Storage, and Fossil Energy. These consortia have now begun work. The BIRD Foundation re-released the call for proposals in Energy Cybersecurity based on a need identified by the U.S. and Israeli governments to better clarify the scope of the award in the cyber area. An Energy Cybersecurity award was announced in April 2021 for a 3 to 5 year grant.

Committee on Foreign Investment in the U.S. (CFIUS)

IA ensures the Department's compliance with the Foreign Investment Risk Review and Modernization Act of 2018

(FIRRMA), which modernizes CFIUS's process to better enable timely and effective reviews of covered transactions to ensure that the U.S. maintains and open policy on foreign investment while properly screening inbound investments to ensure U.S. vital national security interests are protected.

Under FIRRMA, DOE CFIUS assists at a technical level with capacity building among U.S. friends and allies overseas, especially in Europe among NATO partners and member states of the European Union. DOE CFIUS intends to increase and expand international outreach focused on ensuring friends and allies are able to maintain a proper balance between open foreign investment regimes to attract high quality investment, while ensuring vital national security interests are protected from increasingly aggressive predatory investment practices by countries less friendly to the U.S.

International Clean Energy Policy Development and Coordination

IA serves as DOE's representative on internationally-focused Policy Coordination Committees (PCCs) managed by the National Security Council (NSC) and the National Economic Council (NEC), and serves as the conduit for policy and technical expertise across DOE and other Agencies. To achieve its mission, IA collaborates with DOE Senior Leadership, program offices, and the DOE National Laboratory complex, coordinating across the enterprise to leverage technical, policy, and market expertise with international partners. IA develops policies and provides senior-level advice on international energy matters in line with Administration goals and priorities. IA coordinates the U.S. Government's international energy relationships with foreign governments, energy ministries, and International Organizations, working in concert with the Departments of State, Defense, Interior, Commerce and other relevant federal agencies to promote the clean energy transition to net-zero emissions by 2050, advance universal energy access, spur technological innovation open international clean energy markets to U.S. businesses, , and promote energy security fundamentals and practices.

International Working Groups, Meetings, and Activities

IA supports US government leadership through a network of international relationships with energy partners that further our nation's international energy goals. The request fully funds IA participation in and implementation of interagency working groups, international meetings, activities, and policy areas, including:

International Energy Agency	U.S.-Mexico Energy Business Council
U.S.-EU Energy Council	Japan-U.S. Strategic Energy Partnership
G-7/G20 Energy Ministers Meeting	U.S.-Korea Energy Policy Dialogue
Partnership for Transatlantic Energy Cooperation	U.S.-Indonesia Energy Policy Dialogue
Three Seas Initiative	U.S.-Poland Energy Dialogue
Clean Energy Ministerial	Asia-Pacific Economic Cooperation
U.S.-Israel Energy Meetings	Eastern Med Gas Forum
U.S.-Brazil Energy Forum	Gulf of Aqaba Energy Dialogue
U.S.-India Strategic Energy Partnership	Iraq Initiatives
G-7 Energy Ministers Meeting	Net Zero Producers Forum
U.S.-Ukraine Energy Cooperation	

Market Development

This office's mission is to advance policies that foster incentives for decarbonization of the global energy sector while bolstering U.S. jobs, enhancing our innovation edge against our key competitors, and fostering resilient, secure energy markets and supply chains.

In particular, the Office of Market Development is focused on promoting efforts of U.S. vendors in EU nuclear energy markets. In the last several years, U.S. vendors have been consistently at a competitive disadvantage with respect to State-backed nuclear companies. IA is working with the Government of Poland to develop a blueprint for project development drawing upon U.S. technology and financial support from the Export-Import Bank of the United States, the Development Finance Corporation.

In FY 2022, IA will focus on the following objectives for Market Development:
- Mobilizing for Near Term Energy Transition Investment Needs: E.O. 14008 calls on DOE to advance international collaborations on innovation and deployment of clean energy. Market Development will coordinate a technology

and finance-driven approach to help other countries meet their climate objectives and create good-paying American jobs while doing it.

- Harnessing Over-the-Horizon Energy Transition Opportunities: Through close partnerships with programmatic offices and national labs, Market Development will identify policy levers and strategic innovation partnerships to make the U.S. more competitive in net-zero energy technologies.
- Addressing Climate Adaptation, Resilience, and Security: Market Development will lead engagements to help other countries improve the resilience of their energy systems and prepare communities to adapt to a rapidly changing climate, guided by just transition and alleviating energy poverty goals.

Coordination of Foreign Engagements with National Laboratories

IA also serves as the coordinating body for international engagement with DOE's 17 National Laboratories. In this function, IA manages the DOE approval process for the National Laboratories' international partnerships, which include, *inter alia*, Strategic Partnership Projects (SPP), under which the National Laboratories conduct fee for service sponsored research for international customers on a reimbursable basis; Cooperative Research and Development Agreements (CRADA), under which international private sector participants enter a financial and operating arrangement to utilize the laboratories' technologies, processes, research and development (R&D) capabilities, or technical expertise; Memoranda of Understanding (MOU); Agreements for Commercializing Technology (ACT); Technical Assistance (TA) Agreements; User Agreements; Technology Licensing Agreements; and Material Transfer Agreements. IA reviews these agreements to ensure that such work is consistent with or complementary to the missions of DOE and the individual laboratories and does not impede the laboratory's ability to accomplish the DOE mission. IA also ensures that the foreign engagements meet the requirements of DOE Policy 485.1A, Foreign Engagements with DOE National Laboratories to: (1) align consistently with the strategic interests and foreign policies of the United States, (2) be legally sound and compliant with U.S. laws and regulations, and (3) address any counterintelligence considerations.

Interagency Appropriations Transfers and Reimbursable Work

IA federal staff historically implement projects funded by other agencies through appropriations transfers or reimbursable work. The received funds occasionally fund IA federal staff travel and support services contracts, but not salaries, benefits, or administrative expenses.

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Energy Security and Clean Energy Initiatives $1,025,000	$1,025,000	$0
Energy Security and Clean Energy Initiatives provides technology innovation, resilience, sector development, training, and other activities through National Laboratories or headquarters contracts.	In FY 2022, initiatives are designed to decarbonize and improve resiliency of energy systems, protect energy infrastructure, reduce vulnerability in the supply of critical materials, secure markets for clean energy resources, build cooperation among regional trading partners in the Arctic, Americas, Africa, Middle East, Europe and Eurasia, and the Pacific.	No change.
Technical Assistance $1,485,000	$1,485,000	$0
Technical Assistance funds participation through dues, contributions, and other activities in multilateral organizations to improve alignment with U.S. goals.	Continuation of FY 2021 activities in key multilateral organizations include, but are not limited to: Arctic Council, G-7, G20, International Energy Agency, Organization for Economic Cooperation and Development, Clean Energy Ministerial, Nuclear Power Ministerial, Nuclear Energy Agency, International Atomic Energy Agency, Clean Energy Ministerial, Asia-Pacific Economic Cooperation, International Renewable Energy Agency, Asia-Pacific Economic Cooperation, and International Framework for Nuclear Energy Cooperation, etc.	No change.
U.S. – Israel Energy Center of Excellence $4,000,000	$4,000,000	$0
U.S. – Israel Energy Center of Excellence funding is provided to the Center on behalf of the United States Government. Matching contributions are also provided by the Israeli Government and private partners from the United States and Israel. The Energy Center will facilitate joint R&D activities on energy areas by teams of scientists and engineers from the U.S. and Israel.	Continuation of FY 2021 activities.	No change.
BIRD Energy Program $2,000,000	$2,000,000	$0
BIRD Energy Program supports commercialization of new clean energy technologies.	Continuation of FY 2021 activities.	No change.

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Salaries and Benefits $13,530,000	**$16,200,000**	**+$2,670,000**
Use of prior year balances increases the FY 2021 Salary and Benefits of Federal Employees expense to $14.4 million, funding 75 FTEs.	Continuation of FY 2021 activities with 85 FTEs.	Increase supports 10 additional federal staffers. This increase from FY 2021 Enacted will support bilateral and multilateral relationships, market development, and international economic opportunities. The effective increase is $1.8 million over FY 2021 operating level, when use of prior year balances is considered.
Travel $400,000	**$925,000**	**+$525,000**
Travel to support the President, the Secretary, and others supporting meetings and events pertaining to energy policy, science and technology, and multilateral national security engagements.	Continuation of FY 2021 activities.	COVID-19 curtailed travel in FY 2021. In FY 2022, IA requests a return to historical travel levels for 85 FTEs.
Support Services $185,000	**$225,000**	**+$40,000**
Subscriptions and Publications Management Support Contracts for administrative functions.	Continuation of FY 2021 activities.	Increase reflects additional subscription costs.
Other Related Expenses $4,200,000	**$4,640,000**	**+$440,000**
Working Capital Fund, Building Rent, IT Equipment and Services, Training, Secure Communications, Translation Services, Security Investigations, Supplies, Training, and Registrations.	Continuation of FY 2021 activities.	Increase supports expenses for 10 new FTEs and new rent expense for the SCIF.

International Affairs
Research and Development ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted
Applied Research (Direct)				
U.S.-Israel Energy Center of Excellence	4,000	4,000	4,000	0
BIRD Energy Program	2,000	2,000	2,000	0
Total, R&D	**6,000**	**6,000**	**6,000**	**0**

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Argonne National Laboratory			
Office of International Affairs - IA	130	0	0
Strategic Partnership Projects	750	100	100
Total Argonne National Laboratory	**935**	**155**	**100**
Brookhaven National Laboratory			
Strategic Partnership Projects	0	275	275
Total Brookhaven National Laboratory	**80**	**355**	**275**
Fermi National Accelerator Laboratory			
Total Fermi National Accelerator Laboratory	**55**	**55**	**0**
Idaho National Laboratory			
Office of International Affairs - IA	350	0	0
Total Idaho National Laboratory	**505**	**155**	**0**
Idaho Operations Office			
Strategic Partnership Projects	1,000	1,000	1,000
Total Idaho Operations Office	**2,150**	**2,150**	**1,000**
Lawrence Berkeley National Laboratory			
Strategic Partnership Projects	3,500	3,308	3,308
Total Lawrence Berkeley National Laboratory	**3,605**	**3,413**	**3,308**
Lawrence Livermore National Laboratory			
Total Lawrence Livermore National Laboratory	**55**	**55**	**0**
Los Alamos National Laboratory			
Total Los Alamos National Laboratory	**55**	**55**	**0**
National Energy Technology Lab			
Office of International Affairs - IA	250	0	0
Strategic Partnership Projects	150	150	150
Total National Energy Technology Lab	**400**	**150**	**150**
National Renewable Energy Laboratory			
Strategic Partnership Projects	500	500	500
Total National Renewable Energy Laboratory	**1,878**	**1,878**	**500**
Nevada National Security Site			
Total Nevada National Security Site	**25**	**25**	**0**
NNSA Albuquerque Complex			
Strategic Partnership Projects	7,078	8,918	8,918
Total NNSA Albuquerque Complex	**7,078**	**8,918**	**8,918**
Oak Ridge Institute for Science & Education			
Total Oak Ridge Institute for Science & Education	**220**	**220**	**0**

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Oak Ridge National Laboratory			
Strategic Partnership Projects	20,222	12,227	12,227
Total Oak Ridge National Laboratory	**20,277**	**12,282**	**12,227**
Pacific Northwest National Laboratory			
Office of International Affairs - IA	450	0	0
Total Pacific Northwest National Laboratory	**625**	**175**	**0**
Richland Operations Office			
Strategic Partnership Projects	100	100	100
Total Richland Operations Office	**100**	**100**	**100**
Sandia National Laboratories			
Total Sandia National Laboratories	**175**	**175**	**0**
Savannah River Operations Office			
Strategic Partnership Projects	6,700	6,700	0
Total Savannah River Operations Office	**6,700**	**6,700**	**0**
Thomas Jefferson National Accelerator Facility			
Total Thomas Jefferson National Accelerator Facility	**30**	**30**	**0**
Washington Headquarters			
Office Of The Secretary	5,119	5,582	5,582
Congressional & Intergovernmental Affairs	4,395	5,000	6,000
Office of the Chief Financial Officer	52,000	53,590	56,591
Economic Impact & Diversity	8,669	8,727	17,860
Chief Information Officer	140,200	140,200	139,008
Office of International Affairs - IA	23,578	25,800	29,475
Other Departmental Administration	138,182	141,662	193,617
Strategic Partnership Projects	0	6,722	13,422
Total Washington Headquarters	**377,455**	**396,154**	**461,555**
Undesignated LPI			
Economic Impact & Diversity	1,500	1,442	2,140
Chief Information Officer	0	0	93,250
Artificial Intelligence & Technology Office	2,500	2,500	1,500
Artificial Intelligence Technology Office	2,500	2,500	1,500
Office of International Affairs - IA	2,067	1,025	1,025
Total Undesignated LPI	**11,067**	**9,967**	**97,915**
Total Funding by Site for TAS_0228 - Departmental Administration	**433,470**	**443,167**	**586,048**

Inspector General

Inspector General

For expenses necessary for the Office of the Inspector General in carrying out the provisions of the Inspector General Act of 1978, [57,739,000] *$78,000,000* to remain available until September 30, [2022] *2023*.

Public Law Authorizations
- Public Law 95-452, "Inspector General Act of 1978"
- Public Law 103-356, "Government Management Reform Act (GMRA) of 1994"
- Public Law 106-531, "Reports Consolidation Act of 2000"
- Public Law 107-347, "Federal Information Security Modernization Act (FISMA) of 2014"
- Public Law 111-5, "American Recovery & Reinvestment Act (ARRA) of 2009"
- Public Law 111-258, "Reducing Over-Classification Act"
- Public Law 112-194, "Government Charge Card Abuse Prevention Act of 2012"
- Public Law 112-199, "Whistleblower Protection Enhancement Act of 2012"
- Public Law 113-6, "Consolidated and Further Continuing Appropriations Act of 2013/2014 Omnibus Appropriations Act"
- Public Law 113-101, "Digital Accountability and Transparency Act"
- Public Law 114-117, "Grants Oversight and New Efficiency Act"
- Public Law 115-53, "Cybersecurity Act of 2015"
- Public Law 114-261, "To Enhance Whistleblower Protection for Contractor and Grantee Employees"
- Public Law No. 116-117, "The Payment Integrity Information Act of 2019 (PIIA)"

Office of the Inspector General
($K)

FY2020 Enacted	FY 2021 Enacted	FY 2022 Request
54,215	57,739	78,000

Overview

The Office of the Inspector General (OIG) is dedicated to its mission to strengthen the integrity, economy, and efficiency of the Department's programs and operations. The OIG is able to accomplish its mission effectively, in part, because it has the authority to inquire into all Department programs and activities as well as the related activities of persons or parties associated with Department grants, contracts, or other agreements. As a result of its work, the OIG has consistently provided a positive return on its investment.

Highlights of the FY 2022 Budget Request

The OIG focuses its efforts to enhance the efficiency and effectiveness of the Department's programs and operations by:

- **Incurred Cost Audits of Management and Operating Contracts.** Beginning in FY 2022, the OIG will begin conducting, or arranging for, independent incurred cost audits of the Department's Management and Operating Contracts, valued at over $17,000,000,000, as opposed to relying on the Cooperative Audit Strategy through which contractors have been self-auditing. The OIG has budgeted $18,750,000 to assume responsibility for the incurred cost audits work.
- **Data Analytics Program.** OIG will continue to expand data collection and analysis efforts by establishing a centralized secure enclave to store and access data. OIG will use the data to identify trends or provide indications of fraud.
- **Office of Investigations.** In recent years, the OIG has experienced a 30 percent increase in the number of criminal investigations and a substantial increase in the dollar value of contractor fraud cases, resulting in additional work by the Office of Investigations. The Tech Operations Directorate is deploying software for enhanced information sharing and collaboration within the department and with other federal agencies. Additionally, the OIG will add a Special Assistant U.S. Attorney position to increase criminal prosecutions.
- **Office of Audits.** OIG performs audits on Department programs and operations, focused on providing reliable and credible financial and performance information. The scope of this work is determined through a risk-based approach focused on areas of greatest risk. to the Department.
- **Office of Inspections.** OIG's Inspection team will continue to focus on allegations received from OIG's Hotline, special inquiries raised by Congress or senior departmental officials, and intelligence oversight. It will continue to expand the contractor whistleblower investigative capability.
- **Hotline Allegations.** Changes in the Department's operating environment has resulted in a 35 percent increase to the number of allegations received through the OIG Hotline since FY 2017.
- **Contract Review.** OIG assesses the Department's award and administration of approximately $32,000,000,000 in contracts. In FY 2020, OIG work resulted in sizeable settlements by subcontractors.
- **Cybersecurity Oversight Efforts.** OIG conducts oversight in this area and frequently partners with other agencies to address attacks affecting DOE.
- **NNSA Modernization Efforts.** NNSA has undertaken a modernization effort that involves major projects (e.g., weapons complex transformation). OIG will conduct reviews that will proactively seek to identify opportunities to improve the efficiency and effectiveness of these operations.
- **Environmental Management**. The Department's environmental liability of $512,257,000,000 remained on the Government Accountability Office's Biennial High Risk List in 2021. The OIG routinely reviews the efficacy of the Department's environmental programs.
- **Mission Support Costs**. OIG assists in identifying potential costs savings in areas such as the estimated $5,900,000,000 spent each year on National Laboratory support costs.
- **New Offices/Classified Space.** OIG will continue its efforts to open offices in strategic locations and acquire a sensitive compartmented information facility.

Office of the Inspector General
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
Washington Headquarters				
Salaries and Benefits	45,631	46,958	54,405	+7,447
Travel	1,571	2,444	2,619	+175
Support Services	500	757	12,355	+11,598
Other Related Expenses	6,513	7,580	8,621	+1,041
Total, Program Direction	**54,215**	**57,739**	**78,000**	**+20,261**
Federal FTEs	**291**	**303**	**335**	**+32**
Support Services				
Management Support	-	-	11,570	+11,570
Federal Information Security Modernization Act (FISMA)	500	757	785	+28
Total, Support Services	**500**	**757**	**12,335**	**+11,598**
Other Related Expenses				
Council of the Inspectors General on Integrity and Efficiency (CIGIE)	142	190	216	+26
Information Technology	1,537	1,537	1,910	+373
Infrastructure	-	-	500	+500
Training	668	1,443	1,585	+142
Working Capital Fund	3,113	3,173	3,173	-
Other Related Expenses	1,053	1,237	1,237	-
Total, Other Related Expenses	**6,513**	**7,580**	**8,621**	**+1,041**

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $57,739,000	**$78,000,000**	**+$20,261,000**
Salaries and Benefits $46,958,000	**$54,405,000**	**+$7,447,000**
Funding supports 303 Federal staff with specialized skill sets (e.g., Certified Public Accountants, Cyber, Data Analytics, Technology Crime Investigators, and Certified Fraud Examiners) who identify significant Departmental program and operational challenges.	Begin transition to an independent audit program and continue to identify significant Departmental challenges with FTE level of 335.	The funding increase reflects an increase in FTE usage by 32 FTEs. Additional FTEs will enable OIG to implement an independent audit program. Assumes 2.7 percent pay increase in civilian salaries, FERS increase, and supplemental funds for performance award pool increase in FY 22.
Travel $2,444,000	**$2,619,000**	**+$175,000**
Funding supports travel to provide oversight at DOE's 25 geographically dispersed facilities.	Continue to perform audit, inspections, and investigations across the DOE complex.	The funding increase directly reflects increased personnel and workload, the expansion of audits, analytics, cyber, and forensic efforts in direct support of OIG's mission.
Support Services $757,000	**$12,355,000**	**+$11,598,000**
Funding directly supports the *Federal Information Security Modernization Act of 2014* (FISMA). FISMA requires OIG to conduct an annual independent evaluation to determine whether the Department of Energy's unclassified cybersecurity program adequately protected its data and information systems.	Increased management support to implement an independent audit program. Continued support for independent annual evaluations in accordance with FISMA.	The funding increase directly reflects interagency support services and contracts necessary to support the implementation of the independent audit program. The funding increase also includes a nominal increase for FISMA support.
Other Related Expenses $7,580,000	**$8,621,000**	**+$1,041,000**
This funding includes critical training for OIG staff to maintain required levels of proficiency and comply with the Inspector General Act. Funding also supports forensic hardware and software requirements needed to accomplish investigative responsibilities. Funds are included for mandatory support for Council of the Inspectors General on Integrity and Efficiency (CIGIE) and to fund OIG's share of the DOE Working Capital Fund and Energy IT Services.	Continue to support training, information technology needs, secure infrastructure, and other requirements in the performance of OIG duties.	The funding increase reflects forensic efforts, training support, and personnel security investigations. The OIG will also need to increase its investments in cloud technology, forensic hardware, and software to sustain the data analytics program, cyber, and technical crimes capabilities.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Washington Headquarters			
Program Direction - Office of Inspector General	54,215	57,739	78,000
Total Washington Headquarters	**54,215**	**57,739**	**78,000**
Total Funding by Site for TAS_0236 - Inspector General	**54,215**	**57,739**	**78,000**

Technology Transitions

Technology Transitions

Office of Technology Transitions
Proposed Appropriation Language

For Department of Energy expenses in carrying out the activities of the Office of Technology Transitions, $19,470,000, to remain available until September 30, 2027: Provided, that of such amount, $11,095,000 shall be available until September 30, 2023, for program direction.

Explanation of Change

In FY 2022, funding for the Office of Technology Transitions is being requested in a separate appropriation to increase transparency and reflect the multi-year nature of program requirements.

Office of Technology Transitions

Overview

The mission of the Office of Technology Transitions (OTT) is to expand the commercial and public impact of the research investments of the DOE. OTT enhances the public return on investment from DOE's technology portfolio, including the National Laboratories, through a suite of outcome-oriented activities that will enable climate change mitigation, job creation, and commercialization of DOE technology. Internally, OTT works to fill gaps in the research, development, demonstration and deployment (RDD&D) continuum, providing specialized tools, training, analysis, and programs to improve the successful transition of technology from proof of concept to prototype to demonstration. OTT also supports enabling policies for, tracks the impact of, and shares success stories from the Department's commercialization and partnering activities. Externally, OTT supports development of a robust ecosystem for energy entrepreneurs and technology start-ups and seeds public-private partnerships with a diverse set of actors, including state, local and tribal entities; industry, financial, and other market players; as well as academia, non-profits, and philanthropic entities. Fundamentally, OTT supports mechanisms to make the Department's research, development and demonstration (RD&D) more deployment-ready. OTT's FY 2022 budget targets and prioritizes impact in the following areas:

- Place-based approaches to commercializing innovation, which enables catalytic ecosystems that align federal funding with private companies, universities, state and local officials, investors, and non-profit actors.
- Entrepreneurial training and workforce development programs for Lab researchers and students, which enable the current and future workforce to convert innovation into real-world outcomes.
- Access to and searchability of DOE's intellectual property, laboratory experts, and facilities, which enables direct public-private engagement leading to partnerships.
- Support for DOE crosscutting priorities through market and supply chain analysis, which enables market-informed RDD&D program roadmaps and investments and engagement with key players in priority market sectors.
- Policy coordination that breaks down unnecessary barriers making it easier to conduct business with the DOE National Laboratories.
- Convening of decision-makers (e.g., C-suite in private companies) to identify opportunities for partnerships to commercialize DOE technologies.

Highlights of the FY 2022 Budget Request

The Department requests $19,470,000 for OTT in FY 2022. This level of funding will allow OTT to meet its statutory requirements under the Energy Act of 2020, make targeted investments to enhance Departmental commercialization outcomes, and fully fund an ongoing regional clusters program focused on incubators and accelerators. This includes increases for strategic mission areas including market and supply chain analysis and staffing increases to support an expanded program and outreach portfolio.

Technology Transitions
Funding ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted ($)	FY 2022 Request vs FY 2021 Enacted (%)
Washington Headquarters					
Salaries and Benefits	3,151	3,863	4,408	+545	+14%
Travel	150	300	300	0	0%
Support Services	1,884	4,251	5,537	+1,286	+30%
Other Related Expenses	520	850	850	+0	0%
Total, Program Direction	**5,705**	**9,264**	**11,095**	**+1,831**	**+20%**
Total FTEs	**19**	**22**	**23**	**+1**	**+5%**
Support Services					
Management Support Services	1,734	3,951	5,037	+1,086	+27%
Market and Supply Chain Analysis	150	300	500	+200	+67%
Total, Support Services	**1,884**	**4,251**	**5,537**	**+1,286**	**+30%**
Other Related Expenses					
Working Capital Fund (WCF)	320	570	570	0	0%
Other	200	280	280	0	0%
Total, Other Related Expenses	**520**	**850**	**850**	**0**	**0%**
Programs					
Commercialization Activities	3,375	3,375	3,375	0	0%
Energy Program for Innovation Clusters (EPIC)	5,000	5,000	5,000	0	0%
Total, Program Support	**8,375**	**8,375**	**8,375**	**0**	**0%**
Total, Office of Technology Transitions	**14,080**	**17,639**	**19,470**	**+1,831**	**+10%**

Authorizations:

Public Law 109–58, "Energy Policy Act of 2005," Title V

15 U.S. Code § 3708(b and c) - Administrative arrangements – Corporation & Administrative authorization

15 U.S. Code § 3710(a) - Utilization of Federal Technology

42 U.S. Code § 2121(a) - Authority of Commission

42 U.S. Code § 16391(e) - Establishes the Energy Technology Commercialization Fund

Public Law 116-68 Consolidated Appropriations Act 2021 – reference "Energy Act 2020" Title IX

Program Direction fully funds federal salaries and benefits, official travel, training, DOE Working Capital Fund, Energy Information Technology (IT) Services, associated support services contracts, and administrative expenses to execute the OTT mission, comply with the Energy Act of 2020 and coordinate commercialization activities with the Department, including the National Laboratories. This funding supports a communications team, market and supply chain analysis function, annual data collection and reporting, targeted stakeholder outreach and partnering efforts, and oversight and management of all programmatic activities, including the Technology Commercialization Fund (TCF), Energy Program for Innovation Clusters (EPIC), Lab Partnering Service (LPS), Energy I-Corps (EIC), and other commercialization programs and activities, including a new OTT Summer Entrepreneurship Intern Program.

Communicating Successes - Stakeholder engagement is assisted by a clear understanding of the capabilities, possibilities, and impact of the National Laboratories and the broader DOE R&D investment portfolio. OTT regularly amplifies success stories from across the DOE complex and develops communications content to showcase the DOE innovation story. A subset of success stories is reported to Congress annually to meet statutory requirements. OTT's communications bring to life the impacts that the DOE and the National Laboratories have had on companies, industries, the Nation, and the world, underscoring the potential for further external partnerships. FY 2022 funding supports continued communications support at a sustained level.

Data Collection and Reporting - OTT gathers, verifies, and validates unclassified technology transfer partnership and metrics data for all 17 DOE National Laboratories and 4 production facilities on an annual basis. This effort supports annual statutory reporting on National Laboratory utilization and provides unique visibility into the commercial impact of DOE's investments in the National Laboratories and Facilities and the breadth of beneficiaries and partners across the Nation. FY 2022 funding supports data collection and reporting at a sustained level.

Internship Program – OTT is launching its inaugural Summer Entrepreneurship Program cohort of approximately 15 undergraduate students in FY 2021 utilizing prior year carryover funds. This paid internship program will benefit the participants by enhancing their education and training in technology commercialization-related fields and increasing their future marketability in these disciplines. In addition, participants will gain deep insight into the federal government's role in the creation and implementation of policies that will affect energy technology development and commercialization. Participants will also contribute to OTT mission related research activities under the guidance of National Laboratories technology transfer and commercialization specialists and OTT staff. The Budget will sustain this program in FY 2022.

Market Analysis - OTT will continue to expand its market and supply chain analysis capabilities to illuminate technology market trends and drivers. OTT market analysis helps identify commercialization opportunities for DOE-developed technologies. OTT facilitates the development and use of market analysis content, methodologies, and data services across DOE offices and the 17 national laboratories, conducts targeted analysis for crosscutting and strategic topics, and identifies and pursues technology commercialization opportunities based on these insights. OTT's market and supply chain analysis fills gaps in the Department's analytical efforts to maximize the impact of DOE engagement and collaboration with numerous partners including industry, the financial community, interagency partners, and state and local policymakers.

OTT recently developed an energy storage market analysis report to inform the Department's crosscutting energy storage efforts and provide an understanding of domestic and global market dynamics based on the best available public information. This analytical product is representative of the value OTT can add with very limited funding through its targeted market analysis function. In support of this analytical work, OTT collaborated with National Laboratories to promote market awareness of commercialization opportunities for DOE technologies. OTT also works with DOE R&D offices to develop targeted, sector-specific market analysis reports to inform DOE strategy.

In FY 2022, OTT will continue to build out and utilize the market and supply chain analytical capability to bring market intelligence to several crosscutting areas to accelerate the commercialization of DOE-developed technologies. Energy storage, critical materials, and heavy industry (such as cement and steel) are examples of high-priority topic areas that require market and supply chain analysis to galvanize DOE commercialization strategy and efforts.

<u>Partnership Development</u> - Since FY 2016, OTT has supported a high-impact outreach function to expand DOE's network of potential partners. The initial focus of these efforts was to better engage market participants, such as corporations, startups, venture capitalists, and private equity firms. Starting in FY 2019, OTT expanded this function to support increased and more substantive market-informed outreach, including to non-traditional entities, such as foundations, family offices, incubators, and accelerators, as well as non-commercial state, local, and other federal entities. The objective at all times is to increase awareness of the opportunities for partnership with, and to leverage the capabilities of, the DOE and its National Laboratories. By working with a diverse group of capital providers and market actors with various investment time horizons, risk appetites, corporate structures, and constituencies, OTT is well-positioned to identify effective ways to help maximize the impact of the Department's R&D investments.

One example of OTT's outreach efforts is the Innovation*X*Lab Summit series. These are non-technical events that target industry executives and decision-makers, investors, and National Laboratory stakeholders for a two-way exchange of information and ideas, with the goals of:
- Catalyzing public-private and public-public partnerships;
- Engaging the private sector to ensure DOE understands industry's technical needs, risk appetite, and investment criteria; and
- Informing DOE R&D planning to increase commercialization possibilities.

To date, OTT has sponsored seven Innovation*X*Lab Summits covering Energy Storage, Grid Modernization, Advanced Manufacturing, Artificial Intelligence, Biomanufacturing, Carbon Utilization, and Quantum Information Science and Technology. These events – both in-person, and, as of last year, virtual – have included thousands of attendees and over a thousand unique Lab-Industry connections made.

FY 2022 funding will maintain planned staffing levels for strategic partnership development.

<u>Policy Coordination and Prize Authority</u> - OTT will continue its leadership role in coordinating commercialization policies and activities across DOE and across the Federal Government. Within DOE, OTT oversees the implementation of national technology transfer and commercialization authorities and the policy priorities of the Administration and convenes the Technology Transfer Policy Board consisting of DOE program office representatives and the Technology Transfer Working Group consisting of National Laboratory tech transfer and commercialization professionals and DOE site office representatives. Externally, OTT coordinates with other federal agencies through the Interagency Working Group on Technology Transfer and the Federal Laboratory Consortium for Technology Transfer. Additionally, OTT serves as co-chair of and participates in the Lab-to-Market subcommittee of the Office of Science and Technology Policy's National Science and Technology Council. These activities provide an opportunity for OTT to gain insights on best practices and program designs that can be shared across the Federal Government and considered for implementation at DOE.

In FY 2021, OTT is taking action to implement Energy Act 2020 guidance on use of prize authority and is building out a prize center of excellence function that will enable wider and more effective Departmental use of prizes by Applied Energy and other programs. This function will have minimal budget impact as it will be resourced primarily through existing staff time and by leveraging existing Departmental prize infrastructure.

FY 2022 funding will support continued engagement by OTT staff with stakeholders on streamlining central policies and procedures, thus simplifying and enabling private sector access to the capabilities and resources of the DOE National Laboratory enterprise. OTT will continue to assess, document, and disseminate best practices, including those related to use of prize authorities, and to update the DOE Technology Transfer Execution Plan in accordance with statutory requirements.

<u>Program Management</u> – Funding supports HQ oversight and management of all programmatic activities, including the Technology Commercialization Fund (TCF), Energy Program for Innovation Clusters (EPIC), Lab Partnering Service (LPS), Energy I-Corps (EIC), Laboratory Technical Assistance Programs, and other commercialization activities that support OTT's mission. This includes the costs of both federal and contractor staff engaged directly in or in support of program management activities. FY 2022 funding will support increased program management in line with the expanding OTT portfolio of high-impact program activity.

Activities and Explanation of Changes

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
Program Direction $9,264,000	**$11,095,000**	**+$1,831,000**
Salaries and Benefits $3,863,000	**$4,408,000**	**+$545,000**
Funding supports 22 FTEs responsible for managing OTT's commercialization portfolio and providing essential operations support. This includes management of all OTT programs, including the new summer entrepreneurship intern program, as well as all staff focus on creating public-private partnership opportunities.	Funding will support an increase (+1) to 23 FTEs to support growth in the OTT commercialization portfolio. New staff will support the focus on public-private partnership opportunities, in particular around developing place-based innovation ecosystems.	Supports FTE increase and 2.7% increase in civilian salaries, FERS increase and supplemental funds for performance awards in FY 2022.
Travel $300,000	**$300,000**	**$0**
Funding supports travel requirements associated with DOE's commercialization portfolio, such as OTT engagement with the National Laboratories at the bi-annual Technology Transfer Working Group meetings, information gathering from Principal Investigators, outreach at industry events and conferences, and OTT participation in National Laboratory events. In the absence of in-person events for much of FY 2021, OTT has supported virtual event expenses requiring technology platforms and services.	Continuation of activities in FY 2021.	No change.
Support Services $4,251,000	**$5,537,000**	**+$1,286,000**
Funding supports contractor support associated with management of OTT's growing programs portfolio, the new, paid Summer Entrepreneurship Program for undergraduates, all communications support, access to tools and information for more informed industry engagement, market and supply chain analysis, developing guidance and policies, implementing the Administration's technology transfer and commercialization priorities and best practices, and conducting other required data collection, verification, validation and reporting.	Funding will support activities associated with management and stewardship of OTT commercialization programs and activities, including the paid Summer Entrepreneurship Program for undergraduates, all communications support, access to tools and information for more informed industry engagement, market and supply chain analysis, developing guidance and policies, implementing the Administration's technology transfer and commercialization priorities and best practices, and conducting other required data collection, verification, validation and reporting.	Increase in funding reflects expansion of existing activities: funding will support more robust analytical support, including market and supply chain analysis efforts in support of targeted, crosscutting Departmental initiatives and priorities; the Summer Entrepreneurship Program; and program management support.
Other Related Expenses $850,000	**$850**	**$0**

Funding will support the business costs associated with the DOE's Working Capital Fund (office space, phones, utilities, etc.); Energy IT Services (IT equipment and support); specialized software licensing; E-Gov costs; security investigations; and staff development and training to maintain and enhance work related skills and capabilities.	Continuation of activities in FY 2022.	No change.

Office of Technology Transitions
Programs

<u>Description:</u>

In addition to the work of federal and HQ contractor employees funded through Program Direction, OTT requests $8.4 million in Programs funding to support Commercialization Activities and continue the successful regional incubator and accelerator program. The Budget requests a period of availability of five years for OTT's programmatic funding. While the program does not need no-year funding to execute effectively, the current two-year period of availability of OTT funds restricts effective execution toward OTT's mission.

Commercialization Activities:

<u>Energy I-Corps</u> - Energy I-Corps (EIC) is an eight-week training program pairing National Laboratory scientists and engineers with industry mentors to define the value proposition for the National Laboratory-based technology that they are developing. It directly addresses the OTT authorization language to "encourage students, energy researchers, and national laboratory employees to develop entrepreneurial skillsets and engage in entrepreneurial opportunities." Central to the program is a requirement to conduct extensive customer discovery interviews to deepen understanding of the market and other opportunities for a particular DOE-sponsored technology. This program fosters an entrepreneurial workforce and creates a cohort of DOE National Laboratory market-oriented researchers that have been immersed in an intense program of commercialization training centered on customer outreach and partnership with the private sector. Since the program's inception in 2015, **129 teams from 13 National Laboratories** have worked with i**ndustry** to discover the commercial impact of technologies they have developed at the National Laboratories. Because of the teams' participation in the program, these technologies have reached a point of commercial viability that has attracted over **$83 million** in follow-on funding from both federal and private sources and **12** new companies have been launched. In addition, in FY 2019, 14 teams that recently went through the Energy I-Corps curriculum were successful recipients of industry-matched TCF funding, furthering the commercialization of those technologies. Many additional teams are in various stages of developing additional research agreements (CRADAs), licensing agreements, and other partnership opportunities as an outcome of their participation.   OTT funding primarily supports curriculum development and delivery of the training (i.e. program implementation) of the Energy I-Corps program, while participating DOE programs opt in by funding the cost of the participating researchers' time to complete the program. Starting in FY 2021 and continuing in FY 2022, OTT will also directly fund promising project teams that may not align well with any one office's priorities, such as crosscutting topic teams. OTT also supports follow-on training opportunities for some of the most promising EIC program graduates.

<u>Lab Partnering Service (LPS)</u> - OTT's LPS is meets our Energy Act 2020 mandate to: "Establish a Lab Partnering Service Pilot Program to provide services that encourage and support partnerships between the National Laboratories and public and private sector entities, and to improve communication of research, development, demonstration, and commercial application projects and opportunities at the National Laboratories to potential partners through the development of a website and the provision of services, in collaboration with relevant external entities, and to identify and develop metrics regarding the effectiveness of such partnerships."

The Lab Partnering Service (LPS) provides small businesses; corporate entities; State, local and Tribal officials; investors and other external stakeholders interested in advancing energy innovation and connecting with leading DOE National Laboratory assets. Specifically, LPS facilitates access to National Laboratory expertise, technologies, facilities, and success stories. LPS streamlines access to unique capabilities that were previously difficult for investors, innovators, and others to find because the capabilities are distributed across the National Laboratory enterprise and presented primarily for the scientific community. In FY 2022, OTT will focus on driving traffic to LPS, as well as continuing to maintain and update LPS content, especially in fields of high commercial relevance, such as artificial intelligence, quantum computing, and energy storage technologies. OTT will expand virtual outreach efforts designed to maximize public use of the platform and further integrate LPS with existing National Laboratory tools and capabilities, expanding its reach. LPS will advance its capabilities with regard to online access to National Laboratory computing, simulation and modeling capabilities as well as cataloging both open source and licensable software for use by customers of all types. Lastly, LPS will continue to upgrade and modernize the state-of-the-art patent visualization available via the Visual Patent Service (VPS.)

Technology Commercialization Fund (TCF) - In FY 2022, OTT will continue to implement the TCF, authorized in section 1001 of the Energy Policy Act of 2005 with updated flexibility provided in section 9003 of the Energy Act of 2020. The new Congressional authority and the completion in FY 2021 of a program impact study will allow OTT to examine the successes and identify areas for improvement and increased impact for the TCF in FY 2022.

Other Commercialization Activities – OTT continuously assesses the spectrum of commercialization activities across the Department and seeks to seed gap-filling programs and activities with small, targeted investments. Areas of opportunity in FY 2022 may include revisiting mechanisms for small businesses to better engage National Laboratories (such as technical assistance and vouchers), relaunching a student business plan competition, and directly funding innovative Lab commercialization programs.

Regional Incubator and Accelerator Program

Energy Program for Innovation Clusters (EPIC) – EPIC was created in response to congressional guidance in FY20 and FY21 to implement a competitive funding program for incubators supporting energy innovation clusters. OTT requests that $5M continue to be directed to this important space to support the OTT mission. To date the funds have been used to implement a two-part strategy. The first part involved running an EPIC prize program which awarded 20 of the most innovative, comprehensive, and impactful incubators focusing on developing strong innovation clusters, connections, and support for energy-related technology and entrepreneurship. The second part is a funding opportunity announcement (FOA) that seeks to recognize innovation-accelerating organizations focused on stimulating energy hardware development and related supportive ecosystems. EPIC FOA awardees will be multi-year projects and effective oversight of this portfolio requires 5-year funding. The work being stimulated and supported under this funding is unique in the DOE and critical to the overall achievement of OTT and DOE priorities. OTT anticipates fully awarding all EPIC funding by Q1FY22 and will continue this program with a new cycle of funding in FY 2022.

Technology Transitions
Programs

Activities and Explanation of Changes

FY 2020 Enacted	FY 2021 Request	Explanation of Changes FY 2021 Enacted vs FY 2022 Request
Program Support $8,375,000	**$8,375,000**	**$0**
Commercialization Activities $3,375,000	**$3,375,000**	**$0**
Funding supports execution of the Technology Commercialization Fund, Energy I-Corps Program, Technical Assistance Programs, the Lab Partnering Service, and targeted seed investments for new high-impact, gap-filling commercialization programs.	Continuation of FY 2022 activities.	No change.
Energy Program for Innovation Clusters $5,000,000	**$5,000,000**	**$0**
Funding supports the Energy Program for Innovation Clusters initiative, including prizes, grants, and other competitive offerings.	Continuation of FY 2022 activities.	No change.

DEPARTMENT OF ENERGY
Funding by Site
TAS_0346 - Office of Technology Transitions BY2022
(Dollars in Thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Ames Laboratory			
Total Ames Laboratory	0	0	40
Argonne National Laboratory			
Total Argonne National Laboratory	0	0	112
Brookhaven National Laboratory			
Total Brookhaven National Laboratory	0	0	49
Fermi National Accelerator Laboratory			
Total Fermi National Accelerator Laboratory	0	0	40
Idaho National Laboratory			
Total Idaho National Laboratory	0	0	129
Idaho Operations Office			
Total Idaho Operations Office	0	0	2,000
Lawrence Berkeley National Laboratory			
Total Lawrence Berkeley National Laboratory	0	0	190
Lawrence Livermore National Laboratory			
Total Lawrence Livermore National Laboratory	0	0	35
Los Alamos National Laboratory			
Total Los Alamos National Laboratory	0	0	50
National Energy Technology Lab			
Total National Energy Technology Lab	0	0	145
National Renewable Energy Laboratory			
Total National Renewable Energy Laboratory	0	0	1,284
Nevada National Security Site			
Total Nevada National Security Site	0	0	25
Oak Ridge Institute for Science & Education			
Total Oak Ridge Institute for Science & Education	0	0	266
Oak Ridge National Laboratory			
Total Oak Ridge National Laboratory	0	0	40
Pacific Northwest National Laboratory			
Total Pacific Northwest National Laboratory	0	0	175
Princeton Plasma Physics Laboratory			
Total Princeton Plasma Physics Laboratory	0	0	45
Sandia National Laboratories			

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	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request Detail
Total Sandia National Laboratories	0	0	192
Savannah River National Laboratory			
Total Savannah River National Laboratory	0	0	40
Thomas Jefferson National Accelerator Facility			
Total Thomas Jefferson National Accelerator Facility	0	0	40
Washington Headquarters			
Total Washington Headquarters	0	0	14,573
Total Funding by Site for TAS_0346 - Office of Technology Transitions	0	0	19,470

Working Capital Fund

Working Capital Fund

Working Capital Fund
Program Mission
($K)

FY 2020 Obligations	FY 2021 Estimate	FY 2022 Estimate
241,475	281,894	282,272

The Working Capital Fund (WCF or Fund) is a financial management tool for improving the financing and delivery of a range of common administrative services. Service delivery is assigned to business line service managers; financial responsibility resides in a Fund Manager and individual Business Line Managers are responsible for billing and funds control. The Fund creates a framework for business-like organization of support functions and market-like incentives for both customers and suppliers. The objectives of the Fund include:

- Improve the efficiency of administrative services by providing managers with the opportunity and responsibility to make choices on the amount, priority, and sources of administrative services used by their programs;
- Ensure that program mission budgets include a fair allocation of the costs of common administrative services; and
- Expand the flexibility of the Department's budget structure to permit service providers to respond to customer needs.

Fund businesses maintain performance-based plans that inform the budget and alert the Fund Manager of the need to change pricing policies. The Fund Manager reviews financial and business performance each quarter. These reviews culminate in an Annual Report that includes analysis of financial measures, including each business line's performance against its standards and its accomplishments.

WCF charges full cost recovery for each business line in its budget and program billings. Full costs in Fund prices improve cost accounting for WCF activities, support improved decision-making for business line operations and program spending, and allow the Fund Manager to benchmark against other federal agency equivalent costs. Good budgeting practice incorporates full costing, as laid out in OMB Circular A-94, to promote efficient resource allocation through well-informed decision-making that incorporates societal costs and benefits by the Federal Government.

This information will allow the Department to improve the efficiency of WCF service offerings. The Fund Manager has created controls to satisfy oversight requirements, including regular budget reports on spending. This is consistent with other agency WCFs and satisfies the need to recover costs in reimbursable activities. WCF operations are valued by customers, serve the Department, and remain within the fiscal and policy guidelines established by the Department and by Congressional Committees.

The Department continues to examine ways to use the Fund to gain greater management efficiencies. The Fund has reported efficiency and effectiveness performance metrics since its inception and documents continuous improvement efforts to provide program customers with the best goods and services possible in accordance with other statutory requirements.

Working Capital Fund: Business Line Budgets
Table 1 summarizes projected customer billings by business line. These billings are the result of established pricing policies, which provide the basis for programs to manage their utilization of the WCF and control their budgets. The FY 2022 guidance states that Program Office customers may utilize Program funding (as available and appropriate) for expenses that support program operations or agency mission/support and are independent of the number of staff: A-123/Internal Controls; Copy Services; Corporate Business Systems (all segments except Flexible Spending Accounts and Subsidy For Energy Employee Transit (SEET)); Financial Statement Audits; Interagency Transfers; Mail & Transportation; Pension Studies; Printing & Graphics; Project Management Career Development Program (PMCDP); and Procurement Management. WCF expenses that support staff operations or provide staff benefits and fluctuate based on the number of staff, are funded from Program Direction: Building Occupancy; Flexible Spending Accounts and Subsidy for Energy Employee Transit (SEET); Corporate Training Services; Health Services; Overseas Presence; Supply; and Telecommunications.

Table 1
FY 2022 Working Capital Fund Budget Business Lines[a]
($K)

	FY 2020 Obligations	FY 2021 Estimate	FY 2022 Estimate
A-123/Internal Controls	1,422	1,679	1,680
Building Occupancy	101,314	116,748	116,928
Copy Services	2,873	4,189	4,223
Corporate Business Systems	45,356	48,745	48,770
Corporate Training Services	2,230	2,976	2,984
Financial Statement Audits	11,146	12,159	12,160
Health Services	1,201	1,944	1,947
Indirect WCF	863	0	0
Interagency Transfers	4,962	8,821	8,822
Mail and Transportation Services	4,368	4,275	4,308
Overseas Presence	9,815	16,522	16,522
Pension Studies	124	553	553
Printing and Graphics	3,598	4,569	4,573
Procurement Management	11,122	16,253	16,253
Project Management Career Development Program (PMCDP)	1,328	1,653	1,678
Supplies	1,372	2,637	2,649
Telecommunications	38,381	38,169	38,223
Total, Working Capital Fund	**241,475**	**281,894**	**282,272**

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[a] Numbers may not add due to rounding.

Changes from FY 2021

WCF Budget estimates for FY 2022 represent an increase of +$378K compared to the FY 2021 budget submission. The Artificial Intelligence and Technology Office (AITO or AI) was added as a customer in the FY 2021 execution year and FY 2022 formulation cycle ($378K).

Table 2 summarizes projected customer billings by business line and by customer Program Office. Billing for customer organizations may change as a result of the final FY 2022 appropriations enacted for each Program Office, usage-based activities driven by consumption and/or any changes approved by the WCF Board.

Table 2
FY 2022 Working Capital Fund Budget Business Lines by Customer Program Office
($K)

ORG CODE	A-123/INT CNTRL	BLDG OCCUP	COPY SVCS	CORPORATE BUSINESS SYSTEMS	CORP TRNG SVCS	FIN STMT AUDITS	HEALTH SVCS	INTER-AGENCY TRANS	MAIL & TRANSP	OVERSEAS PRESENCE	PENSION STUDIES	PMCDP	PRINT & GRAPH	PROC MGMT	SUPPLY	TELECOM	TOTAL ALL ACTIVITIES	ORG
TYPE $ *	P$	PD$	P$	P$/PD$ (1)	PD$	P$	PD$	P$	P$	PD$	P$	P$	P$	PD$	P$	PD$	P$+PD$	
AI	0	180	35	25	7	1	2	1	32	-	-	26	4	-	11	53	378	AI
AR	18	2,473	31	681	9	128	19	66	33	-	-	-	31	137	0	498	4,123	AR
AU	10	7,426	419	550	40	73	91	57	368	-	-	-	342	56	159	2,533	12,122	AU
BPA	-	130	-	81	518	-	102	135	18	-	-	-	31	-	3	37	1,055	BPA
CF	2	5,225	133	412	44	18	70	19	149	-	-	-	122	22	95	1,839	8,151	CF
CI	0	689	18	40	5	2	9	2	53	-	-	-	20	1	23	174	1,035	CI
CR	7	882	15	115	3	49	6	24	23	-	-	-	22	-	29	52	1,227	CR
EA	4	1,754	62	150	51	28	27	25	53	-	-	-	42	1	45	565	2,804	EA
ED	0	672	45	73	15	4	11	3	48	-	-	-	132	14	19	216	1,252	ED
EE	82	11,664	413	2,983	147	596	147	324	153	661	-	20	587	976	219	3,756	22,747	EE
EI	6	7,929	139	810	106	44	125	37	147	-	-	4	199	186	86	1,264	11,083	EIA
EM	338	8,298	198	8,518	252	2,455	123	1,746	187	330	147	730	209	4,952	236	2,426	31,147	EM
FE	45	3,380	148	2,422	151	330	70	217	127	330	-	75	164	2,867	73	860	11,261	FE
GC	2	5,045	91	344	51	12	65	11	87	-	-	-	140	10	101	844	6,801	GC
HC	1	2,233	151	332	52	9	41	11	118	-	-	-	127	26	41	911	4,053	HC
HG	0	927	15	42	10	2	7	1	53	-	-	-	21	-	5	86	1,168	HG
IA	1	1,720	60	175	13	9	23	6	11	661	-	-	32	43	8	437	3,200	IA
IE	1	106	9	26	1	5	1	3	13	-	-	-	7	7	4	40	222	IE
IG	3	1,971	37	345	55	18	36	18	97	-	-	-	37	32	20	504	3,173	IG
IM	6	6,043	181	278	31	45	43	42	399	-	-	2	129	932	166	2,931	11,228	IM
LM	10	441	15	288	16	73	8	52	41	-	21	24	44	125	16	544	1,719	LM
LP	1	2,107	68	205	23	8	32	7	44	-	-	-	31	4	29	551	3,109	LP
MA	3	6,060	332	570	76	19	83	30	568	-	-	-	401	586	162	2,333	11,224	MA
NA	673	20,946	989	15,520	507	4,885	323	3,857	632	292	-	407	768	3,225	547	8,547	73,519	NA
NE	55	2,239	52	1,476	76	397	57	364	85	2,478	11	-	91	18	60	753	8,313	NE
NR	82	-	-	1,477	41	598	50	290	1	-	-	-	-	-	-	24	2,563	NR
OE	10	1,091	62	362	16	71	23	36	87	330	-	4	114	19	69	490	2,784	OE
OP	0	743	30	80	22	2	15	3	64	-	-	-	75	-	23	301	1,358	OP
PA	0	387	40	41	3	2	6	2	33	-	-	-	39	2	12	109	677	PA
PM	1	571	39	85	16	5	11	3	26	-	-	-	16	-	4	148	927	PM
S	0	1,589	64	30	5	2	10	1	158	-	-	-	162	-	30	467	2,519	S
SB	0	270	40	52	4	1	4	1	84	-	-	-	18	-	10	101	585	SB
SC	300	6,088	162	7,440	213	2,174	172	1,283	184	330	61	275	230	1,960	187	2,377	23,436	SC
SSA	13	5,218	105	593	56	93	67	56	97	-	-	2	96	9	143	931	7,480	SSA
TT	0	309	24	26	6	3	4	2	18	-	-	-	12	-	16	151	570	TT
WAPA	4	124	0	2,124	344	1	63	88	16	-	-	4	77	42	3	368	3,258	WAPA
TOTALS	1,680	116,928	4,223	48,770	2,984	12,160	1,947	8,822	4,308	16,522	553	1,678	4,573	16,253	2,649	38,223	282,272	

* Type $ -- P$ = Program funding; PD$ = Program Direction funding.
* Maximum amount is reflected for P$; Program Office customers can still opt to use PD$ funding at their discretion, within the authorization of their appropriation.
* A number of DOE Program Offices have no P$ funding, therefore their WCF share is financed with PD$.
1) Corporate Business Systems -- FSA & SEET segments = PD$; all other segments = P$.

Table 3 summarizes the projected Federal Full Time Equivalents (FTEs) funded via the WCF by business line and the parent Program Office to which the FTEs are assigned in the DOE personnel system. Associated FTE costs are included as part of the indirect component of the amounts reflected in Tables 1 and 2 in line with the overall WCF goal of recovering full costs. Billing for customer organizations may change as a result of FTE vacancy status and/or any changes approved by the WCF Board.

Table 3
FY 2022 Projected FTEs Funded via the Working Capital Fund by Business Line and Parent Program Office

Business Line	Managing Org	FTEs
A-123/Internal Controls	CF	0.80
Building Occupancy	MA	24.70
Copy Services	MA	1.50
Corporate Business System (CBS)	CF/HC/MA/PA	32.15
Corporate Training Services (CTS)	HC	4.90
CyberOne	IM	0.00
Financial Statement Audits	IG	0.40
Health Services	HC	3.80
Interagency Transfers	IM	0.45
Mail & Transportation	MA	1.50
Overseas Presence	NNSA	22.00
Pension Studies	CF	0.50
Printing & Graphics	MA	6.30
Procurement Management	MA	1.30
Proj Mgmt Career Dev Prog (PMCDP)	MA	1.20
Supplies	MA	0.10
Telecommunications	IM	3.30
Fund Manager/Indirect	WCF	2.00
Total FTE Estimate		**106.90**

The following section includes a description of each business line, along with pricing policy and selected performance measures.

A-123/Internal Controls

Description
The OMB Circular A-123, *Management's Responsibility for Internal Control* and Federal Managers' Financial Integrity Act (FMFIA)*,* define management's responsibility for internal control and include guidance for management to assess the effectiveness of internal control.

A-123/Internal Controls will ensure the Department meets the intent of the Congress and the Executive Branch for internal control of financial reporting and has appropriate support for the Secretary's annual assurance statement, included as part of the Agency Financial Report. Because the requirements of OMB Circular A-123 apply to the Agency as a whole, each benefiting program must share the cost. In addition, DOE pricing policy incorporates the full costing requirements laid out in OMB Circular A-94 to promote efficient resource allocation through well-informed decision-making by the Federal Government for evaluating societal costs and benefits.

In order to support these goals, the business line will develop, provide, and maintain the capabilities needed to implement a comprehensive Department-wide evaluation of internal controls over financial reporting. The technical support resources to maintain and support the evaluation data collection tools are currently not fully available in-house. Furthermore, the Department's internal controls over financial reporting are examined during our yearly external Financial Statement audit, requiring as-needed technical support to document some Financial Statement related internal control processes with DOE-wide impact.

Pricing Policy

The A-123/Internal Controls charges customers a pro rata allocation of costs based on percentage share of three prior fiscal years' combined budget shares, using the Congressional request of the most recent year. Departmental programs that use proprietary financial systems are excluded from billing for this business line.

Building Occupancy

Description

The core services in the Building Occupancy Business Line include space management (rent), utilities such as heat and electricity, cleaning services, snow removal, facility operation and preventive and restorative maintenance, pest control, trash removal, and waste recycling. Engineering and facilities services include drafting of construction documents, developing scopes of work, construction management and inspection, value engineering, leasehold administration, lock repair and key management, safety and occupational health, moving and warehousing services, and conference support. This business also provides electronic services, which involve audio/visual meeting and conferencing support, as well as repair and maintenance of Headquarters radio communications and electronic equipment. Approved improvements to the Headquarters complex are also included.

Pricing Policy

Policy is based on direct costs and allocations in the following manner:
- Each year, organizations sign occupancy agreements that define the space to be assigned to them.
- On a building-by-building basis, direct rental value of the space assigned to each organization is calculated, based on rent charged to the Department by the General Services Administration (GSA). Customer rent costs are based on areas assigned to each organization at the start of each fiscal year.
- Common use space costs in each building are divided among the tenants of that building based on their proportional shares of direct rental costs.
- Certain additional costs, such as common area improvements and health and life safety programs, are allocated as a pro rata addition to the building-by-building charges described above.
- Electronic Services charges are allocated according to direct building occupancy costs.
- In addition, tenants may arrange, at their own cost, alterations of office space.
- Charges related to property management are allocated based on program usage during the prior fiscal year.
- FY 2022 estimates reflect historical costs for utilities as well as information provided by GSA as to the anticipated rent for future years (as of FY 2020), and projections of space usage in future years (as of FY 2020) based on input from customer organizations, historical information, space availability, and Departmental objectives.

Copy Services

Description

This Copy Services Business Line provides the following services:
- Staffed photocopy centers at Forrestal and Germantown capable of reproducing 25,000 impressions per document;
- Centralized (walk-up) photocopy rooms;
- Dedicated (customer-assigned) photocopiers, including needs assessment analysis to determine workload and most appropriate equipment;
- Digital document management, including optical scanning of paper copy documents and storage on electronic files; and
- Digital news clips to programs based on subscriptions.

Pricing Policy

Each office pays the full cost to maintain and supply its assigned dedicated photocopiers. For walk-up and staffed photocopiers, a cost per photocopy is calculated and programs are charged based on the number of photocopies made by program staff. The digitization pricing policy is to charge on a per-page basis to cover the costs of this business segment. FY 2022 estimates reflect amounts based on usage from the year prior to formulation (FY 2019).

Corporate Business Systems

Description
Corporate Business Systems (CBS) is the Department's solution for managing enterprise-wide systems and data. CBS is consolidating and streamlining Department-wide systems and business processes to integrate financial, budgetary, procurement, personnel, program, and performance information. CBS is supported at the core by a central data warehouse/portal that links common data elements from each of the Department's business systems and supports both external and internal reporting. The line of business provides efficiencies in its administration that result in a single, senior business manager for DOE's corporate business systems. The business consists of STARS, STRIPES, Funds Distribution System (FDS) 2.0, iPortal, Payment Processing, CHRIS and related sub-segments, Digital Media and Payroll.

Standard Accounting and Reporting System (STARS) Segment provides the Department with a modern, comprehensive, and responsive financial management system that records and processes accounting transactions for general accounting, payments, and receivables; purchasing, including obligations and reservations, accruals, plant and capital equipment; nuclear materials accounting, and many other functions. STARS is also used for financial reporting including Governmentwide Treasury Account Symbol (GTAS), Standard Form (SF) 220.9, SF 224, and the Department's financial statements. Costs include all operations and maintenance support, including the Chief Information Officer's Application Hosting and annual Oracle Software licensing.

Strategic Integrated Procurement Enterprise System (STRIPES) Segment replaced and consolidated federal corporate, regional and local procurement-related systems across the Department. STRIPES automates all procurement and contract activities required or directly associated with planning, awarding, and administering various unclassified acquisition and financial assistance instruments, thereby increasing the internal efficiency of the Department. STRIPES is also fully integrated with STARS, creating efficiency between the two systems and improving the accuracy and timeliness of funding commitments and obligations. Costs include all operations and maintenance support, including the Chief Information Officer's Application Hosting and the annual Compusearch subscription fees.

Funds Distribution System (FDS) 2.0 Segment is a corporate solution that automates, standardizes, and streamlines the funds distribution and formulation processes and procedures across the Department. Costs include all operations and maintenance support, including the Chief Information Officer's Application Hosting and annual Oracle Software licensing.

iPortal/Information Data Warehouse (IDW) Segment is the CBS face to its customers. It provides the gateway into all CBS applications and services. The IDW provides capability to integrate and store data from various corporate and/or program systems for reporting using Business Intelligence reporting tools. Costs include the operations and maintenance of the technical infrastructure, consisting mostly of Application Hosting and annual software licensing fees.

Payment Processing Segment: The Oak Ridge Financial Service Center processes all of the Department's payments. It completes over 168,000 payments annually. Costs include operations and maintenance of Financial Accounting Support Tool (FAST), Vendor Inquiry Payment Electronic Reporting System (VIPERS), and the Department of Energy Payment and Collection (DOE-PAC) systems.

Corporate Human Resource Information System (CHRIS) Segment is a nation-wide operational portfolio of systems within the Department that serves as the official system of record for human resource management information for all employees. CHRIS supports the Administration's strategic human capital management initiative and expands e-government within DOE, combining electronic workflow and other best practices in work processes with a web-based IT architecture and suite of software applications based on off-the-shelf products (PeopleSoft, Monster Government Solutions and USA Staffing), and the legacy Employee Self-Service. This budget also funds Jobs One-Portal (J1P), recruitment using social media, and specific recruiting efforts to reach veterans and disabled veterans. In addition, costs for inter-agency contributions for electronic benefits are financed in WCF. Costs include all operations and maintenance support, including the Chief Information Officer's Application Hosting and annual Oracle Software licensing.

Digital Media Segment rationalizes hundreds of websites and streamline web operations, reducing duplicative spending, and improving overall digital communications. Costs will include the operations and maintenance of the technical infrastructure of the Department's Home Page (Energy.gov), consisting mostly of application hosting, iterative development, and platform upgrades to meet ongoing scale and usage demands.

Payroll Services Segment encompasses three areas: Payroll, Flexible Spending Account (FSA) administrative fees, and Subsidy for Energy Transit (SEET). Civilian payrolls are prepared based on authenticated documentation. Through the Defense Finance and Accounting Service (DFAS) this segment: computes, deposits, and reports Federal, State, and local income taxes; maintains employee records related to Civil Service and Federal Employees Retirement Systems (CSRS and FERS); reports retirement information to the Office of Personnel Management (OPM); and performs reconciliation of account balances with DFAS, OPM and Treasury. Payroll services accounts for and reports on employees' health benefits coverage, thrift savings plans, transit subsidies (SEET), and unemployment compensation, among other non-salary employee payments. It also processes donated leave into the Defense Civilian Pay System. Additionally, it maintains and operates the Department's system of allocating payroll costs to the proper appropriation.

eDiscovery is a corporate solution to respond to legal, congressional, regulatory and discovery requests. Costs include all operations and maintenance support, including application hosting and annual software licensing.

Pricing Policy
CBS activities charge programs a pro-rata allocation of costs based on percentage share of three prior fiscal years' combined budget shares, using the Congressional request of the most recent year. Exceptions to this pricing policy include:
- STRIPES charges based on the number of 1102 series system users recorded during the fiscal year prior to formulation (for FY 2022 this is FY 2019).
- ORFSC charges programs based on a pro-rata share of processed transactions during the fiscal year prior to formulation (for FY 2022 this is FY 2019).
- CHRIS and Payroll charges programs based on an allocation of Federal employment on-board by organization at the beginning of the formulation year (for FY 2022 this is FY 2020).
- SEET and FSA are charged to programs based on actual usage during the fiscal year. Estimates are derived from the twelve month period prior to formulation.

Corporate Training Services

Description
The Corporate Training Services (CTS) Business Line combines Training Delivery and Services (TDS), Learning Nucleus, OPM 360 Assessments and National Defense University (NDU) business segments to deliver courses which support the Department's mission at competitive pricing and fee for service pricing.

Learning Nucleus Segment is a web-based commercial off-the-shelf training system that provides access to online learning and training. The Learning Nucleus program provides access to online learning activities proven to improve learning outcomes and reduce costs independently or in combination with other training methods. The overall vision of the Learning Nucleus program is to provide all DOE federal employees with access to web-based training. The Learning Nucleus has been structured to meet DOE needs with a customized access process and DOE-specific information (including DOE-mandated training).

Training Delivery and Services (TDS) Segment includes the design, development, and delivery of competency-based courses to meet critical skills development needs in Project Management, Program Management, and Acquisition and Assistance Management. A series of Continuing Education courses present new topics and refresher training. Program offerings include modular course design and customized training for on-site and centralized delivery. The training management services are offered to customers on a negotiated basis only.

Office of Personnel Management (OPM) 360 Degree Assessment Program Segment provides the Department with services through an Interagency agreement with OPM. DOE's program is part of a larger effort to change the leadership culture throughout the agency. By administering leadership behavior assessments and simple, but targeted, evaluations of leadership training efforts, the Department can track changes in the perception of leadership behaviors over time and assess the effectiveness of leadership training. Participants are rated by people of varying relationships to the participant (e.g., peer, subordinate/direct report, and supervisor). Assessments will focus on leadership competencies most relevant to DOE's current strategic plan, and include items related to personal training experiences and the effectiveness of those experiences.

National Defense University (NDU) Segment provides services through an Interagency Agreement with the National Defense University (NDU/DOD) for DOE participation at the National Defense University (National War College) for Energy Master/Certificate Programs and the Advanced Management Program.

Pricing Policy
Pricing policy for Corporate Training Services Business Line is as follows:
- Learning Nucleus - Participating DOE organizations pay for Learning Nucleus access through a fixed annual fee per student and allocation of administrative costs, based on number of employees per program.
- TDS - Participating DOE organizations in the TDS pay $250/day for each employee enrolled in professional skills training courses.
- OPM 360 - Participation in the OPM 360 Assessments is financed by the benefitting program; fees per person are based upon specific assessment options.
- NDU - Participation in the NDU is financed by the benefitting program; fees per person are based upon the specific training program.
- Federal staff support consists of program management, developing curriculum, contractor oversight of distance learning, and managing classroom delivery by contractor staff.
- FY 2022 estimates reflect amounts based on usage from the fiscal year prior to formulation (FY 2019), except Learning Nucleus, which is based on an allocation of the number of employees on-board by organization at the beginning of the formulation year (FY 2020).

Financial Statement Audits

Description
Support services relating to the audit contract are required to attain contractor expertise, needed primarily for financial statement audits required by the Government Management Reform Act (GMRA) (e.g., actuaries, petroleum engineers, information technology support personnel and vulnerability testing, as required by the Federal Information Security Management Act (FISMA)). Oversight of this process and contract activities is provided by the Office of the Inspector General.

Pricing Policy
The business line charges customers a pro-rata allocation of costs based on percentage share of three prior fiscal years' combined budget shares, using the Congressional request of the most recent year. Departmental programs that use proprietary financial systems (e.g., the FERC and the PMA's) will be excluded from billing for this business.

Health Services

Description
The Health Services Business Line provides common administrative services to the DOE Headquarters community. These services include Headquarters health centers, a drug testing program (DOE-wide), an employee assistance program, and disability services. The Department's analysis shows cost reductions will result from consolidating these activities under one enterprise with a focus on program demand for these services.

Health Center Segment consists of two HQ facilities: one at Forrestal and one at Germantown. Services provided include: emergency response; travel immunizations; fitness-for-duty and pre-employment physical exams; annual influenza vaccinations; and general occupational health concerns. The health center is operated under an Interagency Agreement with the Department of Health & Human Services, Federal Occupational Health (HHS/FOH) to provide packaged services, which reduces costs and DOE resource needs.

Drug Testing Program Segment, a DOE-wide program, provides for collection, testing, and medical review of alcohol and drug testing. This activity supports testing of DOE positions for fitness-for-duty, pre-employment, and random drug testing and positions which require a clearance (e.g., security, technical, and/or executive positions) in line with Federal mandates (Executive Order 12564; Department of Transportation Regulations; and 49 Code of Federal Regulations Part 40). The

Department has an existing Interagency Agreement with Department of the Interior to utilize their contracts, which reduces costs and saves DOE resources.

Employee Assistance Program (EAP) Segment at Headquarters finances professional EAP counselors to offer assistance to DOE federal employees for family, work, health, and other concerns (work-life) in line with Federal mandates (Executive Order 12564; Public Law 79-658; Public Law 99-570 (5 U.S.C. §§7361 and 7362); Public Law 98-24 (42 U.S.C. §290dd-1); Public Law 96-24 (42 U.S.C. §290ee-1); Sec. 7361 and Sec. 7362 of Public Law 99-570; and the Public Health Services Act).

Disability Services Segment coordinates contract vendors to provide sign language interpreting services for deaf and hard-of-hearing federal employees at Headquarters in line with Federal mandates (Rehabilitation Act of 1973, as amended).

Pricing Policy
Charges for Health Service segments are based on an allocation of Headquarters Federal employment on-board by organization at the beginning of the formulation year (for FY 2022, this is FY 2020). Charges for the Drug Testing segment are based on an allocation of DOE-wide Federal employment on-board by organization at the beginning of the formulation year (for FY 2022, this is FY 2020).

<div align="center">

Interagency Transfers

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Description
Interagency transfers are necessary to finance National Archives and Records Administration (NARA) storage and management of critical DOE records and the Integrated Acquisition Environment. Other activities include E-Government initiatives, which consist of consolidation studies of lines of businesses, agency assessments, and other intergovernmental procurement systems.

The DOE Records Management Program ensures compliance with the Federal Records Act of 1950, as amended, by promoting the management of records throughout their life cycle in an economical, efficient, and effective manner. DOE maintains an annual agreement with NARA on records storage costs and appropriate records management and disposition, consistent with approved records schedules.

Integrated Acquisition Environment (IAE) provides a secure business environment that facilitates and supports cost effective acquisition of goods and services in support of mission performance. To accomplish this mission, IAE focuses on the following goals:
- Create a simpler, common integrated business process for buyers and sellers that promotes competition, transparency and integrity.
- Increase data sharing to enable better business decisions in procurement, logistics, payment, and performance assessment.
- Take a unified approach to obtaining modern tools to leverage investment costs for business-related processes.

IAE is operated under an Interagency Agreement with GSA to provide packaged services, reduce costs, and save DOE resources by leveraging economy of services. GSA is charged with the fiduciary responsibility to work across government to provide acquisition services to support agency missions by delivering timely acquisition tools and services, including but not limited to, the Central Contractor Registration, excluded parties list, electronic subcontracting reporting, federal business opportunities, federal procurement data, wage determinations, and others, as business requirements are identified by the acquisition community.

Per OPM, agencies will need to contribute funding to cover credit monitoring and related services/benefits for the OPM cybersecurity incidents affecting Federal and contract employees. Coverage will include a suite of services (e.g., credit monitoring, call center/support services, and identity theft protection).

Pricing Policy
E-Gov and NARA - these activities will be charged to programs on a pro rata allocation of costs based on percentage share of three prior fiscal years' combined budget shares, using the Congressional request of the most recent year.

OPM Credit Monitoring - Program office cost shares are based on an allocation of HQ and Field credential numbers by organization from the beginning of the formulation year (for FY 2022, this is FY 2020).

Mail and Transportation Services

Description
The Mail Center provides a variety of mail services for all official and other authorized mail for DOE and its employees. Services include the processing of all incoming postal mail, outgoing official mail, internal mail processing, accountable mail processing, pouch mail, a variety of overnight express mail services, messenger services, directory services, and pick-up and delivery services. In response to the threat of dangerous or hazardous items being mailed to the Department and its employees, the business line has implemented various processes for sanitizing and testing mail for dangerous or hazardous materials.

The Transportation Service includes shuttle bus operations, Headquarters executive transportation, motor vehicle fleet administration, and courier service. The shuttle bus operates between DOE Headquarters facilities, utilizing two bio-diesel buses. Executive transportation is provided to Headquarters executive staff for official business required to further the mission of the Department of Energy. Motor vehicle fleet administration includes fleet maintenance, monitoring and tracking fleet activity, conducting fleet management activities, and the vehicle maintenance program. Courier service is for the delivery and pick-up of sensitive and non-sensitive material within the Washington Metropolitan area.

Pricing Policy
Mail and transportation pricing has multiple components:
- Offices pay the actual dollar cost for outgoing United States Postal Service (USPS) mail and for Federal Express or other special mail services. Offices pay for internal mail distribution based on the number of mail stops.
- Offices pay for Mail Security based on their percentage of incoming USPS mail over the preceding six-month period.
- Offices pay for Express Mail labor based on their percentage of the total volume of incoming and outgoing special mail during the preceding six-month period.
- Offices pay for USPS Outgoing labor based on their percentage of actual outgoing mail for the preceding six months.
- Offices pay for specified special services on a negotiated basis.
- Programs pay for shuttle bus services based on their prior year usage.
- Programs pay for courier and messenger services based on their prior year usage.
- Programs pay for Headquarters executive transportation services based on their prior year usage.

Overseas Presence

Description
The Department has a long-standing presence in several diplomatic missions around the world, enabling the Department to promote American trade and support critical treaties with our allies.

DOE funds 22 federal positions and 28 locally employed staff in 21 countries that support the Secretary and, by extension, the entire Department. The business line provides administrative and operational support service to Departmental personnel traveling overseas for mission programs.

The budget finances federal salaries, overseas operating costs, and International Cooperative Administrative Support Services (ICASS) and Capital Security Cost Sharing (CSCS) programs. The Department utilizes State Department resources as shared services to ensure that costs are minimized.

Pricing Policy
Charges for Overseas Presence are based on actual usage of these services by program offices. The annual bill for these charges will cover the fixed cost of the program and be allocated to programs based on the previous year's actual usage. FY 2022 estimates reflect allocations determined by the Overseas Presence Advisory Board based on negotiations with appropriate program offices.

<div align="center">**Pension Studies**</div>

Description
Pension Studies provide program offices with an independent measure of contractor benefits and compare each contractor to both internal and external benchmarks. Program offices use the results of these studies in discussions with contractors regarding the need for reducing costs associated with contractor employee benefits. Results can be measured by the changes made to contractor employee benefit plans.

Pension Studies require access to actuarial expertise that is essential to understanding the implications on federal budgets of potential pension liabilities. Factors that impact pensions are dynamic and include: volatility of contributions, inflation, benefit plan provisions, workforce restructuring, and pension legislation. These studies support the Department's budget projections, financial statements analysis, Office of General Counsel, and pension and post-retirement benefit management plans. Additionally, the business line regularly provides analysis and assistance to DOE program offices and contractors facing difficult pensions and benefits issues that require objective Departmental expertise.

Under the terms of the contracts that the Department has with each of its management and operations (M&O) contracts, the Department reimburses the contractors for reasonable costs associated with fulfilling their duties under the terms of the contract. These reasonable costs include costs associated with providing benefits to the contractors' employees.

Beginning in 2009, the Department increased its oversight of these benefits and began regular reporting on the expected reimbursements for pension plans. DOE also reports on expected reimbursements for other postretirement benefits (primarily medical). A key goal of this oversight is to improve transparency among the contractors with respect to the benefits being provided to the contractors' employees, as well as the associated annual cost per employee. The collection and analysis of this data requires the use of external actuarial services.

Publicizing the results of the study has exerted pressure on the contractors to address the costs associated with their benefit plans.

The Pension Studies line of business and its systems also supports DOE's compliance with mandated financial reporting. This includes a Congressional mandate to provide semiannual reports to Congress in April and September with updated information on Department of Energy contractor defined benefit pension plans and mandated reporting of pensions and benefits information in the Annual Financial Report.

Pricing Policy
Programs will be charged based on each program's sites' ratio of the total pension and post-retirement reimbursements reported in the April Report to Congress for the prior fiscal year. Studies are conducted on a biannual cycle (currently the even fiscal years), with reduced billings required for off-cycle years (currently odd fiscal years).

<div align="center">**Printing and Graphics**</div>

Description
The Printing and Graphics Business Line provides procurement and liaison services with commercial printers through the Government Printing Office. It also provides design and development of pre-press graphics, electronic forms and exhibits, and court reporting services. Contractor staff distributes materials produced in-house as well as materials produced by other government agencies. This business line also provides professional photography, lab technicians, portrait studio operations, graphics, visual aids, and presentation materials. Centralized visual archives are provided through a repository of general interest photos.

Pricing Policy
Organizations pay direct costs for printing, printed products, Federal Register publications, and graphics services. Additionally, programs pay maintenance costs on graphics equipment and graphics supplies as a percentage allocation of costs incurred in the previous fiscal year. FY 2022 estimates reflect amounts based on usage from the fiscal year prior to formulation (FY 2019).

<center>**Procurement Management**</center>

Description

Audit Services, Contract Closeout, and Purchase Card Surveillance business segments work together to help validate compliance with procedures and improve the internal controls of the Department. These segments also respond to specific issues raised by the Inspector General. Ultimately, savings to programs are realized by preventing fraud, waste, and abuse.

Audit Services Segment of the business represents funding to various audit entities; however, the majority of the funding is provided to the Defense Contract Audit Agency (DCAA). DCAA provides audit services to the Department's program offices in support of their acquisition activities, at the request of their contracting officers. These services benefit DOE by supporting contracting officers in making determinations for reasonableness and realism, and also by validating contractor costs, indirect rates, disclosure statements, and accounting systems.

Contract Closeout Segment of the business is the final stage in contract administration support for DOE Headquarters elements. Services include ensuring that all contracted products and services have been delivered, final releases are obtained, final invoices and vouchers are processed for payment, and any remaining unexpended funds under the contract are released. During FY 2020, the return on investment calculation shows that for every one dollar invested in the contract closeout activity, $16 of uncosted funding was de-obligated from expired instruments. As a result of the Grants Oversight and New Efficiency (GONE) Act of 2016, the closeout of financial assistance instruments was prioritized. During FY 2020, the Contract Closeout Team successfully closed all GONE Act financial assistance awards that were delivered to HQ Procurement Services for retirement.

Purchase Card Data Mining Segment monitors purchase card usage within the Department. DOE purchase cards are issued under a task order through the SmartPay3 program administered by GSA. Funding for this effort is derived from rebates DOE elements receive, based upon the dollar volume of purchases. The vendor provides a version of the data mining system (IntelliLink) to DOE at no cost for the basic version. This segment provides surveillance over the use of purchase cards and oversees the data mining to track and resolve suspicious purchase card transactions through risk-based analytics. DOE has incorporated customizations to the IntelliLink data mining system in an effort to enhance security.

Pricing Policy

Procurement Management pricing has multiple components:

- Closeout - each Headquarters element pays the actual contract closeout cost, determined by the unit price of each contract type, and negotiated level of service.
- Purchase Card Data Mining costs are allocated based on the distribution of refunds resulting from the DOE purchase card program.
- DCAA audits are charged to programs based on actual usage from the previous fiscal quarter.
- FY 2022 estimates reflect amounts based on usage from the fiscal year prior to formulation (FY 2019).

<center>**Project Management Career Development Program**</center>

Description

The Project Management Career Development Program (PMCDP) establishes requirements and responsibilities for all federal project directors (FPDs) with line management responsibility for capital asset projects. The PMCDP defines the necessary project management knowledge, skills, and abilities; project management training requirements; a career development tracking system; and a project management certification program to successfully manage DOE/NNSA projects. Certification requirements and responsibilities are applied in accordance with the Certification and Education Guidelines (CEG) developed and maintained by the Office of Project Management Oversight and Assessments and approved by the PMCDP Certification Review Board. All candidates for PMCDP certification must have individual development plans (IDPs) that address planned training and course work, details, rotational assignments, mentoring agreements, and other developmental activities defined in DOE O 361.1C, Acquisition Career Management Program, Chapter V.

Pricing Policy

In FY 2022, the business line will continue to assess programs based on the number and value of their projects in the Department's portfolio, and the number of incumbent FPDs or potential FPDs identified by the programs. Fixed costs

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related to the PMCDP will be charged to programs based on their pro-rata share of the number of projects and the value of those projects in the Project Assessment and Reporting System (PARS). The variable costs of delivering courses will be charged to programs based on their pro-rata share of targeted participants. FY 2022 estimates reflect amounts based on programmatic statistics reported in PARS and PMCDP Program participant profile data at the time of formulation (FY 2020). This data includes estimates of present and forecasted needs that include number of projects, portfolio value of projects, and the number of incumbent and candidate FPDs.

In addition, we expect some programs outside of the assessment pool to request participation in the training offered. In those cases, the business will allocate a certain number of slots, on a space-available basis, at the rate of $200 per day. These charges will offset other development costs and future charges to the programs.

Supplies

Description
This business line operates two self-service stores, which carry a wide variety of consumable office products. At customers' request, it acquires specialty items, not stocked in conventional stores. Products carried are based on review of equipment in the agency inventory and customer input and suggestions. This business operates the supply stores as a commercial operation, which is paid only for the supplies purchased by DOE employees. In support of federal green purchasing Executive Orders and statutory mandates, the Headquarters supply stores (located in Forrestal and Germantown) offer a wide range of environmentally friendly supplies that are energy efficient or contain post-consumer waste (recycled) materials, bio-based materials (biological, agricultural or forestry-based), and biodegradable materials (decompose easily).

Pricing Policy
Each organization pays for supplies purchased by its employees. FY 2022 estimates reflect amounts based on usage from the fiscal year prior to formulation (FY 2019); extraordinary or unusual changes in usage patterns are not anticipated in the Fund's estimates.

Telecommunications

Description
The Telecommunications Business Line consists of comprehensive enterprise activities to include: Network and Voice Infrastructure Services, DOEnet Services, Video Teleconferencing and Cellular Services.

Network and Voice Infrastructure Services Segment provides connectivity for DOE Headquarters (HQ) and Field operations through Local, Metropolitan and Wide Area Networks. This connectivity provides interoperability for organizational Local Area Network (LAN) and Metropolitan Area Network (MAN) segments in two main Headquarters (DC Metro area) and associated satellite buildings; and connectivity to the Headquarters-located corporate applications. Wide Area Network (WAN) infrastructure provides access to/from and cybersecurity for Internet access, e-mail and other applications for information processing and sharing through non-HQ infrastructure.

Voice infrastructure connects two main Headquarters and satellite buildings for internal and external phone service. The infrastructure includes communication networks, installed telephones and processing switching equipment. Telephone services includes local, long distance and international dialing; and specialized services such as operator-assisted conference calls, voice mail, call forwarding and automatic ring-back.

DOEnet Services Segment provides connectivity to the entire national complex. DOEnet is a centrally managed DOE-Wide Area Network that provides a common standard service to carry business related data, access to the Trusted Internet Connection (TIC) compliant service, and access to Headquarters Corporate applications, systems and services DOE-wide.

Cellular Services Segment encompasses procurement of cell phones, smart phones, and other cellular equipment. The cellular device costs are monitored regularly, and carrier plans are centrally adjusted to attain maximum savings.

Direct Customer Charges Segment supports above-standard services including: local, long distance and international person-to-person and operator-assisted calling; specialized services such as multiple-party conferencing and electronic voice mail; Federal Relay Services which enable federal employees who are deaf, hard-of-hearing, deaf/blind, or have

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speech disabilities equal communication access; Wireless Access Point (WAP) hardware; cabling projects requiring use of external vendor support; toll-free services; circuit costs that support specific customer locations; and procurement of other telecommunications related equipment.

Pricing Policy
Charges for Telecommunications are based on usage of these services by program offices, including the following components:

- Network and Voice Infrastructure Services Segment – Infrastructure charges represent infrastructure costs which are composed of: (1) the cost of leased telecommunications circuits; (2) the cost of maintaining common infrastructure components and upgrades where needed; and (3) the cost of providing technical staff to install, repair and monitor/operate the various common infrastructure components. These charges are allocated among program organizations based on the number of active LAN connections and phone numbers, as a monthly charge. Since the Fund's inception, program customers have been validating the number of these connections. The costs of dedicated communication circuits are allocated to organizations requesting installation of such lines. All long distance, local and international calls at Headquarters are allocated to the originating telephones and thus to programs based on the actual billing information.

- DOEnet Services Segment – DOEnet costs are predominately comprised of: (1) the cost of leased telecommunications circuits; (2) site hardware components and maintenance; and (3) the cost of technical support staff. DOEnet costs are allocated to participating sites based on the costs associated with providing the service – circuit costs, hardware and maintenance costs, and the costs of technical support staff.

- Cellular Services Segment – Cellular charges represent costs which are composed of: (1) administrative support involved with ordering, activation, rate analysis, rate selection, deactivation, accumulating, translating and validating commercial vendor billing data systematically for the record keeping, accounting and financial reporting and customer reporting; (2) cellular device costs; and (3) cellular plan costs. Administrative charges are allocated among program organizations based on the number of active cellular devices, as a monthly charge. All cellular device and plan costs are allocated to the program office owner.

- Direct Customer Charges Segment – Programs are billed in proportion to consumption of goods and services. FY 2022 estimates reflect amounts based on usage from the fiscal year prior to formulation (FY 2019). Extraordinary or unusual changes in usage patterns are not anticipated in the Fund's estimates.

Crosscutting Activities

Crosscutting Activities

Alternative Fuels
Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Projects Agency-Energy	**28,591**	**22,000**	**TBD***	**TBD***
Energy Efficiency and Renewable Energy	**313,500**	**335,000**	**450,770**	**115,770**
Bioenergy Technologies	259,500	255,000	340,000	+85,000
Hydrogen & Fuel Cell Technologies	50,000	76,000	99,500	+23,500
Solar Energy Technologies	0	0	7,000	+7,000
Weatherization and Intergovernmental Programs	4,000	4,000	4,270	+270
Fossil Energy and Carbon Management	**141,000**	**159,100**	**221,000**	**+61,900**
CCUS and Power Systems	141,000	159,100	221,000	+61,900
Science	**188,600**	**192,800**	**211,000**	**+18,200**
Basic Energy Sciences	88,600	92,800	107,000	+14,200
Biological and Environmental Research	100,000	100,000	104,000	+4,000
Grand Total	**671,691**	**708,900**	**882,770***	**+195,870***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

FY 2021 Enacted (aggregated): $708,900,000
FY 2022 Request (aggregated): $882,770,000

Summary:
Hard-to-electrify sectors such as heavy transport, air travel, and shipping will continue to require energy-dense fuels. DOE's alternative fuels crosscut investments sponsor research, development, demonstration, and deployment (RDD&D) initiatives in low-carbon and carbon-neutral fuels such as biofuels, hydrogen, and electrofuels (e-fuels) to ensure economy-wide decarbonization is achievable. Alternative fuels RDD&D will also incorporate carbon capture, utilization, and storage to support net-zero emission fuels where appropriate. Low-carbon and net-zero carbon emission fuels are a critical part of DOE's portfolio of solutions to achieve an abundant, reliable, and affordable supply of clean energy, reduce our impact on climate change, address environmental justice, support transition in coal and power plant communities, meet the 2035 and 2050 decarbonization goals, and maintain our prosperity throughout the 21st Century and beyond. DOE coordinates across offices through annual merit reviews, proposal reviews, joint analysis to identify technology gaps and impact potential in the area of alternative fuels, and participation on tech teams by participating offices.

Crosscut Objectives:
- *Reduce Cost:* Conduct RD&D to develop technologies that will produce cost effective, alternative fuels, including low carbon "drop-in" biofuels, that are compatible with existing fueling infrastructure and vehicles, as well as e-fuel and hydrogen that may be used as fuels across a range of transportation modes, including alternatives to diesel, jet, and marine fuels.
- *Reduce Risk of Scale-Up:* Conduct scaling of promising technologies through public-private partnerships through pre-pilot, pilot, and demonstration scale to provide operational data to enable financing of commercial facilities.
- *Enhance Sustainability*: Assess availability of sustainably sourced feedstocks, reduce water usage, and improve water and soil quality, and preserve ecosystems services ensuring stewardship of our communities and the environment.
- *Reduce CO_2 emissions*: Conduct RD&D on the use of Carbon Capture, Utilization and Storage (CCUS) to further drive CO_2 emissions to zero, or even negative, by 2050.

- *Increase Volumes:* Demonstrate a significant number of pathways to fuels, mobilizing the development of the Nation's domestic biomass resources.
- *Innovate:* Foster fundamental science and applied R&D to enable breakthroughs along the value chain of alternative fuels production including biofuels, hydrogen, and e-fuels.

Program 'Action Areas':
DOE program offices (Energy Efficiency and Renewable Energy (EERE), Fossil Energy and Carbon Management (FECM), Office of Science (SC), and the Advanced Research Projects Agency (ARPA-E) will:
- *Strengthen Cross-DOE Coordination and Collaboration:* Ensure an integrated approach to avoid duplication and increase collaboration, conduct integrated systems analysis, workshops and Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.
- *Support Fundamental and Applied R&D and Technology Transfer:* Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer to enable meeting goals for alternative fuels demonstrations.
- *Coordinate Information/Knowledge and Technology Transfer:* From SC Bioenergy Research Centers, Energy Frontier Research Centers, and Fuels from Sunlight Hubs, to DOE applied research, pilot facilities, consortia, and scale up activities where synergies exist.
- *Conduct Systems Analysis:* Conduct life cycle, resource, regional, sustainability, and techno-economic analyses to guide the portfolio and strategy.
- *Coordinate on Regional Transition Action Plans:* Conduct studies on co-gasification of waste coal, waste plastics, municipal solid waste and biomass (where available) into hydrogen and transportation liquid fuels like gasoline, diesel, and jet fuel as potential transition strategies in communities, preventing economic and job losses in the transition away from coal.
- *Coordinate on Workforce/STEM and Diversity, Equity, and Inclusion:* Collaborate on best practices and accelerate progress towards common goals.

Program Organization:
1. Energy Efficiency and Renewable Energy ($450.8M): EERE focuses on the production of alternative fuels including low-carbon "drop in" biofuels and biochemicals from domestic biomass and wastes, renewable hydrogen as both a fuel and intermediate needed for renewable fuels production and e-fuels derived from CO_2 waste gases. RD&D activities include:
   a. Biomass and waste feedstock supply and preprocessing and algal biomass production and logistics systems to supply high-quality, energy-dense, and sustainable conversion-ready feedstocks for bioenergy applications.
   b. Conversion research in both biological and thermochemical) routes to convert biomass, waste feedstocks, and other complex organic polymers into "drop-in" biofuels (sustainable aviation fuels, marine fuels, and legacy fuels such as diesel), fuel components, and chemical intermediates.
   c. The development, testing, and verification at increasing larger scale for integrated biorefinery process performance, and development of novel methods to expand end-user acceptance of biofuel and bioproducts.
   d. Focus on multiple pathways for clean and affordable hydrogen production, delivery infrastructure and dispensing of hydrogen fuel, and enable fuel cells to meet application-specific requirements for transportation.

2. Advanced Research Projects Agency – Energy ($TBD): ARPA-E funds early stage research and development programs focused on non-traditional approaches and high risk/high impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. Examples include:
   a. Accelerating innovative concepts such as: improving the carbon efficiency of bioconversion platforms through the accommodation of external reducing equivalents, investing in the development of scalable technologies for conversion of electrical or thermal energy from renewable sources into chemical energy, and converting high-energy materials currently going into landfills into high-energy content liquid product capable of displacing energy imports used for fuel or chemical production.

b. Specific programs relevant to alternative fuels include: Energy and Carbon Optimized Synthesis for the Bioeconomy (ECOSynBio), REFUEL Integration and Testing Program, and Solicitation on Topics Informing New Program Areas - Recycle Underutilized Solids to Energy program.

3. Office of Fossil Energy and Carbon Management ($221M): FECM is developing technologies that leverage the fossil energy infrastructure for H_2 production, transportation, storage, and use coupled to carbon management (CCUS). FECM will also invest in approaches that reduce methane emissions from the oil, gas (e.g., fugitive methane and flaring), and coal (methane emissions from active and abandoned mines/wells) industries toward the production of useful chemicals such as ammonia. Hydrogen offers an emissions-free fuel for power generation, industrial applications, and the transportation sector. Co-firing waste fossil fuels with waste biomass or plastics, coupled to CCUS, in addition to mineral and carbon extraction from coal using safe and sustainable technologies, will leverage both regional resources and existing labor forces to achieve a clean energy economy. CCUS and Carbon Dioxide Removal are crosscutting technologies for many industrial sectors (hydrogen, biofuels, cement, steel, and power) to enable removal and conversion of CO_2 from the atmosphere to reach the 2050 decarbonization goal. Areas of collaboration in FY 2022 include:
    a. High temperature electrolysis development and reversible fuel cells;
    b. Studies of biomass supply available as feedstock for decarbonization technologies and the sustainability of biomass supply over time;
    c. Utilization of municipal solid waste, including non-recyclable plastics;
    d. Advancing polygeneration, including co-gasification with waste biomass;
    e. Regional studies of hydrogen infrastructure requirements; and
    f. Systems analysis focused on techno economics, life-cycle analysis, and market modules to support hydrogen deployment.
    g. Advanced materials to establish a new domestic supply chain of hydrogen resistant materials.

Pre-combustion capture technologies for gasification and pyrolysis systems can be used to remove carbon from the fuels produced, such as hydrogen or ammonia. Post combustion technologies can remove CO_2 from fermentation systems and auxiliary heater and boilers supporting alternative fuels systems. Carbon capture technologies, when coupled with carbon storage, can support pathways to net-zero or even negative, depending on the amount of CO_2 captured. Finally, CO_2 utilization investments are focused on developing advanced catalysts and processes to convert CO_2 with renewable hydrogen to fuels.

4. Science: The Office of Science supports foundational, crosscutting, fundamental research relevant to alternative fuels that underpin the technology offices activities. The SC research supports innovative, field-leading research that is not technology-specific.
    a. Basic Energy Sciences: $107M: Research activities in Basic Energy Sciences include the Fuels from Sunlight Hub program, Energy Frontier Research Centers, and core research activities to advance clean-energy applications. The focus of this research is on discovery, design, and synthesis of novel materials and the development of the understanding required to control the complex chemical mechanisms important in the production of alternative fuels. This crosscutting science provides knowledge to enable the efficient generation of fuels by photoelectrochemical and electrochemical routes. Examples include hydrogen production from water splitting directly using solar energy or using renewably generated electricity, and conversion of plentiful feedstocks (e.g., carbon dioxide and nitrogen) into chemical fuels. Research grants and National Laboratory research support postdoctoral, graduate, and undergraduate research activities. Other programs include support of graduate student internships at National Laboratories, as well as Small Business Innovation Research topics in membranes for photoelectrochemical and electrochemical systems. SC user facilities host broad community research and industrial users who advance energy storage technologies.
    b. Biological and Environmental Research: $104M (Biological Systems Science/Bioenergy Research Centers) The Bioenergy Research Centers (BRCs) are major multidisciplinary, multi-institutional research centers conducting research to achieve the basic science breakthroughs needed to produce alternative fuels, chemicals and materials, currently derived from petroleum, from renewable sustainable plant biomass cost-effectively on a commercial

scale. The four BRCs are (1) the Great Lakes Bioenergy Research Center, led by the University of Wisconsin-Madison in partnership with Michigan State University; (2) the Center for Bioenergy Innovation, led by Oak Ridge National Laboratory; (3) the Joint BioEnergy Institute, led by Lawrence Berkeley National Laboratory; and (4) the Center for Advanced Bioenergy and Bioproduct Innovations (CABBI) led by the University of Illinois Urbana-Champaign. Each center performs foundational, basic research to underpin production of a range of renewable alternative fuels and bioproducts from a suite of potential bioenergy crops, using a broader range of microbial hosts for conversion processes. These efforts are distinct but coordinated with applied research and demonstration projects supported within the DOE Office of Energy Efficiency and Renewable Energy's Bioenergy Technologies Office and ARPA-E.

This includes a network of user facilities and coordinated R&D efforts to ensure rapid innovation and progress in a variety of technology areas.

The Alternative Fuels Crosscut strives to include the leading activities and technologies across multiple DOE Offices to meet goals. Informal quarterly meetings are held between EERE, SC, FE, and ARPA E to share information and look for synergies. Examples include fundamental understanding of catalysts and membranes to applied electrolysis R&D, the use of hydrogen and carbon dioxide to produce synfuels, and direct electrochemical reduction of carbon dioxide – which span the offices of SC, EERE, FE, and ARPA-E. Technical expertise is shared through joint workshop planning and attendance, semi-/annual program peer reviews and project merit reviews. Shared understanding of regional and sustainability analyses, lifecycle emissions and supply chain assessments are planned for FY 2022. Shared staff through details enables a clearer understanding of the unique and similar aspects of the Offices.

Biotechnology Crosscut

Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($Change)
Advanced Research Program Agency-Energy	**47,100**	**500**	**TBD***	**TBD***
Advanced Research Program Agency-Energy	47,100	500	0	0
Energy Efficiency and Renewable Energy	**53,350**	**59,375**	**57,250**	**-2,125**
Bioenergy Technologies	53,350	59,375	57,250	-2,125
Science	**638,608**	**640,728**	**658,935**	**+18,207**
Advanced Scientific Computing Research	10,000	10,000	10,000	0
Basic Energy Sciences	223,829	228,154	242,435	+14,281
Biological and Environmental Research	404,779	402,574	406,500	+3,926
Grand Total	**739,058**	**700,603**	**716,185***	**+16,082***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Summary:

The bioeconomy accounted for about five percent of the U.S. gross domestic product in 2016 and could play a major role in global decarbonization efforts across transportation, industry, and agriculture. DOE invests in biotechnology including fundamental science, tool development and targeted capabilities to support technologies as they mature from applied research to demonstration at commercially-relevant scales. These include bioengineering and bioprocessing technologies to optimize microbes and plants for production of biofuels and bioproducts, as well as enhancing the ability of bioenergy crops and residue to help sequester carbon in soils. Activities focus on enabling biotechnology to tackle challenges in hard to decarbonize sectors by enhancing the relationship between fundamental discovery and technology application, helping to put the United States on an irreversible path to a net-zero economy by 2050.

Crosscut Objectives:

- *Innovation built on strong foundations:* Exploit and improve on genomic diversity within Nature to identify new biological, bioinspired, and biohybrid functions.
- *Enhance access to tools and facilities:* Facilitate user access and interoperability between SC user facilities relevant to biotechnology.
- *Increase range of production of biofuels and bioproducts:* Conduct R&D to increase the variety of sustainable biofuels and bioproducts made from plants and microbes.
- *Develop advanced modeling and data analytics for biotechnology:* Creating integrative, collaborative, and open access computational platforms for biotechnology, with capabilities in Artificial Intelligence and Machine Learning techniques.

Program 'Action Areas':

DOE program offices (Office of Science, Energy Efficiency and Renewable Energy, Advanced Research Projects Agency - Energy - will:

1. *Strengthen Cross-DOE Coordination and Collaboration:* Ensure an integrated approach including clearly defined "swim lanes" and "relay points," to avoid duplication and increase collaboration, share best practices for

management of user facilities and other community resources, workshops and PI meetings, community/stakeholder engagement, and data/information sharing.

2. ***Support Fundamental and Applied R&D and Technology Transfer:*** Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer to enable dissemination and scale-up for biotechnology.

3. ***Develop coordinated "use cases" and collaborations to identify technical and process (workflow) challenges:*** Establish informal working groups and formal collaborations to regularly assess the state of biotechnology and DOE's readiness to facilitate the entire biotechnology workflow.

4. ***Coordinate on Workforce/STEM and Diversity, Equity, and Inclusion:*** Collaborate on best practices and accelerate progress towards common goals.

Program Organization:

Science ($658.9M):

1. Advanced Scientific Computing Research: ($10M FY 2022 request) ASCR employs high performance computing and the exascale ecosystem to accelerate progress in biotechnology across mission areas and national priorities. Through partnerships and collaborations within the Office of Science, DOE and related mission agencies (National Institutes of Health (NIH), U.S. Department of Agriculture) ASCR is advancing the foundational research, computational readiness, and HPC access for biotechnology applications that underpin predictive capabilities for climate, National preparedness and security, and other DOE missions.

   a. Computational Partnerships supports collaborations with Biological and Environmental Research and NIH to incorporate ASCR research, methods and capabilities into mission critical applications to drive innovation and harness the potential of high performance computing (HPC) to provide insights and predictive models that support an array of biotechnology goals.

   b. Existing partnerships with the National Cancer Institute and NIH incorporate DOE expertise in multiscale modeling, artificial intelligence, data management and workflows, collaborative community driven model development, and HPC with grand challenges in cancer and health to validate existing methods across diverse datasets and applications and to generate new, hybrid methods that accelerate progress in improving health outcomes and DOE mission critical applications. This includes new efforts to explore the technical readiness and feasibility of digital twin technology to improve cancer treatment outcomes and the development of clinically informed predictive models of radiation impacts on human health across time and length scales.

   c. ASCR is expanding partnerships to include new collaborations with applications focused on emergency response to build an enhanced response capability with state-of-the-art predictive models that leverage the DOE exascale ecosystem and can be rapidly employed when needed.

2. Basic Energy Sciences: ($242.4M FY 2022 request) BES supports fundamental chemical and materials research to underpin the development of biotechnology. Research supported by BES may also use biotechnological approaches to understand molecular and atomic mechanisms in biochemical and chemical processes and structures which, in turn, may advance new biotechnologies. BES provides tools for characterizing biotechnology-relevant materials and processes through x-ray, neutron, electron beam scattering, and nano-science capabilities.

   a. BES biosciences programs support basic research to provide mechanistic understanding of the biochemistry, chemistry, and biophysics of energy capture, conversion, and storage in plants and microbes. Research provides insights into the mechanisms of light harvesting and creation and transport of energy carriers in natural photosynthesis, develops molecular-level understanding of redox and active site protein chemistry controlling energy and molecular conversions, and discovers biochemical and biophysical

principles that determine the synthetic pathways to produce biomolecules and structures with specific architectures. These detailed mechanistic studies can enable strategies for biotechnology-based approaches to energy capture and conversion.

b. BES research on biomolecular materials focuses on the creation of robust, scalable, energy-relevant materials and systems with emergent behavior that work with the extraordinary effectiveness of molecules and processes of the biological world, foundational for biotechnology applications.

c. Research in catalysis science and solar photochemistry focuses on mechanistic understanding of energy and molecular conversion processes that establish a foundation for development of bio-inspired, biohybrid and biomimetic systems. Future research areas include programmable biomaterials and biocatalysts, neuromorphic computing, and design of chemical processes and integrated systems. Next-generation tools will foster new developments in biotechnology.

d. Advances at BES scientific user facilities will ensure a broad science and capability base for research at the interface of physical, biological, and computational sciences to understand integrated systems, including those driving or developed through biotechnology.

3. Biological and Environmental Research: ($406.5M FY 2022 request) BER employs biotechnological approaches such as genome sequencing, proteomics, metabolomics, structural biology, high-resolution imaging and characterization, and integration of information into computational models that can be iteratively tested and validated to advance a predictive understanding of biological systems for DOE mission goals.

a. Genomic Science supports fundamental research on discovery and manipulation of genome structure, regulatory elements and epigenetic controls to understand genotype to phenotype translations in microbes and plants. These efforts include biosystems design research to explore genomic pathway design and new secure gene-editing and multi-gene stacking techniques for designing new functions into plants and microbes providing a crucial foundation for advancing biotechnology.

b. Additionally, these efforts seek to gain an understanding of how genomic mechanisms translate to understanding the functioning of plants and soil microbial communities in the environment. This information leads to understanding how plants and microbes impact the cycling and fate of carbon, nutrients, and contaminants in the environment and contribute to more sustainable ecosystems.

c. Advances in genomic science increasingly require integrative, collaborative, and open access computational platforms to converge on optimized solutions for clean energy production and renewable products. New capabilities in AI/machine learning techniques will aid discovery of novel processes and key insights into the functioning of biological systems by examining enormous datasets with powerful analytics to discover new biological principles hidden in complex multivariate data.

d. BER supports four Bioenergy Research Centers (BRCs) engaged in multidisciplinary genome-enabled biotechnology research to sustainably produce a range of bioenergy and bioproducts from renewable plant biomass. The BRCs seek to identify the genomic underpinnings of complex plant traits in crops with promising bioenergy/bioproduct characteristics, streamline biomass deconstruction processes to funnel plant components into defined process streams, design new pathways in microorganisms to convert plant biomass to a range of fuels, chemicals and products, and develop the needed agronomic understanding of how to manage bioenergy crops for sustainable production on marginal lands laying the scientific foundation for a broader bio-based economy.

e. New quantum-enabled instrumentation for imaging biological processes will be explored in Biomolecular Characterization and Imaging Science for visualizing cellular metabolism non-destructively. Multimodal imaging concepts will also be pursued to create integrative systems to validate hypotheses of cellular function or design of new process.

f. The Joint Genome Institute (JGI) provides users with high quality genome production and new analysis techniques for complex plant and microbiome samples. Integrative activities with the DOE Systems Biology Knowledgebase will provide new cross-platform capabilities for JGI users and users of the new National Microbiome Data Collaborative () providing information on how microbial communities function in a variety of environments.

Energy Efficiency and Renewable Energy ($57.3M):

1. Energy Efficiency and Renewable Energy ($57.3M): EERE's Bioenergy Technologies Office () focuses on developing bioengineering techniques to optimize production of targets (fuels, chemicals, and materials) in microbes. These RD&D activities include:

   a. Agile BioFoundry, a consortium of seven National Laboratories that brings together world-class biotechnology capabilities to target a 50 percent reduction in the time and cost to bring new bio-derived molecules to market by speeding up the Design-Build-Test-Learn cycle.

   b. Biological engineering including enzymatic hydrolysis, fermentation, downstream separations, and catalysis as a part of its State of Technology pathways which demonstrate transformation of bio-based feedstocks into jet fuels and chemicals.

   c. Biological methods for plastic deconstruction and upcycling including optimization of novel enzymes and organisms to achieve commercial relevance.

Advanced Research Projects Agency - Energy (TBD):

1. ARPA-E funds early-stage research and development programs focused on non-traditional approaches and high risk/high impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. Examples include:

   a. Accelerating innovative concepts such as: sensing, analytics, and phenomics for biofuels; synthetic biology to extract critical materials; and establishing technologies to improve the carbon efficiency of bioconversion platforms

   b. Specific programs relevant to the Biotechnology Initiative include: Solicitation on Topics Informing New Program Areas - Biotechnologies to Ensure a Robust Supply of Critical Materials for Clean Energy (TINA-Biomining), Systems for Monitoring and Analytics for Renewable Transportation Fuels from Agricultural Resources and Management (SMARTFARM), and Energy and Carbon Optimized Synthesis for the Bioeconomy (ECOSynBio).

Carbon Dioxide Removal Crosscut

Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Projects Agency-Energy	**3,895**	**1,944**	**TBD***	**TBD***
Advanced Research Projects Agency-Energy	3,895	1,944	TBD*	TBD*
Energy Efficiency and Renewable Energy	**20,325**	**20,350**	**20,700**	**+350**
Advanced Manufacturing Office (AMO)	10,000	10,000	10,000	0
Bioenergy Technologies (BETO)	10,000	10,000	10,000	0
Water Power Technologies Office (WPTO)	325	350	700	+350
Fossil Energy and Carbon Management	**20,000**	**40,000**	**63,000**	**+23,000**
Carbon Dioxide Removal	20,000	40,000	63,000	+23,000
Science	**~27,500**	**~35,500**	**~45,500**	**~+10,000**
Basic Energy Sciences	~4,500	~12,500	~22,500	~+10,000
Biological and Environmental Research	~23,000	~23,000	~23,000	0
Grand Total, Carbon Dioxide Removal	**~71,720**	**~97,794**	**~129,200***	**+33,350***

*ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

FY 2021 Enacted (aggregated): ~$97,794

FY 2022 Request (aggregated): ~$129,200

Summary:

Carbon dioxide (CO_2) removal (CDR) is vital to ensuring a net-zero-carbon economy by 2050 and avoiding the worst impacts of the climate crisis. Distinct from point source carbon capture and storage (CCS), CDR comes in many forms, from improved forest management to using chemicals, novel materials, or minerals to separate CO_2 directly from the atmosphere. Projects in the CDR crosscut will invest in enhancement of natural and biological systems as well as engineered technologies that remove CO_2 from the atmosphere or oceans and durably store it in geological, terrestrial, or ocean reservoirs, or in products. These approaches include, but are not limited to, bioenergy with carbon capture and sequestration (BECCS), direct air capture (DAC) with durable storage, biological methods, enhanced mineralization, soil carbon sequestration, afforestation and reforestation, direct ocean capture (DOC), enhanced ocean alkalinity, and coastal blue carbon. Within these approaches, the technology or mechanisms for CO_2 removal are variable, leading to challenges in how to quantify reductions via lifecycle analyses, and how to accurately define the economics and costs. The essentiality of CDR requires increased and collaborative investment across the full research, development, demonstration and deployment (RDD&D) spectrum such that breakthroughs are rapidly transferred and scaled and that deployment of first-of-its kind technologies quickly informs the next generation of innovation.

Crosscut Objectives:
- *Capturing Carbon Emissions Directly from the Air and Ocean:* Conduct RDD&D on CDR technologies and systems. These approaches include, but are not limited to BECCS, DAC, biological approaches, geologic/enhanced mineralization, soil carbon sequestration, afforestation/re-forestation, DOC, enhanced ocean alkalinity, and coastal blue carbon.
- *Remove Carbon Emissions Directly from the Air and Ocean:* Conduct RDD&D on CDR technologies and systems.
- *Enable Low-Cost and Scalable CDR Infrastructure:* Identify and address critical barriers to reducing the costs and energy requirements for CDR systems through targeted research investments. Promote and demonstrate the strategic deployment of diverse CDR systems and strategies.
- *Address Resource and Sustainability Requirements:* Assess availability of primary energy, water, and other inputs to ensure holistic, sustainable, low and negative-life-cycle emissions pathways, and ensure the stewardship of our communities, natural resources, and the environment. For demonstration and deployment projects, coupling carbon accounting through life cycle and techno-economic analyses are critical to assessing the net amount and timescale of carbon removal alongside associated costs.

- ***Innovate:*** Foster crosscutting fundamental science and applied research and development (R&D) to enable breakthroughs along the carbon removal and utilization value chain.

<u>**Program 'Action Areas':**</u> The Department of Energy (DOE) Program offices Energy Efficiency and Renewable Energy (EERE), Fossil Energy and Carbon Management (FECM), Science (SC), and Advanced Research Projects Agency-Energy (ARPA-E) will:

1. ***Strengthen Cross-DOE Coordination and Collaboration:*** Ensure an integrated approach including clearly defined "swim lanes" and "relay points," integrated systems analysis, workshops and Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.
2. ***Support Fundamental and Applied R&D and Technology Transfer:*** Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer to enable DOE to meet program goals.
3. ***Conduct Systems Analysis:*** Conduct life cycle, resource, regional, and techno-economic analyses to guide the portfolio and strategy.
4. ***Promote Safety Sharing:*** Share best practices and resources and make safety a priority in our activities and projects.
5. ***Coordinate on Workforce/STEM and Diversity, Equity, and Inclusion:*** Collaborate on best practices and accelerate progress towards common goals.

<u>**Program Organization:**</u>

1. ***Energy Efficiency and Renewable Energy ($20.7M)***: EERE has longstanding investments in removing carbon dioxide from the atmosphere through biological, chemical, and engineering approaches as well as a strong portfolio in carbon dioxide utilization research. In recent years and looking ahead, EERE seeks to increase efforts in terrestrial and saltwater based technologies, systems, and practices that draw down carbon. EERE focuses on CDR through the following activities:
    a. Bioenergy Technologies (BETO) supports RDD&D on technologies, systems and practices to increase carbon removal from biomass, including sustainable agriculture, forest management, and the use of biomass CO_2 from point sources and DAC technologies to improve the productivity of algal biomass. The FY 2022 Budget Request will initiate an R&D program to study sustainable agriculture practices and help farmers maximize profits on marginal lands while providing valuable feedstocks for bioenergy production. This work includes developing tools and remote sensors for soil carbon monitoring, researching the long-term carbon-drawdown potential of biochar, pursuing landscape design analysis, and investigating the feasibility and carbon sequestration potential of sustainable BECCS practices, including biomass conversion to advanced fuels and chemicals.
    b. Advanced Manufacturing Office (AMO) is developing technology to improve the feasibility of DAC through manufacturing improvements to DAC sorbents and intensified process development that couples DAC with durable and using industrial byproducts, such as steel slags and mine tailings, for carbon mineralization to produce products for beneficial use and/or local carbon sequestration.
    c. Water Power Technologies Office (WPTO) will build on its National Laboratories seed funding program and internal scoping activities to further investigate the role of marine energy in CDR in FY 2022. Investments may include understanding the energy requirements of offshore seaweed farming for CDR with AMO and ARPA-E; building on Pacific Northwest National Laboratory/National Oceanic and Atmospheric Administration's Pacific Marine Environmental Laboratory research interests, including ocean observing to assess ocean-based CDR projects, sustainable mariculture for CO_2 offsets, and methods for ocean alkalinity enhancement and CDR in coastal ecosystems; and a host of foundational R&D projects at National Laboratories and universities to understand energy requirements, siting, and energy storage needs of marine-energy powered CDR.
2. ***Fossil Energy and Carbon Management (FECM) ($63M)***: FECM focuses primarily on engineered CDR approaches that include chemicals, minerals and biological pathways. FECM has been working on carbon capture, utilization, and storage (CCUS) projects for almost 20 years and has invested heavily in the development of technologies to capture CO_2 from power plants and industrial sources. More recently, DOE has been applying this technology development to various approaches, including BECCS and DAC coupled to dedicated storage. The FECM CDR subprogram is a new budget line in the FY 2022 Budget Request and funding is focusing on DAC, BECCS, and mineralization concepts. However, it builds upon past CCUS efforts which have been funded through FECM's CCUS activities, such as past work on DAC, mineralization, co-firing of biomass, and capture technology development. RDD&D activities include:
    a. DAC with durable storage: FECM funds significant DAC research, development and demonstration (RD&D) alongside all carbon storage research at DOE. This includes transformational DAC materials and components, pilot-scale testing, front-end engineering and design () studies, and large-scale extended tests. FECM is requesting funds for the DAC Test Center at a National Energy Technology Laboratory campus.

b. Biomass waste R&D: R&D on biomass waste coupled with CCUS which offers an opportunity for near-term deployment of CDR technologies. This includes gasification of waste feedstocks, such as plastics and sustainably-available biomass waste with CCUS;

c. Enhanced mineralization: FECM has and is continuing to invest in RDD&D for in situ, ex situ, and surficial mineralization opportunities; and,

d. Significant RDD&D investments and work for geological CO_2 storage and CO_2 transport. Coupled to CO_2 capture processes, such as bioenergy and DAC, reliable storage on timescales that will positively impact climate are of central focus. For example, reliable storage on the scale of 1000s years is desired, which may include geologic storage deep underground, or the conversion of CO_2 to synthetic aggregates (replaces sand and gravel for construction) or plastics.

3. *Science (~$45.5M)*: SC provides foundational knowledge and state-of-the-art capabilities in support of crosscut objectives and has supported theoretical and experimental science related to understanding chemical and biological processes, separations, materials, and geochemistry related to carbon capture for many years. Key activities for DAC of CO_2 include:

   a. Supporting scientific discoveries and major scientific tools to transform our understanding of CO_2 chemistry, gas separation systems, and materials important to DAC technologies. Research focuses on energy transfer mechanisms for efficient regeneration and mass transport, interfacial mechanisms to enable control of mineral dissolution and formation rates, and science-driven synthesis. Topics emphasize novel materials and chemical systems including: Membranes – polymeric membranes; adsorbents – porous metal organic framework materials; solvents – CO_2 binding organic liquids; interfacial geochemistry – important for CO_2 mineralization and sequestration; and reactive separations.

   b. In addition, SC operates major x-ray, neutron, nanoscience, genome sequencing, and high-performance computing user facilities that provide advanced synthesis, fabrication, characterization, and computational capabilities to this community for basic, applied, and industrial research.

   c. In related research, there is a focus on increasing understanding of the use of critical materials such as platinum group metal catalysts and to reduce the dependence on such materials (Critical Minerals/Materials Crosscut).

   d. Fundamental systems biology research on i.) plants and plant microbiomes to capture atmospheric CO_2 and sequester stabilized forms of carbon in biomass and soil, and ii.) algal systems to convert gaseous CO_2 waste streams into a broad range of bioproducts in support of other DAC technologies.

4. *Advanced Research Projects Agency - Energy ($TBD)*: ARPA-E funds early-stage R&D programs focused on non-traditional approaches and high risk/high impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. Examples include:

   a. Accelerating innovative concepts such as: establishing robust, energy efficient, and low-cost strategies for direct removal of CO_2 from oceanwater (or other natural waters) and ambient air.

   b. Specific programs relevant to CDR include: Solicitation on Topics Informing New Program Areas – Direct Removal of CO_2 from Oceanwater (TINA-DOC) program and Solicitation on Topics Informing New Program Areas – Direct Removal of CO_2 from Ambient Air (TINA-DOA) program.

Funding by Appropriation and Program Control

($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Projects Agency-Energy	**36,030**	**10,000**	**TBD***	**TBD***
Advanced Research Projects Agency-Energy	36,030	10,000	TBD*	TBD*
Energy Efficiency and Renewable Energy	**299,750**	**278,050**	**365,700**	**+87,650**
Advanced Manufacturing Office	30,000	20,000	15,000	-5,000
Bioenergy Technologies Office	259,500	255,000	340,000	+85,000
Hydrogen and Fuel Cells Technologies Office	9,925	2,700	10,000	+7,300
Water Power Technologies Office	325	350	700	+350
Fossil Energy and Carbon Management	**217,800**	**228,300**	**368,000**	**+139,700**
Carbon Capture	97,800	86,300	150,000	+63,700
Carbon Storage	79,000	79,000	117,000	+38,000
Carbon Utilization	21,000	23,000	38,000	+15,000
Carbon Dioxide Removal	20,000	40,000	63,000	+23,000
Science	**31,500**	**36,700**	**46,700**	**+10,000**
Basic Energy Sciences	8,500	13,700	23,700	+10,000
Biological and Environmental Research	23,000	23,000	*	0
Grand Total, Carbon Management Crosscut	**585,080**	**553,050**	**780,400***	**+237,250***

*ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

FY 2021 Enacted (aggregated): $553,050,000
FY 2022 Request (aggregated): $780,400,000

<u>Summary:</u>
The serious threats of the climate crisis necessitate that solutions are developed and deployed to manage carbon emissions and waste streams. Carbon management includes a broad portfolio of approaches including carbon capture, utilization, and storage of emissions at point sources, the increased use and recycling of renewable carbon and waste carbon feedstocks, as well as carbon dioxide (CO_2) removal (CDR) technologies and approaches.

Carbon capture and storage is a process that captures and reliably stores CO_2 emissions from point sources like natural gas power plants or cement plants so it will not enter the atmosphere. In carbon capture and utilization, captured emissions are converted into useable products such as fuels, chemicals, and building materials. Use and recycling of renewable carbon and wastes constitutes collecting and converting carbon polymers such as sorted municipal solid waste (MSW), plastics, agricultural residues, biosolids, manures, and food waste into energy and other higher value products. CDR comes in many forms, from improved forest management to using chemicals, novel materials, or minerals to separate CO_2 directly from the atmosphere. Projects in the CDR crosscut will invest in enhancement of natural and biological systems as well as engineered technologies that remove CO_2 from the atmosphere or oceans and durably store it in geological, terrestrial, or ocean reservoirs, or in products.

Not only is carbon management essential to achieving a net-zero-carbon economy by 2050; it is also a centerpiece to ensuring a just and equitable energy transition. Further, successful management of supplies of renewable carbon, carbon oxides, and carbon wastes enables a circular economy wherein generated emissions, byproducts, and wastes are repurposed to generate new employment and economic opportunities. Realizing these opportunities and mitigating the climate crisis, requires increasing the deployment of more mature carbon management technologies and infrastructure, reducing costs and accelerating the scale-up of new technologies and approaches, and achieving fundamental research and process breakthroughs. It also requires developing a diverse portfolio of technologies and approaches so that communities can adopt a carbon management strategy fit for their needs.

The carbon management crosscut benefits from and advances the mission of several other crosscuts, including but not limited to: Alternative Fuels, Hydrogen (H₂), Decarbonizing Industry, and Biotechnology. In addition, the CDR crosscut is an important subset of this crosscut.

<u>Crosscut Objectives:</u>
- ***Research, develop, demonstrate, and deploy carbon capture and storage:*** Conduct fundamental science and applied research, development, demonstration, and deployment (RDD&D) on carbon capture technologies from point sources, the atmosphere, and the oceans and on novel materials and chemistries for carbon storage. Additional information on research related to carbon removal from the atmosphere and oceans is described in the CDR Crosscut.
- ***Develop and Enable Low-Carbon Supply Chains, End Uses, and Infrastructure:*** Develop, reduce costs, and deploy novel approaches to recycle carbon oxide (CO_x) emissions, principally CO_2, into value-added products such as cement, concrete, steel, chemicals, and fuels using systems-based carbon management approaches.
- ***Accelerate Carbon-Neutral Hydrogen (H_2):*** Develop technologies that leverage the natural gas infrastructure for H_2 production, transportation, storage, and use coupled to carbon management. Hydrogen offers an emissions-free fuel for power generation, industrial applications, and the transportation sector.
- ***Develop and Enable Renewable Carbon Supply Chains, Circular Carbon Lifecycles and Infrastructure:*** RDD&D approaches that extend the useful lifecycle of renewable sources of carbon, including biomass, and carbon-based resources at their end of life. Approaches may include reuse or use towards the production of fuels and products to provide cost-effective, scalable, and renewable fuels, chemicals and materials.
- ***Invest in Thoughtful Transition Strategies:*** Invest in technologies and approaches and deploy regional initiatives to help in the transition to a net-zero carbon economy. Engage stakeholders in frontline, coal, and fossil-based power plant communities, and cooperatively develop strategies that leverage regional carbon resources, place-based capabilities and existing labor forces to achieve a clean energy economy.

<u>Program 'Action Areas':</u> The Department of Energy (DOE) Program Offices in this crosscut are the Office of Fossil Energy and Carbon Management (FECM), Office of Energy Efficiency and Renewable Energy (EERE), Office of Science (SC), and Advanced Research Projects Agency-Energy (ARPA-E) will:
1. ***Strengthen Cross-DOE Coordination and Collaboration:*** Ensure an integrated approach including clearly defined "swim lanes" and "relay points," integrated systems analysis, workshops and Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.
2. ***Support Fundamental and Applied Research and Development (R&D) and Technology Transfer:*** Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer to enable DOE to meet programmatic goals.
3. ***Conduct Systems Analysis:*** Conduct life cycle, resource, regional, and techno-economic analyses to validate technologies and to guide the portfolio and strategy.
4. ***Coordinate on Regional Transition Action Plans:*** Conduct studies on regional deployment of carbon management strategies, coupled with other crosscut activities such as CDR, Hydrogen, Alternative Fuels, Biotechnology, and Decarbonization of Industry as potential transition strategies in communities, preventing economic and job losses in the clean energy transition.

<u>Program Organization:</u>
1. ***Fossil Energy and Carbon Management ($368M):*** FECM has been working on carbon capture, utilization, and storage (CCUS) projects for almost 20 years and has invested heavily in the development of technologies to capture CO_2 from power plants and industrial sources.
   a) ***Carbon Capture:*** The Carbon Capture activity has completed its efforts in first-generation technology through successful demonstration projects. The FY 2022 Budget Request provides $150 million to the Carbon Capture activity for pre- and post-combustion capture RDD&D on transformational gas separation technologies (at least 95% of the CO_2 at 95% purity) that can help achieve decarbonization goals. FY 2022 activities represent a focus on new capture technologies in addition to the demonstration of more proven capture approaches. Additionally, the Carbon Capture program will leverage its prior and current RDD&D experience on carbon capture technology development for application to industrial applications. RDD&D will focus on optimization of technologies for these applications to reduce cost and improve performance.
   b) ***Carbon Utilization:*** The FY 2022 Budget Request provides $38 million for this activity for early-stage CO_2 utilization technologies that have the potential to develop additional markets for CO_2 based-products. Areas of research include, but are not limited to, new projects focused on the catalytic conversion to higher value products such as fuels, chemicals, polymers, and nutraceutic ls; mineralization to building products; generation of solid

carbon products; and algal systems designed to integrate CO_2. Specific focus on catalysts made from low-cost materials and improved reactor designs will be pursued to lower the energy penalty and capital cost of the conversion process. Funding will support the development of at least one, fully integrated field-test system as well as continued support for carbon utilization test facilities at the National Carbon Capture Center in Alabama.

c) **Carbon Storage:** The FY 2022 Budget Request provides $117 million for RDD&D activities that address the performance challenges of operating and monitoring commercial scale CO_2 storage sites. The RDD&D supported by the Carbon Storage subprogram in FY 2022 will aim to improve storage and operational efficiency, improve understanding of overall cost and de-risking strategies to reduce it. Achieving each of these elements is critical for enabling a CCUS industry that is safe, economically viable, and environmentally benign.

d) **Carbon Dioxide Removal:** More recently, the Department has been applying this technology development to various negative emissions technologies (NET), including bioenergy with carbon capture and storage (BECCS) and direct air capture (DAC) coupled to dedicated storage. The FECM CDR subprogram is a new budget line in the FY 2022 Budget Request at $63 million. Funding is focused on DAC, BECCS, and mineralization concepts. However, it builds upon past CCUS efforts, which have been funded through FECM's CCUS activities, such as past work on DAC, mineralization, co-firing of biomass, and capture technology development. RDD&D activities include:

- Conducting materials and components RDD&D, pilot-scale testing, front-end engineering and design studies, and large-scale extended tests;
- R&D on biomass waste coupled with CCUS which offers an opportunity for near-term deployment of CDR technologies;
- Development of transformational DAC materials and components;
- Feasibility studies of current DAC systems;
- National Laboratory RDD&D on mineralization and enhanced weathering concepts; and
- Evaluation of waste biomass co-feeding concepts with CCUS at existing facilities.

2. **Energy Efficiency and Renewable Energy ($365.7M):** EERE has several offices, including the Advanced Manufacturing Office (AMO), Bioenergy Technologies Office (BETO), Hydrogen and Fuel Cell Technologies Office (HFTO) and Water Power Technologies Office (WPTO) that work on carbon management.

a) AMO ($15.0M) has a long history of improving manufacturing systems, processes, and components to increase energy efficiency across the industrial sector. This includes sustainable manufacturing, which seeks to minimize resource extraction through circular economy approaches to material production. More recently, AMO expertise in industrial systems and manufacturing has been used for more efficient and cost-effective carbon capture and utilization technology. It is also helping design more productive capture systems through integration with industrial processes.

b) BETO ($340.0M) focuses on the management of renewable carbon sources, such as cellulosic biomass, algae, and wet wastes (e.g. biosolids) as well as other carbon sources like MSW and CO_2. BETO has long supported development and demonstration to recycle carbon from industrial off-gases, reformed biogas, and syngas generated from biomass or MSW. BETO's mission is to develop the technologies needed to utilize renewable carbon resources and convert them into low-carbon fuels, chemicals, and products. Recognizing that CO_2 is a major cost-driver for algae cultivation, BETO funds research at the interface of algae cultivation and DAC. BETO is also at the forefront of several CDR technologies, including BECCS and soil carbon sequestration.

c) HFTO ($10.0M) supports deep-decarbonization across sectors through the H2@Scale initiative, which includes the utilization of clean hydrogen derived from diverse renewable resources to decarbonize end uses in transportation, power generation and the industrial/chemicals sectors. Topic areas relevant to decarbonization through carbon management include the use of clean hydrogen with captured CO_2 in the synthesis of renewable fuels, waste-to-hydrogen projects that help manage carbon in organic feedstocks, and novel iron and steel refining processes using clean hydrogen as a reduction agent.

d) WPTO ($700,000) supports CDR efforts as described in the Carbon Dioxide Removal crosscut.

3. **Science ($46.7M):** SC provides foundational knowledge and state-of-the-art capabilities in support of crosscut objectives and has supported theoretical and experimental science related to understanding chemical and biological processes, separations, materials, and geochemistry related to carbon capture, utilization and storage for many years. SC's Basic Energy Sciences (BES) Program has a wide range of fundamental and basic research programs that advance the scientific foundations to enable the development of new technologies in these areas, with recent emphasis on DAC. BES research emphasizes the discovery, design, and understanding of new materials and new chemical, biochemical, and geological processes at atomic through macroscopic levels, as a basis for new approaches to harness energy

resources and mitigate impacts of energy use. SC's Biological and Environmental Research Program uses insights obtained from fundamental systems biology research, including sequenced genomes of plants and microorganisms to understand natural processes of carbon capture, sequestration of stabilized forms of carbon in biomass and soil, and conversion of gaseous CO_2 waste streams by algal systems to form a broad range of bioproducts. In addition, SC operates major x-ray, neutron, nanoscience, genome sequencing, and high-performance computing user facilities that provide advanced synthesis, fabrication, characterization, and computational capabilities to this community for basic, applied, and industrial research. In addition, SC also supports CDR efforts in the CDR crosscut.

4. ***Advanced Research Projects Agency - Energy ($TBD)****:* ARPA-E has funded on-going exploratory programs focused on non-traditional approaches and high risk/high impact concepts. Funding for advanced research efforts is directed through focused programs developed through workshopping efforts that take into account agency mission and stakeholder priorities. Current carbon capture, utilization and management efforts include support for efficient point source carbon capture as well as enabling biochemical, thermochemical, electrocatalytic, and hybrid carbon utilization strategies. Specific examples include:
    a) Advancing innovative concepts such as: functional material storage, flexible point source carbon capture, gas fermentation of CO_2, reactive capture of CO_2, electrocatalytic reduction of CO_2, low cost renewable H_2 production, and gas and sugar fermentation via non-oxidative synthetic biopathways.
    b) Specific programs relevant to carbon management include: Solicitation on Topics Informing New Program Areas – Extremely Durable Concretes and Cementitious Materials program, Renewable Energy to Fuels Through Utilization of Energy-Dense Liquids (REFUEL) program, FLExible Carbon Capture and Storage (FLECCS) program, and Energy and Carbon Optimized Synthesis for the Bioeconomy (ECOSynBio) program.

Climate and Clean Energy

Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 22 vs. FY 21 ($ Change)
Advanced Research Projects Agency-Climate	0	0	200,000	+200,000
Advanced Research Projects Agency-Energy	425,000	427,000	500,000	+73,000
Electricity	0	0	300,000	+300,000
Energy Efficiency and Renewable Energy	2,777,277	2,861,760	4,732,000	+1,870,240
Fossil Energy and Carbon Management	607,650	625,939	789,978	+164,039
Indian Energy Policy and Programs	22,000	22,000	122,000	+100,000
Loan Programs	36,000	36,000	186,000	+150,000
Nuclear Energy	1,432,250	1,316,130	1,457,080	+140,950
Office of Clean Energy Demonstrations	0	0	400,000	+400,000
Science	2,465,075	2,472,842	2,697,842	+225,000
Climate and Clean Energy Total	**7,765,252**	**7,761,671**	**11,384,900**	**+3,623,229**

Overview:

The Climate and Clean Energy Crosscut tracks funding for activities across the Department of Energy's Office of Science, Office of Energy Efficiency and Renewable Energy, Office of Fossil Energy and Carbon Management, Loans Programs Office, Advanced Research Projects Agency-Energy), Advanced Research Projects Agency-Climate, the Office of Clean Energy Demonstration, the Office of Electricity, and the Office of Indian Energy that deliver transformative science and research , develop, demonstrate, and/or deploy clean energy technology solutions that will significantly reduce greenhouse gas emissions contributing to climate change. In addition, within the Office of Science funding supporting the US Global Change Research Program will advance high-fidelity science-based climate models and provide the computational capabilities to understand the impacts of climate change.

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Projects Agency - Energy	**0**	**12,845**	**TBD***	**TBD***
Energy Efficiency and Renewable Energy	**214,740**	**242,710**	**798,800**	**+556,090**
Advanced Manufacturing	10,000	24,000	486,000	+462,000
Bioenergy Technologies	22,400	15,500	24,000	+8,500
Hydrogen and Fuel Cell Technologies	121,000	114,000	148,500	+34,500
Solar Energy Technologies	2,500	2,500	37,500	+35,000
Strategic Programs	0	710	800	+90
Water Power Technologies	58,840	86,000	102,000	+16,000
Fossil Energy and Carbon Management	**259,800**	**256,600**	**353,200**	**+96,600**
Advanced Energy Systems	57,500	63,300	43,000	-20,300
Crosscutting Research	4,500	5,000	5,000	0
Carbon Capture	97,800	86,300	150,200	+63,900
Carbon Utilization	21,000	23,000	38,000	+15,000
Carbon Storage	79,000	79,000	117,000	+38,000
Loan Programs Office	**29,000**	**29,000**	**179,000**	**+150,000**
Innovative Technology Loan Guarantee Program	29,000	29,000	179,000	+150,000
Science	**18,500**	**23,700**	**55,700**	**+32,000**
Basic Energy Sciences	8,500	13,700	40,700	+27,000
Biological and Environmental Research	10,000	10,000	15,000	+5,000
Grand Total, Decarbonizing Industry	**522,040**	**564,855**	**1,386,700***	**+834,690***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

FY 2021 Enacted (aggregated): $564,855,000
FY 2022 Request (aggregated): $1,386,700,000

Summary:

The **Decarbonizing Industry Crosscut** will engage multiple offices across the Department of Energy (DOE) to foster innovations and enable scale up of cost-competitive, low-emissions technologies to achieve the DOE goal of decarbonizing energy intensive and high greenhouse gas (GHG)-emitting industries to achieve net-zero greenhouse gas emissions, economy-wide, by no later than 2050. The Crosscut leverages research, development, demonstration and deployment (RDD&D) across the pillars of industrial decarbonization: energy efficiency; electrification; low carbon fuels, feedstocks and energy sources; and carbon capture utilization and storage (CCUS). The goal is challenging as the U.S. industrial sector is considered a "difficult-to-decarbonize" sector of the energy economy, due in part to the diversity of energy inputs into a wide array of heterogeneous industrial processes and operations. Industry accounts for 32% of the Nation's primary energy use and 28% of energy-related carbon dioxide (CO_2) emissions, with refining, chemicals, iron and steel, cement, and food products representing the top energy-consuming sectors. Given the technologies and systems interdependencies across the decarbonization pillars, crosscut activities will be an enabling piece of DOE's portfolio of solutions to achieve a net zero carbon economy by 2050, with the potential to contribute to a reduction of 400 million metric tons of CO_2 of industrial emissions by 2050 in the most energy and emissions intensive industrial subsectors. Additionally, industrial decarbonization investments can improve manufacturing productivity, develop innovative products, and meet expanding societal needs while enabling jobs and maintaining our prosperity throughout the 21st Century and beyond.

Crosscut Objectives:

A serious industrial decarbonization effort will require multiple approaches and significant investments to advance cost-effective technology solutions to produce manufactured goods competitively and attain emissions reduction targets. Given the reliance on carbon and variation of energy sources, uses, and product mixes, it will be critical to proactively pursue multiple decarbonization approaches in parallel, which include the following:

- *Address Energy Efficiency:* Conduct RDD&D to enable energy efficiency in the industrial sector ranging from energy intensive unit operations (e.g. process heating) to facilities/systems operations including waste heat recovery () and flexible combined heat & power (CHP) approaches that have the potential to significantly reduce energy consumption and associated GHG emissions in the near term.
- *Enable Electrification and use of Low Carbon Fuels, Feedstocks and Energy Sources:* Enable viable direct and indirect electrification approaches for energy/emissions intensive industrial operations such as process heating, which consumes approximately 7.5 quads of energy and currently uses >95% fossil energy sources. Opportunities range from electrification via increased uptake of industrial heat pumps and boilers, to developing pathways for the use of low carbon fuels, feedstocks and energy sources such as renewable hydrogen, biomass, or solar thermal to reduce emissions. Biomass feedstocks may also offer an effective alternative to replace current petroleum-based feedstocks for a variety of high-volume chemical products leading to significant GHG emissions reductions.
- *Develop and Implement CCUS Approaches:* Select industrial operations emit not only large quantities of energy-related CO_2, but also can emit CO_2 inherent in the industrial process (for example, cement production drives a chemical reaction releases CO_2) that require systems integration approaches to enable capture and utilization of CO_2. CCUS provides an opportunity to achieve deep decarbonization of the industrial sector. RDD&D focuses on applied technologies that can improve capture performance; convert CO_2 into valuable products, in some cases, products that can augment those produced in the industrial sector such as cement; and safely store CO_2 in geologic formations. Viable CCUS pathways need both a value proposition as well as assessment of the availability of primary energy, water, and other inputs to ensure holistic, sustainable, low-life cycle emissions pathways, and ensure stewardship of our communities and the environment.
- *Innovate Alternate Pathways and New Technologies:* The current predominantly linear production system of materials extraction to manufacturing to product use to disposal does not optimize around energy or GHG emissions; circular economy approaches, and reverse supply chain may provide entirely new opportunities for energy/emissions improvements in concert with new economic opportunities for transformative material and resource utilization. Opportunities exist to foster fundamental science and applied research and development (R&D) aligned with other crosscuts and DOE priorities such as advanced manufacturing including biomanufacturing; circularity for critical materials, plastics, water; as well as entirely new pathways for carbon dioxide removal (CDR) approaches via utilization of alkaline by-products or waste (e.g., mine tailings).

Program 'Action Areas':

Through cohesive coordination, DOE program offices include the Office of Energy Efficiency and Renewable Energy's (EERE) Advanced Manufacturing Office (AMO), Hydrogen and Fuel Cell Technologies Office (HFTO), Bioenergy Technologies Office (BETO) and other EERE offices, the Office of Fossil Energy and Carbon Management (FECM), Office of Science (SC), Loan Programs Office (LPO), and the Advanced Research Projects Agency-Energy (ARPA-E), will:

1. *Strengthen Cross-DOE Coordination and Collaboration:* Ensure an integrated approach including clearly defined "swim lanes" and "relay points," integrated systems analysis, workshops and Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.
2. *Support Fundamental and Applied R&D and Technology Transfer:* Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer to enable meeting the Decarbonizing Industry program goals, including Institutes/Hubs as appropriate.
3. *Launch Demonstration Projects:* Establish Decarbonizing Industry demonstration projects in priority areas aligned with pre-demonstration stage DOE investments and use data to guide future RDD&D.
4. *Conduct Systems Analysis:* Conduct life cycle, jobs, resource, regional, and techno-economic analyses to guide the portfolio and strategy.
5. *Promote Information and Data Sharing:* Share best practices and resources to accelerate progress across the Technology Readiness Level (TRL) value chain.
6. *Coordinate on Workforce/STEM and Diversity, Equity, and Inclusion:* Collaborate on best practices and accelerate progress towards common goals.

7. ***Overcome Barriers:*** Numerous technical challenges specific to industrial subsectors/operations will be addressed through the approaches outlined in the crosscut objectives; additionally, a number of significant challenges to the uptake of decarbonization of the industrial sector broadly, must also be addressed if targets are to be met including:
   - Lengthy timeframe for capital and production facility turnover.
   - Diverse use of energy sources and cyclical energy pricing.
   - Complex product life cycles with many market participants throughout supply chains.
   - Insufficient market signals to motivate commodity product manufacturers to adequately invest in disruptive technologies.
   - Lack of readily-available capital for zero-carbon investments for the industrial sector.

Program Organization:
1. ***Energy Efficiency and Renewable Energy ($798.8M):*** EERE supports the Decarbonizing Industry crosscut in several ways, including:
   a. RDD&D to improve the energy efficiency of industry with a focus on the highest energy-consuming subsectors, including iron/steel, cement, refining, and chemicals.
   b. Public-private partnerships that reduce emissions through material efficiency, enable renewable power and fuel switching, and drive energy efficiency during manufacturing and throughout their lifecycle.
   c. RDD&D that replaces petroleum-based and heat-driven processes with low-carbon, energy efficient alternatives, including electrification and bio-based feeds.
   d. Development of industry partnerships to establish carbon reduction best practices, set carbon reduction goals, and provide support to reduce emissions.
   e. Support for CCUS through RDD&D on integration of CCUS into industrial processes, manufacturing of carbon capture sorbents, and intensified carbon capture and utilization processes including gas-fermentation particularly with energy-rich waste gasses (Hydrogen, Carbon Oxide).
   f. Analysis on lifecycle energy and emissions impacts of emerging technology.
   g. RDD&D on hydrogen production, delivery, storage, fuel cells, and end use, including demonstrating hydrogen use in steel/iron manufacturing and ammonia production.
   h. RDD&D on replacement of petrochemical-sourced chemicals and materials with municipal solid waste and bio-based replacements, including performance-advantaged and direct replacements.
   i. RDD&D of industrial processes driven by solar thermal energy. This activity includes both low-temperature systems focused on low-cost embodiments of existing technologies, and the development of components and system designs for high-temperature systems that are difficult to decarbonize through electrification.
2. ***Fossil Energy and Carbon Management ($353.2M):*** FECM supports the Decarbonizing Industry crosscut in several ways, including:
   a. RDD&D on CCUS including technical feasibility, economic potential, and siting/systems considerations to co-locate large industrial facilities with CCUS availability.
   b. RDD&D on the production of hydrogen with CCUS from fossil resources/wastes (such as plastics and co-production using biomass, where available).
   c. RDD&D on turbines that can utilize hydrogen, ammonia, and other low carbon fuels for power generation to be used in industrial applications, as well as hybrid and integrated systems to maximize efficiency.
   d. Reversible solid oxide fuel cells/solid oxide electrolyzer cells, focused on natural gas and co-producing hydrogen, in coordination with EERE's HFTO.
   e. Large scale transport and geological energy storage, including ammonia at scale to support bulk power generation.
3. ***Science ($55.7M):*** SC provides foundational knowledge and state-of-the-art capabilities in support of crosscut objectives, including theoretical and experimental science related to understanding opportunities for decarbonizing industry. The research to support this crosscut is also discussed in the Carbon Management, Critical Materials and Minerals, and Advanced Manufacturing crosscut narratives. SC supports the Decarbonizing Industry crosscut in several ways, including:
   a. Support scientific discoveries and major scientific tools to transform our understanding of materials and conversion processes related to chemicals, low carbon fuels, and manufacturing processes. SC operates major x-ray, neutron, nanoscience, and high-performance computing user facilities that provide advanced synthesis, fabrication, characterization, and computational capabilities to this community for basic, applied, and industrial research.

b. Enable advances in synthesis, catalysis, modeling, artificial intelligence/machine learning, analytical instrumentation at user facilities, high-performance computing, and bio-inspired approaches. Key basic research focus areas include: Novel materials for low carbon fuels/feedstocks (e.g., hydrogen), membranes for separations, design of catalysts at the nanoscale, co-design for manufacturing (combining disciplines and computation for a "whole systems" approach), and science for scale-up from initial discoveries to bridge the gap to applied research and commercial application.

c. Increase understanding of the use of critical materials in manufacturing processes and reducing the dependence of such materials in coordination with the Critical Minerals Crosscut.

d. Enable advances in biomanufacturing, especially with respect to genome-enabled engineering and design of biomaterials, to replace or improve performance relative to petroleum-derived products.

e. Fundamental systems biology research on algal systems to convert gaseous CO_2 waste streams into a broad range of bioproducts in support of other direct air capture technologies.

4. ***Loan Programs Office ($179M):*** The Title 17 Innovative Technology Loan Guarantee Program operated by LPO contributes to decarbonizing industry and supports the Decarbonizing Industry crosscut including:

a. The Title 17 Innovative Technology Loan Guarantee Program (Title 17) offers loan guarantees to accelerate the deployment of innovative energy technology that avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases. Eligible technologies include advanced nuclear facilities, coal gasification, carbon sequestration, energy efficiency, renewable energy systems, and other clean energy technologies. Title 17 has over $22 billion is currently available to support projects such as renewable electricity; transmission; distributed generation/efficiency; pumped hydro/battery storage; carbon capture and storage; green hydrogen; critical minerals projects; and offshore wind.

b. The FY 2022 Budget Request includes $150 million of appropriated credit subsidy (and $1.5 billion of new loan authority) for innovative electric vehicle infrastructure, carbon management and other clean energy projects that create good paying jobs with a free and fair choice to join a union.

5. ***Advanced Research Projects Agency - Energy ($TBD):*** ARPA-E has on-going funded exploratory programs focused on non-traditional approaches and high risk/high impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. ARPA-E supports the Decarbonizing Industry crosscut by accelerating innovative concepts such as innovative ammonia production beyond the conventional Haber-Bosch process, energy storage, medium temperature fuel cells that could be used for CHP in industrial applications.

Summary:

The Decarbonizing Industry Crosscut coordinates activities aligned with the program plans in relevant offices including AMO's Industry Decarbonization roadmap and the DOE Hydrogen Program[1] which outlines key activities for achieving Crosscut objectives. DOE experts meet regularly across relevant offices to share status, progress; and plan joint workshops, to address research gaps, joint regional analysis, lifecycle emissions and supply chain assessments, and joint proposal peer reviews for solicitations. Through these activities, early investments in RDD&D can position the United States as a global leader in industrial modernization allowing the U.S. to tap into the competitive benefits of energy efficiency, electrification, and low carbon fuels, and CCUS.

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[1] https://www.hydrogen.energy.gov/pdfs/hydrogen-program-plan-2020.pdf

Grid Modernization Initiative

Funding by Appropriation and Program Control
($ in thousands)

Appropriations and Program Controls	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Cybersecurity, Energy Security, and Emergency Response	**95,000**	**96,000**	**108,000**	**+12,000**
CEDS Projects Awarded from Research Calls, Competitive FOAs, and DNFAs	85,000	86,000	0	-86,000
Advance Tools to Support Cyber Threat Situational Awareness and Analytics			50,000	+50,000
Supply Chain Risk Management			32,000	+32,000
Cyber Risk Assessments, Frameworks and University Collaborations			26,000	+26,000
Darknet Project/Activity Awarded via DNFA	10,000	10,000	0	-10,000
Electricity	**172,000**	**193,720**	**307,000**	**+113,280**
Transmission Reliability and Resilience	57,000	48,220	37,000	-11,220
Resilient Distribution Systems	45,000	50,000	50,000	0
Energy Storage	*56,000*	*80,000*	*119,000*	*+39,000*
Research	55,000	57,000	72,000	+15,000
Construction: Grid Storage Launchpad	1,000	23,000	47,000	+24,000
Cyber R&D	0	0	25,000	+25,000
Transformer Resilience and Advanced Components	7,000	7,500	22,500	+15,000
Energy Delivery Grid Operations Technology	0	0	43,500	+43,500
Defense Critical Electric Infrastructure (DCEI) Energy Mission Assurance	0	1,000	0	-1,000
Transmission Permitting and Technical Assistance	7,000	7,000	10,000	+3,000
Advanced Research Projects Agency - Energy	**20,888**	**0**	**TBD***	**TBD***
Advanced Research Projects Agency – Energy Projects	20,888	0	TBD*	TBD*
Energy Efficiency and Renewable Energy	**174,365**	**188,950**	**299,110**	**+110,160**
Advanced Manufacturing Office (AMO)	0	2,000	0	-2,000
Building Technologies (BTO)	54,220	49,300	70,000	+20,700
Hydrogen and Fuel Cell Technologies (HFTO)	15,000	46,000	62,000	+16,000
Solar Energy Technologies (SETO)	70,000	53,000	77,750	+24,750
Vehicle Technologies (VTO)	11,500	18,000	18,000	0
Water Power Technologies Office (WPTO)	12,950	15,000	27,000	+12,000
Wind Energy Technologies Office (WETO)	10,695	5,650	44,360	+38,710
Fossil Energy and Carbon Management RDD&D	**3,233**	**3,726**	**2,726**	**-1,000**
Advanced Energy and Hydrogen Systems	1,800	2,075	1,518	-557
Crosscutting Research	1,313	1,513	1,107	-406
Carbon Capture, Utilization, and Storage	120	138	101	-37
Nuclear Energy	**332,000**	**365,478**	**433,350**	**+67,872**
Advanced SMR RD&D	74,000	107,478	70,000	-37,478
Light Water Reactor Sustainability	55,000	47,000	60,000	+13,000
TRISO Fuels and Graphic Qualification	30,000	36,000	36,000	0
Crosscutting Technology Development	13,000	15,000	22,000	+7,000
Advanced Reactor Demonstration 1	80,000	80,000	108,700	+28,700
Advanced Reactor Demonstration 2	80,000	80,000	136,650	+56,650

Appropriations and Program Controls	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs. FY 2021
Total, Grid Modernization Initiative	**797,486**	**847,874**	**1,150,186***	**+302,312***

*ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Overview

The Grid Modernization Initiative (GMI) is a collaborative partnership of six DOE Offices focused on research, development, demonstration, and deployment (RDD&D) to ensure an affordable, resilient, flexible, secure, sustainable, equitable, and reliable grid. The GMI coordinates RDD&D across DOE applied energy offices to accelerate the development of the technologies and tools to enable modernization of the grid to support U.S. economic growth, environmental quality, energy justice, and security objectives. The GMI works with public and private partners to develop the concepts, tools, and technologies needed to measure, analyze, predict, protect, and control the grid of the future. The portfolio of work helps integrate all sources of electricity better, improve the security of our Nation's grid, solve challenges of energy storage and distributed generation, and provide a critical platform for U.S. competitiveness and innovation in a global energy economy.

DOE can assess regional and national grid modernization efforts, technology and market developments, and institutional barriers affecting generation, transmission, distribution, and end-use technologies. Through a coordinated GMI, DOE leadership will:

- Fund cost-sharing research, development, demonstration, and deployment to accelerate the pace of technological innovation, especially where market fragmentation impedes the ability to individual entities to capture the value of investments.
- Provide technical assistance, drawing upon unique technical capabilities of the National Laboratories.
- Catalyze private-sector innovation through the expertise within DOE and its National Laboratories, working in collaboration with other key stakeholders to help establish the technological foundation for grid modernization.
- Address unique regional issues to deliver collaborative partnerships and initiatives that are tailored to regional needs as well as able to deliver national benefits.
- Use its convening power to listen, synthesize, and help communicate, without being prescriptive.

The Offices of Cybersecurity, Energy Security, and Emergency Response (CESER); Electricity (OE); ARPA-E; Energy Efficiency and Renewable Energy (EERE); Fossil Energy and Carbon Management (FECM); and Nuclear Energy (NE) participate in the GMI.

Coordination Efforts

The applied offices, ARPA-E, and CESER, work together to fund foundational projects that are critical to the mission through GMI lab calls with the Grid Modernization Laboratory Consortium (GMLC). The offices work together to identify topic areas for solicitations that require synergy across the Department, the National Labs respond with proposals through the GMLC, and applied offices select projects to fund together. The most recent GMLC solicitation was issued at the end of 2019 for $80M for projects lasting three years.

Highlights and Major Changes

Office of Cybersecurity, Energy Security, and Emergency Response

CESER has a central role in the Department's integration of cybersecurity activities across DOE, and coordinates with other DOE offices to ensure cybersecurity is built in across different R&D programs. CESER leverages GMI to engage our leading experts and resources at DOE's National Laboratories to collaborate on the goal of securely modernizing the Nation's electric grid. CESER employs an integrated approach to ensure that DOE-funded studies and research and development are

efficiently coordinated. CESER's participation in the GMI enables cybersecurity by design approach in security and resilience R&D. All of CESER's cybersecurity risk management tools and technologies funding is included in the GMI. This includes:

- Advanced protection, monitoring, detection, response, containment, forensics, and recovery tools.

- Developing cyber situational awareness and analytics including newly announced DOE Electricity Industrial Control Systems (ICS) effort.

- Cradle to grave supply chain cybersecurity, including programs like Cybersecurity Testing for Industrial Control Systems (CyTRICS) and digital subcomponent enumeration, and mitigation efforts.

- Innovative tools and technologies geared toward the grid of the future, such as cybersecurity tools for distributed energy resources (DERs) and electric vehicles (EVs).

- Operationalizing cybersecurity tools for the Operational Technology Environment.

- Developing and transitioning to practice tools, guidance, and practices that help energy organizations' understanding and management of cybersecurity risk to systems, people, assets, data, and capabilities.

- Cyber resilience through cyber engineering by way of programs such as the Consequence-driven Cyber-informed Engineering (CCE)

- Collaborations with universities to support workforce development and to stimulate innovation by students to address cyber risks to energy infrastructure.

- The Defense Critical Electric Infrastructure (DCEI) Energy Mission Assurance program was established in FY 2021 to identify, evaluate, prioritize, and assist in developing executable strategies to ensure that critical national defense and security missions have reliable access to power as energy supply disruptions threaten the civilian grid due to intensifying cybersecurity threats as well as other hazards. For FY 2022, DOE proposes to move the DCEI Energy Mission Assurance program functions out of OE and into CESER's suite of activities partnering with, supporting, and sharing information with the electric utility industry to address cybersecurity.

Office of Electricity

Grid modernization is a critical aspect of all OE programs, and virtually the entire OE program is included in the GMI.

- The reduction in OE's Transmission Reliability and Resilience (TRR) program is driven by the completion of funding in FY 2021 for North American Energy Resilience Model (NAERM) development and 3 fully funded congressionally directed projects. These funding reductions also offset TRR growth in Transmission Reliability and Renewable Integration and in Advanced Grid Modeling. NAERM operations and maintenance transitions to the Energy Delivery Grid Operations Technology (GOT) program in FY 2022
- The FY 2022 request for Resilient Distribution Systems (RDS) supports a competitive award process to harness emerging sources of energy for balance, reliability, and control: EVs, connected homes and buildings, increasing distributed solar, and energy storage. Situational Awareness Network (SAN) activities related to operational support, maintenance, and expansion transition to EDGOT.
- The Energy Storage request supports technology development of novel materials and system components, building a safety and reliability knowledge base for energy storage systems and components, developing open-source analytic tools to address issues such as energy storage planning, sizing, placement, valuation, and societal and environmental impacts, and full funding to complete construction of the Grid Storage Launchpad construction project.
- Cyber R&D is a new activity for OE in FY 2022, previously supported by CESER, that addresses R&D for energy sector cybersecurity associated with electricity delivery systems, with a focus on data and physics to redesign grid architecture that exposes the electricity system to cyber threats.

- The Transformer Resilience and Advanced Components request accelerates the timeline for field validation of innovative, flexible, and adaptable prototypes for large power transformers (LPTs), which will promote greater standardization to increase grid resilience.
- Energy Delivery Grid Operations Technology program is new in FY 2022, and includes operations and maintenance for NAERM, which was developed by TRR program, as well as the Post-Event Analysis Coordination (PEAC) network and Situational Awareness Network (SAN), which were previously supported by TRR and RDS, respectively. EDGOT will support a public–private partnership to develop national-scale energy planning and real-time situational awareness capabilities by focusing on developing large, networked communication and data infrastructures across multiple utility boundaries.
- The Transmission Permitting and Technical Assistance (TPTA) request expands TPTA's outreach and support activities with Federal, State, and industry partners to address the climate crisis by decarbonizing the electricity sector and maximizing cost-effective demand-side resources and solutions to achieve 100% carbon-free electricity by 2035.

Advanced Research Projects Agency - Energy

ARPA-E is developing programs for transformational research across a wide range of energy technologies and applications. The assessment process for new programs is now underway and any potential future investments in Grid Modernization will be determined in FY 2022.

Office of Energy Efficiency and Renewable Energy

EERE's grid modernization activities focus on ensuring the seamless integration of energy efficiency, renewable power, and sustainable transportation technologies into the electrical power system. Interactions and interdependencies are increasing within and among power system infrastructures and other interrelated systems such as communications networks. These interactions can have profound implications for the reliability and security of the energy system. Through its Grid Integration activities, EERE will seek to develop and validate technologies, tools, and approaches to address the grid integration barriers and opportunities associated with variable power resources, distributed renewable power generation sources, electric vehicle charging/discharging, and building efficiency and controls. Success integrating these technologies at scale will be critical to delivering on the Nation's climate and energy goals. Specific topic areas include electricity affordability, generation and hybrid systems, resilience modeling, cyber-physical security, advanced sensing, energy storage and system flexibility.

Building Technologies, $70.0M: Fund highest impact action steps identified in the Grid-interactive Efficient Buildings (GEB) Roadmap. Expand the Connected Communities work (BTO's major multi-office, renewables-efficiency integrating, place-based demonstration program). New laboratory call for core sensors and control work to advance building to grid integration. Support expanded scope of a laboratory call to advance technologies from the laboratory to industry and provide laboratory capabilities to industry to advance the state of the art more rapidly leading to grid modernization.

Hydrogen and Fuel Cell Technologies, $62.0M: The FY 2022 Request includes support for energy storage and grid integration reversible fuel cells; and systems development and integration, including offshore wind to hydrogen; along with supporting analysis.

Vehicle Technologies (VTO), $18.0M: The Request sustains funding focused on grid-connected electric vehicle topics such as smart charge management and controls for grid services, integration of chargers and vehicles with distributed energy resources, such as behind the meter storage, and development of new high power and dynamic charging technologies and new methods for connecting the charging facilities to the grid.

Solar Energy Technologies (SETO), $77.8M: The Request increases funding for Grid Modernization Laboratory Consortium (GMLC) projects and other Systems Integration activities. Topics include but are not limited to resiliency, system modelling, energy storage integration, distributed energy resource control coordination, demonstrating grid services from solar and

wind and more. In addition, technical assistance work from the Balance of Systems/Soft Costs program supports this effort as well.

Water Power Technologies, $27.0M: The Request continues support for the HydroWIRES (Water Innovation for a Resilient Electricity System) Initiative to understand, enable, and improve hydropower's contributions to reliability, resilience, and integration in the rapidly evolving U.S. electricity system. Building on existing HydroWIRES efforts, the Request will support flexibility enhancement studies, hybrid use case investigations, technical assistance for PSH valuation and other topics, and innovative pumped storage hydropower (PSH) R&D. Outcomes will include increased flexibility in the existing hydropower fleet, and the advancement of PSH projects toward deployment.

Wind Energy Technologies, $44.4M: R&D on wind provision of stackable grid services, forecast for grid services with hybridization options, cybersecurity intrusion detection and response, and innovative technology to improve converter performance and reduce cost.

Office of Fossil Energy and Carbon Management (FECM)

FECM's participation in the GMI crosscut ensures perspective for fossil generation and fuel security. FECM has been able to successfully incorporate interrelated elements to the GMI process which could have otherwise been overlooked. FECM is directly funding 4 projects involving 3 of the GMI topic areas:

- Design and Optimization Infrastructure for Tightly Coupled Hybrid Systems focuses on incorporating advanced coal and nuclear technologies into existing model frameworks.
- Near-Term Reliability and Resiliency will look at reliability issues due to changing generation over the next ten years in electricity regions across the country.
- Blockchain for Optimized Security and Energy Management (BLOSEM) involves the National Energy Technology Laboratory (NETL) and the use of Blockchain to secure energy systems.
- Digital Twin Reinforcement Learning focuses on artificial intelligence to detect new and previously unknown cyber threats.

Office of Nuclear Energy

Office of Nuclear Energy efforts are focused on ensuring the current and future of provision of zero carbon baseload electricity to the grid and providing options that maximize the ability to integrate other clean energy power sources into the grid. Specifically, NE has entered into 2 cost shared awards to demonstrate new advanced reactor designs and is working with a developer of an advanced small modular reactor to support NRC licensing. NE is working with utilities to maximize the economics of existing commercial reactors to prevent their premature retirement and to investigate the use of those reactors for uses with other energy sources are available, e.g., hydrogen production.

- Support cost-shared industry partnership awards that have high potential to accelerate the development of both emerging and more mature small modular reactor designs.
- To support existing plant economics, complete analysis of the Zion reactor pressure vessel materials, benchmark performance models, and evaluate safety margins; complete application for the prediction of component health by creating data-driven reliability models for components; produce an investor-grade report to support the production of zero or net-zero carbon synthetic fuels using hydrogen and CO2 resources from air, ethanol production or natural gas at an operating nuclear power plant, addressing chemical plant cost, economic, and environmental benefits; and develop a concept for integrating the instrumentation and controls architecture into a seamless digital environment that enables wide-spread automation and process efficiencies across plant support functions.
- Continue development of fuels for advanced reactors including TRISO particle fuel development and graphite development and qualification efforts provide data to support the use of graphite in high temperature reactor environments.

- Conduct research to support the development of standards for reducing nuclear power plant supply chain risks and for integrating nuclear safety risk management with cybersecurity risk management, to support improved economic and security performance at existing and future plants.
- Support research into Integrated Energy Systems such that nuclear energy can also support various industrial, transportation, and energy storage applications. The successful integration of energy systems would allow the electric grid to continue to rely on clean nuclear baseload electricity, while offering economic benefits to nuclear energy operators.

Hydrogen Crosscut

Funding by Appropriation and Program Control

($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Program Agency-Energy	**36,400**	**10,000**	**TBD***	**TBD***
Energy Efficiency and Renewable Energy	**165,500**	**155,900**	**226,500**	**+70,600**
Advanced Manufacturing	12,500	5,000	20,000	+15,000
Hydrogen & Fuel Cell Technologies	150,000	150,000	197,500	+47,500
Solar Energy Technologies Office	0	0	4,000	+4,000
Vehicle Technologies Office	3,000	0	0	0
Wind Energy Technologies Office	0	900	5,000	+4,100
Fossil Energy and Carbon Management	**53,000**	**88,700**	**141,000**	**+52,300**
Clean Coal and Carbon Management	53,000	87,000	111,000	+24,000
Oil and Natural Gas	0	1,700	30,000	+28,300
Nuclear Energy	**14,000**	**13,000**	**13,000**	**0**
Science	**15,500**	**17,000**	**20,000**	**+3,000**
Grand Total	**284,400**	**284,600**	**400,500***	**125,900***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

FY 2021 Enacted (aggregated): $284,600,000
FY 2022 Request (aggregated): $400,500,000

Summary:

The DOE Hydrogen Crosscut coordinates activities across multiple offices in DOE that sponsor research, development, demonstration, and deployment (RDD&D) to foster innovations and develop widely available, net-zero emission, cost-competitive technologies for the production, storage, and delivery of hydrogen, and for its end use as a chemical feedstock or fuel. Hydrogen is a versatile energy carrier that can be produced with net-zero greenhouse gas emission by using diverse domestic resources including renewables, nuclear, and fossil fuels with carbon capture and storage. Accordingly, hydrogen is an enabling piece of DOE's portfolio of solutions to achieve an abundant, reliable, and affordable supply of clean energy to meet our climate goals, and maintain our prosperity throughout the 21st century and beyond. Crosscut activities will focus on enabling carbon-pollution free hydrogen for hard-to-decarbonize applications in industry and heavy-duty transport, as well as in power generation and energy storage.

Crosscut Objectives:

- *Achieve Carbon-pollution free Hydrogen Production Goals:* Conduct research, development, and demonstration (RD&D) to achieve $1/kg carbon pollution free hydrogen cost target.
- *Enable Market Competitive End Uses and Hydrogen Infrastructure:* Enable viable end uses for hydrogen in hard-to-decarbonize sectors (e.g., steel/chemicals manufacturing, heavy-duty transport, power generation/storage) through RDD&D and by addressing institutional barriers such as safety, codes, and standards.
- *Address Resource and Sustainability Requirements:* Assess availability of primary energy, water, and other inputs to ensure holistic, sustainable, net-zero life-cycle emissions pathways, and ensure stewardship of our communities and the environment.
- *Innovate:* Foster fundamental science and applied R&D to enable breakthroughs along the value chain of hydrogen technologies, fuel cells, turbines, and end uses.

Program 'Action Areas': Through the Science and Energy Tech Team on Hydrogen, DOE program offices (Energy Efficiency and Renewable Energy (EERE), Fossil Energy and Carbon Management (FECM), Science (SC), Nuclear Energy (NE) and the Advanced Research Projects Agency-Energy (ARPA-E)), will:

1. ***Strengthen Cross-DOE Coordination and Collaboration:*** Ensure an integrated approach to RDD&D hydrogen activities to include integrated systems analysis, workshops and Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.
2. ***Support Fundamental and Applied R&D and Technology Transfer:*** Establish the foundational scientific infrastructure, knowledge base, innovation, and technology transfer activities to enable DOE to meet the crosscut objectives
3. ***Launch Demonstration Projects:*** Establish Hydrogen Hubs and demonstration projects, aligned with the American Jobs Plan and the H2@Scale initiative, and use data to guide future RD&D.
4. ***Conduct Systems Analysis:*** Conduct life cycle, resource, regional, and techno-economic analyses to guide the portfolio and strategy.
5. ***Promote Hydrogen Safety Sharing:*** Share best practices and resources and make hydrogen safety a priority in our activities and projects.
6. ***Coordinate on Workforce/STEM and Diversity, Equity, and Inclusion:*** Collaborate on best practices and accelerate progress towards common goals.

Coordination Efforts:

The Hydrogen Crosscut coordinates activities aligned with the DOE Hydrogen Program[1] which outlines key activities and a matrix of roles and responsibilities across the pipeline of hydrogen production, delivery, storage, and end use RDD&D efforts. The cross-DOE Hydrogen Science and Energy Tech Team meets regularly to coordinate the DOE Hydrogen Program strategy. The offices also meet monthly at a technical level across relevant DOE offices to share status, progress, and gaps, as well as meet monthly with other agencies involved in hydrogen activities. Plans also include joint workshops, a joint Annual Merit Review and Peer Evaluation Meeting, a Basic Energy Sciences Roundtable to address research gaps, joint regional analysis, lifecycle emissions and supply chain assessments, and joint proposal peer reviews for solicitations.

FY 2022 Program Highlights

1. Energy Efficiency and Renewable Energy ($226.5M): EERE focuses on hydrogen production from renewables, hydrogen delivery and storage for transportation, industrial/chemicals, and energy storage, as well as fuel cells for stationary and transportation applications, and manufacturing of components and systems along the value chain. RD&D activities include:
   a. Focus on electrolysis and advanced water-splitting from renewables, materials and carbon-fiber tanks for hydrogen storage, materials (e.g., hydrogen carriers) and components for hydrogen delivery and infrastructure;
   b. Fuel cell materials (catalysts, membranes, etc.) and components (stacks, balance-of-plant), and systems, for multiple types of fuel cells (operating below 600° C) and reversible fuel cells (in collaboration with FECM);
   c. End uses in the transportation, industrial (e.g., steel, ammonia) and stationary sectors; and enabling activities including safety, codes, standards, analysis, systems integration, and workforce development;
   d. RDD&D across multiple offices in EERE include offshore wind to hydrogen, solar and thermochemical routes, the production of sustainable aviation fuels/synfuels using hydrogen, thermal integration/hybrid systems (and nuclear to hydrogen in collaboration with NE), manufacturing of hydrogen and fuel cell systems, reduction of critical materials, steel and ammonia production, and the Super Truck program.

2. Fossil Energy and Carbon Management ($141M): FECM focuses primarily on hydrogen production from fossil resources, wastes such as plastics, and available biomass, along with carbon capture and storage (CCS)/carbon capture, utilization, and storage (CCUS), to achieve net-zero carbon hydrogen, as well as large scale power generation using turbines and large scale/geological hydrogen storage. RDD&D activities include:
   a. Gasification, including gasification of waste feedstocks such as plastics and available biomass with CCUS; advanced approaches beyond steam methane reforming, such as pyrolysis; advanced pre-combustion capture systems coupled with gasification systems to eliminate CO_2 emissions;
   b. Advanced turbines and combustion technologies, firing hydrogen blends and 100% hydrogen fuel or zero carbon fuels such as ammonia;

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[1] https://www.hydrogen.energy.gov/pdfs/hydrogen-program-plan-2020.pdf

     c. Reversible solid oxide fuel cells ()/solid oxide electrolysis cells (), focused on natural gas and co-producing hydrogen, in coordination with EERE's Hydrogen Fuel Cell Technologies Office;
     d. Large scale transport and geological energy storage, including ammonia at scale to support bulk power generation.

3. Nuclear Energy ($13M): NE focuses on enabling hydrogen production from nuclear power, including existing and next generation/advanced reactor designs. Activities include:
     a. Technical feasibility, economic potential, and license considerations to validate the feasibility and business case for producing hydrogen at nuclear power plants in different regions of the country;
     b. Laboratory infrastructure capabilities with a thermal delivery system and electrical connection to demonstrate the coupling of nuclear reactors to high-temperature steam electrolysis;
     c. Full-scope nuclear plant simulators to help develop operating concepts and human factors that will enable operations of nuclear power plants to dispatch energy safely and efficiently to the hydrogen plant, when switching to full production of electricity for the grid according to real-time market signals;
     d. Demonstration of hydrogen production using heat and electricity from existing nuclear reactors (pilot projects underway in collaboration with EERE).

4. Science ($20M): SC provides foundational knowledge and state-of-the-art capabilities in support of crosscut objectives and has supported theoretical and experimental science related to understanding hydrogen technologies and materials for many years. Key activities include:
     a. Supporting scientific discoveries and major scientific tools to transform our understanding of hydrogen-related technologies including hydrogen storage, production, utilization, and conversion. SC operates major x-ray, neutron, nanoscience, and high-performance computing user facilities that provide advanced synthesis, fabrication, characterization, and computational capabilities to this community for basic, applied, and industrial research.
     b. Enabling breakthrough advances beyond conventional approaches such as electrolysis; includes work conducted by the Solar Fuels Hub program and the Energy Frontier Research Centers, which complement the technology-specific RD&D supported by DOE's applied energy offices and provides foundational knowledge that can bring advances to many areas of technology development.
     c. Enabling advances in synthesis, catalysis, modeling, artificial intelligence/machine learning, analytical instrumentation at user facilities, high-performance computing, and bio-inspired approaches. Key basic research focus areas include: novel materials for hydrogen storage, membranes for separations, purification, ion transport, novel materials, chemical processes for production and use of hydrogen such as design of nanoscale catalysts, bio-inspired materials and processes, and solar hydrogen production.
     d. Increasing understanding of the role of critical elements such as rare earth elements and platinum group metals used in catalysts to reduce their use and dependence on such materials in coordination with the Critical Minerals Crosscut.

5. Advanced Research Projects Agency - Energy ($TBD): ARPA-E funds early stage research and development programs focused on non-traditional approaches and high risk/high impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. Examples include:
     a. Accelerating innovative concepts such as alkaline membranes, innovative ammonia production and utilization, energy storage, medium temperature fuel cells, fuel cell hybridization and advanced hydrogen production and conversion technologies.
     b. Specific programs relevant to hydrogen include: Range Extenders for Electric Aviation with Low Carbon and High Efficiency, Duration Addition to electricity Storage, Methane Pyrolysis Cohort, Innovative Natural-Gas Technologies for Efficiency Gain in Reliable and Affordable Thermochemical Electricity-Generation, Integration and Optimization of Novel Ion-Conducting Solids, Renewable Energy to Fuels through Utilization of Energy-dense Liquids, and Reliable Electricity Based on ELectrochemical Systems.

Integrated Energy Systems
Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY2021 ($ Change)
Energy Efficiency & Renewable Energy	**380,423**	**424,442**	**534,180**	**+109,738**
Advanced Manufacturing Office (AMO)	0	5,000	10,000	+5,000
Bioenergy Technologies (BETO)	4,500	5,000	5,000	0
Building Technologies (BTO)	285,000	290,000	287,000	-3,000
Geothermal Technologies Office (GTO)	0	0	12,770	+12,770
Hydrogen and Fuel Cell Technologies (HFTO)	0	62,000	82,000	+20,000
Solar Energy Technologies (SETO)	70,000	53,000	77,750	+24,750
Water Power Technologies Office (WPTO)	2,000	1,000	3,400	+2,400
Wind Energy Technologies Office (WETO)	18,923	8,442	56,260	+47,818
Fossil Energy	**181,767**	**200,333**	**266,000**	**+65,667**
Carbon Capture	97,800	86,300	150,000	+63,700
Carbon Utilization	21,000	23,000	38,000	+15,000
Advanced Energy and Hydrogen Systems/Gasification Systems	7,500	19,000	48,000	+29,000
Advanced Energy and Hydrogen Systems/ Reversible Solid Oxide Fuel Cells (formerly Solid Oxide Fuel Cells)	17,000	30,000	2,000	-28,000
Crosscutting Research/Sensors, Controls and Other Novel Concepts	9,000	8,000	3,000	-5,000
Crosscutting Research/Simulation Based Engineering	6,800	6,200	4,000	-2,200
Carbon Dioxide Removal	6,667	13,333	21,000	+7,667
Supercritical Transformational Electric Power (STEP)	16,000	14,500	0	-14,500
Nuclear Energy	**0**	**23,000**	**25,000**	**+2,000**
Nuclear Energy	0	23,000	25,000	+2,000
Total, Integrated Energy Systems	**562,190**	**647,775**	**825,180**	**+177,405**

Summary:

The Department's Integrated Energy Systems (IES) Initiative supports the Department's goal to achieve energy independence and enhance grid resilience by integrating all types of energy resources to optimize the production of electrical and nonelectrical energy products.

The U.S. power grid is undergoing transformational changes that defy its traditional design of large-scale generation remotely located far from consumers, centralized control structures with minimal feedback, limited energy storage, and passive loads. Over the last decade, the U.S. electric generation mix has changed dramatically, with increased generation from highly-flexible natural gas, rapid deployment and penetration of variable renewable resources, and decreased generation from traditional baseload resources. Other changes include increased deployment of energy storage technologies, and greater use of digital and communication technology in the control of power systems. The introduction of new sources of dispatchability, flexibility, and reliability offers the potential for a more optimized, cost-effective, modern energy sector from fuel to generation to delivery to load. Integrated energy systems combine multiple energy sources such as renewables, nuclear plants, and fossil plants to help meet our nation's clean energy goals and enhance the U.S. energy grid's flexibility.

By tightly coupling these sources, employing thermal energy storage systems to provide necessary capacity if electricity demand surpasses supply, and leveraging excess energy output to produce key industrial commodities such as hydrogen and synthetic fuels when the grid demand is met, the grid becomes more sustainable, reliable, affordable, and resilient.

Section 8003 of the Energy Act 2020 authorizes a Research, Development, and Demonstration program to develop cost-effective IES for a variety of purposes, incorporating a variety of technologies, including nuclear energy, renewable energy, storage, and carbon capture.

The initiative is led by the Offices of Nuclear Energy (NE), Energy Efficiency and Renewable Energy (EERE), and Fossil Energy (FE) with support from the Offices of Electricity (OE), Cybersecurity, Energy Security, and Emergency Response (CESER), and Advanced Research Projects Agency – Energy (ARPA-E).

Office of Energy Efficiency & Renewable Energy (EERE)
As part of the Administration's goal to achieve a carbon pollution-free electricity sector no later than 2035, EERE supports cross technology approaches to enable IES. To transition to a carbon-free power sector, the Request provides support to continue to make major strides to integrate more renewable energy generation onto the grid, while ensuring it is reliable, secure, and resilient even as it evolves. The Request includes a sizable increase for investments enabling IES including:

- Increased cross-EERE and cross-DOE efforts to support the widespread integration of renewables in a resilient, reliable power system. This includes efforts sponsored across EERE's Renewable Power offices to expand data, tools, analysis, and technical assistance significantly for stakeholders faced with making data-driven decisions and investments, including state and local governments, regulators, system operators, utilities, and local communities.
- Efforts to integrate solar and wind energy into the grid and accelerate its adoption supported by the Solar Energy Technologies Office and Wind Energy Technologies Office. Topics supported include resiliency, system modelling, energy storage integration, distributed energy resource control coordination, and demonstrating grid services from solar and wind.
- Increased funding through Water Power Technologies Office (WPTO) for increased deployment of variable renewable generation (VRG) assets and lower costs of grid-scale battery energy storage which have led to increased deployment of hybrid generation and storage systems. WPTO will support research into large-scale deployment of utility-scale hybrid generation and conduct experimental validation and demonstration of a scalable multi-megawatt hybrid plant at NREL's Flatirons Campus to compare the technical and financial value of integrating battery energy storage with run-of-river (RoR) hydropower, wind, solar, and tidal generation resources, as well as develop a RoR and energy storage hybrid resource representation model to represent the new combination of resources in the day-ahead market. In addition, the program will evaluate the feasibility of integrating hydropower plants and energy storage devices through continued support for a field demonstration with Idaho Falls Power in April 2021 of black start and grid islanding that combines run-of-river hydropower with supercapacitors. Finally, working with the Solar Energy Technologies, the Request will support the development and demonstration of an integrated control solution for a Photovoltaic-hydropower hybrid system (PHHS) system - a hybrid plant that enables enhanced flexibility and reliability to the grid can achieve a higher energy production by sharing grid infrastructure, land, and maintenance services for the different assets.
- Increased support for High Temperature Electrolyzer Manufacturing R&D by Advanced Manufacturing in collaboration with Hydrogen and Fuel Cell Technologies that could use heat from nuclear plants and other thermal sources to increase efficiencies and lower costs of hydrogen production. In addition, Advanced Manufacturing and Hydrogen and Fuel Cell Technologies are collaborating to support activities leveraging clean hydrogen in industrial end uses such as ammonia and steel production; energy storage and grid integration; reversible fuel cells; and systems development and integration.
- Bioenergy Technology RD&D on carbon utilization strategies that use hydrogen and renewable electricity to produce fuels and chemicals from carbon dioxide. The Request supports the expansion of efforts at the National Laboratories on efficient and economical strategies to reduce carbon dioxide into useful chemical intermediates for upgrading to finished fuels and products.
- Funding from Building Technologies to focus on the integration of building efficiency and grid interactivity. Given the ability for public buildings -- federal, state, and local -- to use systems involving multiple energy sources, storage, and/or conversion technologies that are combined to achieve enhanced capabilities, value, and/or cost savings compared to their standalone alternatives, all efforts in Building Technologies are focused on integrated energy systems at the building level.

Office of Fossil Energy and Carbon Management (FECM)

Fossil Energy and Carbon Management [FECM] is undertaking research and development projects to address challenges and promote innovations in IES. FECM's goal is to deploy flexible capacity to the electric grid with low-cost thermal energy storage systems; conversion of carbon byproducts into useful chemicals and materials; and production of transportation fuels, hydrogen, ammonia, and heat for industrial applications to expand the use of carbon-free energy.

FECM already has a strong foundation in Simulation Based Engineering and has toolsets for modeling, simulation and techno-economic analysis to resolve challenges and optimize power plants as they integrate with a dynamic, evolving electricity grid. These efforts will help improve the reliability, flexibility, and economics of the existing fossil fleet and accelerate the development of modular fossil plants of the future.

Office of Nuclear Energy (NE)
Nuclear plants in the U.S. provide firm capacity to the grid, which is reliable, constant power 24 hours a day, 7 days a week, 365 days a year when not refueling. Flexible capacity is essential for operating the electric grid, as energy supplied to the grid must equal energy removed from the grid at all times. Flexible capacity requires electrical generators to have the ability to ramp power up or ramp power down on demand, to allow the supply of power to balance the demand of power on the grid in addition to accommodating the uncertainty of power flow from renewable power sources. NE's goal is to deploy flexible capacity to the electric grid in addition to currently available firm, carbon-free capacity, to enable a greater penetration of both nuclear and variable renewable energy sources. NE uses two strategies for grid flexibility: thermal energy storage systems to store and dispatch energy on demand, or demand response of a coproduct, such as hydrogen. Demand response will divert energy normally used for a coproduct to support the grid when the demand on the grid is high. The second goal for NE's integrated energy systems program is to expand the use of clean, nuclear energy into the transportation and industrial sectors. NE will conduct research and development of approaches to integrate commercial nuclear power plants with low-cost thermal energy storage systems; convert carbon byproducts into useful chemicals and materials; and produce transportation fuels, hydrogen, ammonia, and heat for industrial applications to expand the use of carbon-free energy.

Departmental Collaboration
The IES Initiative Science and Energy Tech Team (SETT) maintains close collaboration with the Grid Modernization Initiative, Energy Storage Grand Challenge, and the IES Initiative.

Congressional Interactions:
Per Congressional direction in the FY 2021 Omnibus, FECM will be submitting a report to highlight research and development projects in DOE's IES portfolio for various generation technologies from all DOE offices (Energy Efficiency and Renewable Energy [EERE][1], Fossil Energy and Carbon Management [FECM], and Nuclear Energy [NE].

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[1] Research activities within the Office of Energy Efficiency and Renewable Energy is further segmented across the Office of Renewable Power (including Solar Energy Technologies [photovoltaics and concentrating solar power], Wind Energy Technologies, Water Power Technologies, and Geothermal Technologies), the Office of Transportation, and the Office of Energy Efficiency.

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Program Agency-Energy	**3,491**	**0**	**TBD***	**TBD***
Energy Efficiency and Renewable Energy	**50,500**	**20,500**	**16,000**	**-4,500**
Advanced Manufacturing Office (AMO)	20,000	10,000	5,000	-5,000
Bioenergy Technologies (BETO)	0	10,000	10,000	0
Water Power Technologies Office (WPTO)	30,500	500	1,000	+500
Fossil Energy and Carbon Management	**12,500**	**16,500**	**35,000**	**18,500**
Advanced Energy and Hydrogen Systems	2,000	5,500	16,000	+10,500
Carbon Utilization	10,500	11,000	19,000	+8,000
Science	**0**	**14,500**	**14,500**	**0**
Basic Energy Sciences (BES)	0	8,250	8,250	0
Biological and Environmental Research (BER)	0	6,250	6,250	0
Grand Total	**66,491**	**51,500**	**65,500***	**+14,000***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Summary:

The Plastics Innovation Challenge leverages expertise across the Office of Energy Efficiency and Renewable Energy (EERE), Office of Fossil Energy (FE), Office of Science (SC), and the Advanced Research Projects Agency-Energy (ARPA-E) to deliver transformative science and technology solutions that will reduce the energy and greenhouse gas impacts of plastic production and reuse. Today, over 300 million metric tons of new plastic are produced globally, while current technologies are limited to recycling only a small percentage of discarded plastics. The energy and climate impacts of plastic production – manufacturing of plastics, resins, and synthetic rubber – consumes approximately two percent of total energy in the United States, uses nearly 6 percent of global oil production, and generates about four percent of green-house gas emissions annually. Recycling and upcycling is a key pathway to enable the decarbonization of plastics manufacturing. The Plastics Innovation Challenge crosscut engages the collective capabilities across DOE offices that span R&D stages from scientific discovery to technology development and demonstration to deliver ground-breaking approaches to addressing plastic and polymer upcycling. By creating the scientific foundations and technological innovations for plastic and polymer upcycling, the crosscut will position the United States as a world leader in development and deployment of technologies that shift the paradigm of discarded plastic from waste to a valuable resource, creating the foundations for a circular plastics industry.

Crosscut Objectives:

The Plastics Innovation Challenge strives to include the leading activities and technologies across multiple DOE Offices to meet goals for improving energy efficiency and reducing greenhouse gas emissions associated with the production and use of plastics and polymers. The activities of the crosscut focus on research, development, and demonstration (RD&D) to reduce energy consumption and greenhouse gas emissions associated with the production and use of plastics and polymers.

Four key pathways are being pursued to develop a more circular lifecycle for plastics:
- **Deconstruction:** Develop biological, chemical, and thermal methods for deconstructing plastic waste into useful chemicals and chemical intermediates.
- **Upcycling:** Develop technologies to upcycle waste chemical streams into higher-value products, encouraging increased recycling.

- **Recyclable by design:** Design new, renewable plastics and bioplastics that have the properties of today's plastics, are easily recycled, upcycled, or degraded for beneficial use via biodegradation or composting and can be manufactured at scale domestically.
- **Scale and Deploy:** Support an energy- and material-efficient domestic plastics supply chain by helping companies scale and deploy new technologies in domestic and global markets, while improving existing recycling technologies such as collection, sorting, and mechanical recycling.

Advances in these areas will reduce the energy and environmental impacts of plastics, including reducing the release of plastics into rivers and oceans. The FY 2022 Request promotes partnerships and implementation of R&D of technologies to recover and reuse existing plastic waste and move toward reduction in use of oil and gas to produce future plastics.

Program 'Action Areas':
EERE, FE, SC, and ARPA-E will coordinate across DOE and the scientific community to make progress on the challenges associated with reducing plastic waste and lowering the energy and climate impacts of plastic production and reuse. The Offices will:
1. *Strengthen Cross-DOE Coordination and Collaboration:* Ensure an integrated approach to all DOE activities on plastics including integrated analysis, workshops and Principal Investigator (PI) meetings, community/stakeholder engagement, and data/information sharing.
2. *Engage the Scientific and Technical Community***:** Share the results of plastic and polymer upcycling and recycling research efforts, as well as provide opportunities for collaboration and feedback from stakeholders and outside experts.
3. *Coordinate on Competitive Award Review***:** Participate on each other's competitive award review panels – evaluating multiple proposed research plans, participating in review panel discussions, providing objective evaluation of merit, and ensuring that newly selected projects complement the broader DOE research portfolio, beyond the scope of the sponsoring office.
4. *Speak with a Unified DOE Voice in Inter-agency Groups:* Reducing plastic waste is a key objective for several Federal agencies, including the U.S. Environmental Protection Agency, State Department, Department of Commerce, and National Science Foundation. This DOE crosscut will enable a unified, coordinated response in engagements with other agencies.
5. **Coordinate Research Activities:** Offices will coordinate efforts in the following areas:
   a. *Chemical Upcycling:* SC and EERE will coordinate on chemical upcycling activities to develop catalytic and other chemical methods for polymer upcycling, leading to the development of chemical processes at scale that are agnostic to composition or the presence of contaminants.
   b. *Biological Upcycling:* Biological upcycling explores biological mechanisms to deconstruct polymers and convert the resulting monomers to other higher-value products including more biodegradable products. A variety of microorganisms harbor the enzymatic machinery to breakdown polymers and use the resulting products as substrates. These efforts will be coordinated with chemical mechanisms of polymer conversion within the SC Basic Energy Sciences (BES) and EERE and upscaling process research within EERE.
   c. **Design for Circularity:** Design for Circularity activities advance the knowledge base of how the chemical composition and structure of polymers yield desired properties of the plastic material, including the ability to deconstruct them with atom and energy efficiency into components for making valuable products. The research builds on mechanistic understanding of chemical and biological upcycling from efforts led by BES and the SC Biological and Environmental Research (BER), with a focus on research efforts in BES to design and synthesize new materials with controlled function and chemistries of assembly and disassembly. The research also coordinates with EERE efforts in developing bio-based and biodegradable plastics.
   d. **Thermal Processes:** Thermal Processes activities aim to optimize thermal deconstruction processes, such as gasification and pyrolysis, to increase carbon efficiency and lower energy input. Research efforts on polymer degradation span EERE, FE, ARPA-E, and SC and also consider integration with

upcycling processes. These efforts will be coordinated with research on chemical mechanisms of polymer conversion in BES and EERE informing the incorporation of catalytic processes to increase selectively and decrease energy input.

e. **Physical Recycling and Recovery:** Seeks to gain basic advances in sorting technologies and polymer composition to improve physical recycling and recovery, develop models to reflect material flows and end-of-life fate, optimize mechanical and chemical recycling processes, and develop methods to cost-effectively compound recycled plastics into primary plastics. EERE and ARPA-E are coordinating on this topic area.

Program Organization:

1. **Energy Efficiency and Renewable Energy ($16M):** Within EERE, the Advanced Manufacturing Office (AMO), Bioenergy Technologies Office (BETO), and Water Power Technologies Office (WPTO) participate in the Plastics Innovation Challenge. AMO and BETO utilize applied RD&D approaches to target crosscut goals of energy and emissions reduction. WPTO focuses on waterborne plastics assessment and collection technologies. RD&D activities include:

   a. Analysis of supply chain impacts of various novel circular-by-design polymers, recycling, and upcycling pathways.
   b. Public-private partnerships to increase the use of recycled plastics, improve the efficiency and economics of existing recycling pathways and decarbonize plastics manufacturing.
   c. Establishment of industry partnerships to share waste reduction practices and facilitate technology transfer.
   d. National Lab-led consortium and R&D projects to develop novel bio-based polymers that are recyclable-by-design; and biological and chemical decomposition pathways to generate intermediates that can be upgraded to valued products.
   e. Prediction and validation of regional and seasonal estimates of the U.S. watershed contributions to marine debris using high-fidelity models.
   f. Valuation of the reclaimed plastics streams relative to the supply chain within a circular economy.
   g. Characterization of the quality and quantity of plastics debris available for reclamation in those same waterways.
   h. Identification of promising technologies to detect, measure, collect, sort, or transport waterborne plastics.
   i. Assessment of the *in situ* renewable power available to mitigate plastic debris in significant impaired waterways.
   j. Optimal siting of promising plastic reclamation projects.
   k. Serving as a repository for waterways data, and a hub for analysis and technology development.

2. **Office of Science ($14.5M):** RD&D activities include:
   The SC BES and BER Programs support research that probes the frontiers of physics, chemistry, materials science, and systems biology, and are stewards of world-leading scientific user facilities at DOE National Laboratories.
   a. BES supports research based on its efforts in novel catalyst design and molecular-level control of chemical transformations; the understanding and control of reaction mechanisms; active-site protein chemistry that provides a basis for highly selective and efficient bio-inspired catalysts; and design and synthesis of novel materials with an emphasis on the chemistry and chemical control of structure and collective properties. BER's research includes genomic and microbiome science to explore biological mechanisms for polymer breakdown and conversion; identification and/or modifications of metabolic pathways, organisms, and microbial communities to convert polymers to value-added bioproducts; and computational resources and novel analysis tools to leverage systems biology data for genome editing to design new biological systems.
   b. The FY 2020 BES FOA for Energy Frontier Research Centers (EFRCs) funded two new centers focused on chemical upcycling of polymers. BES issued a FOA in FY 2021 on chemical upcycling of polymers to solicit proposals for single PI and small group efforts that complement the EFRC efforts.

c. BER issued a FOA in FY 2021 that builds on the experience with lignocellulosics to broaden investigations of other polymers, including plastics that may also be susceptible to breakdown by some types of microorganisms.

3. **Advanced Research Projects Agency - Energy ($TBD):** ARPA-E funds early-stage R&D programs focused on non-traditional approaches and high risk/high impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. Examples include:
   a. Accelerating innovative concepts such as: developing technologies to convert high-energy materials currently going to landfills into a high-energy content liquid product.
   b. Specific programs relevant to the Plastics Innovation Challenge include: Solicitation on Topics Informing New Program Areas – Recycle Underutilized Solids to Energy program.

4. **Fossil Energy and Carbon Management ($35M):** The Office of Fossil Energy and Carbon Management's (FECM) gasification, pyrolysis, and CO_2 utilization programs have been working for decades on associated technologies that can be used for thermochemical conversion to gasify co-fired plastics for syngas, hydrogen, and CO_2 as the building blocks for valuable materials. The programs are working with industry stakeholders to develop advanced gasification processes and utilize CO_2 to form new polymers or building blocks for new plastics. The program also integrates carbon capture, utilization, and storage into all systems to reduce carbon and other emissions. The R&D of which main focus is on co-gasification of waste plastics with other feedstocks to produce syngas (H_2, CO) and further conversion of the syngas into hydrogen and other chemicals with utilization of CO_2 to make precursors for plastics or utilization with CCS. R&D activities include:
   a. The FY 2020 Gasification FOA (titled on Enabling Gasification of Blended Coal, Biomass and Plastic Wastes to Produce Hydrogen with Potential for Net Negative Carbon Dioxide Emissions) funded four projects.
   b. The FY 2021 Gasification FOA issued on Process Intensification for Low-Cost H_2 Production via Modular Gasification of waste plastics and other mixed feedstocks with CCUS.
   c. The FY 2022 Gasification Program will continue to support the development of new modular gasification system to produce H_2 from waste plastics and other wastes with CCUS.
   d. The Carbon Utilization program supports catalytical conversion of CO_2 to CO and other monomers as the building blocks for plastics.

DOE holds informal quarterly meetings attended by experts from EERE, SC, FE and ARPA E to ensure coordination on research directions and investments across DOE. Through these efforts, DOE offices also coordinate joint workshop planning and attendance, program peer reviews, project merit reviews, and other stakeholder engagement activities to facilitate information exchange and collaboration across the range of fundamental and applied researchers, technologists, and industry partners. In FY 2021, the crosscut partners jointly developed and released a draft Plastics Innovation Challenge Roadmap. DOE solicited stakeholder feedback on this strategic document and intends to refine the Roadmap to ensure that its direction reflects stakeholder feedback and Administration priorities for decarbonization of industry.

Quantum Information Sciences Initiative

Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 22 vs. FY 21 ($ Change)
National Nuclear Security Administration (NNSA)	**6,000**	**12,000**	**12,000**	**0**
Advanced Simulation and Computing	6,000	12,000	12,000	0
Science	**195,270**	**270,391**	**300,881**	**+30,490**
Advanced Scientific Computing Research	54,680	98,402	107,649	+9,247
Basic Energy Sciences	72,270	92,050	102,000	+9,950
Biological and Environmental Research	12,000	12,000	14,500	+2,500
Fusion Energy Sciences	7,520	9,520	10,000	+480
High Energy Physics	38,500	45,072	51,566	+6,494
Nuclear Physics	10,300	13,347	10,866	-2,481
Isotope R&D and Production Program	–	–	4,300	+4,300
Total, Quantum Information Science Initiative	**201,270**	**282,391**	**312,881**	**+30,490**

Overview
In FY 2022, the Department of Energy (DOE) will continue its leadership role in the National Quantum Initiative (NQI); the DOE goal is to create the ecosystem needed to foster and facilitate advancement of Quantum Information Science (QIS) with public benefits in national security, economic competitiveness, and leadership in scientific discovery.

Participating offices within DOE are National Nuclear Security Administration (NNSA) and the Office of Science (SC). The following is a summary of program activities to support QIS in FY 2022:

NNSA: $12M
The Office of Defense Programs (DP)'s Quantum Computing (QC) portfolio investigates the application of quantum computing algorithms and hardware to NNSA mission needs. The overarching goal is to gain a detailed understanding of the best technical approaches and benefits of emerging quantum technologies for NNSA applications and develop a roadmap for their integration into DP's Advanced Simulation and Computing (ASC) program's high-performance computing (HPC) environment. The ASC QC activities leverage other foundational research and development investments from Laboratory Directed Research & Development (LDRD), DOE Office of Science and other agencies.

DP work scope will fall into three areas:
- Investigation, both computationally and experimentally, into efficient mapping of algorithms to quantum simulation platform capabilities, specifically for NNSA application areas.
- Implementation of a quantum simulation hardware testbed platform with fast feedback control and integration of classical HPC resources.
- Evaluation of emerging QC hardware technologies, via in-house labs or cloud environments.

Office of Science (SC): $300.9M
SC's QIS investments are focused on 3 key areas:

1. QIS Core Basic Research: $168.625M
   To realize the full potential of QIS requires a detailed understanding of how quantum systems behave, accurate knowledge of how to integrate the components into complex systems, and precise control of the structures and functionalities. In FY 2022, SC will continue to invest in core basic QIS research in key DOE areas including computing, simulation, sensing, communication, and isotope production.
2. National QIS Research Centers: $125.0M

In FY 2020, DOE established five National QIS Research Centers to accelerate the transformational advances in basic science and quantum-based technology needed to develop world-leading capabilities in QIS, and in support of the NQI. The FY 2022 Request will fully support the Centers at $25M each.

3. Quantum Information Science Network: $19.212M
DOE envisions a quantum internet connecting DOE National Laboratories and User Facilities with each other and with quantum-enabled resources to accelerate scientific discovery across all SC programs. The FY 2022 Request will support regional-scale quantum testbeds able to interface with satellite links and classical networks.

In FY 2022, SC's investment will support continued quantum collaborations in support of an MOU with NNSA and DOD as well as the coordination across the SC program offices.

Program Organization:
As the Nation's leading supporter of basic research in physical sciences and the unique capabilities and expertise that are resident in the DOE National Laboratory complex, SC will continue to advance QIS core basic research through investments from its program offices on topics that align with SC's mission.

1. Advanced Scientific Computing Research (ASCR) ($107.6M)—Key QIS contributions will continue to provide early access to new technology through quantum computing and network testbeds and, to support basic research programs in quantum algorithms and computer science, and in quantum communications.
2. Basic Energy Sciences (BES) ($102.0M)—BES will continue to support research and infrastructure to advance understanding and control of quantum coherence and entanglement in quantum materials and molecular systems to enable applications in information processing, communication, sensors, and energy technologies.
3. Biological and Environmental Research (BER) ($14.5M)—BER will continue to support exploration of QIS concepts for enhanced imaging, sensing and characterization of cellular metabolic processes.
4. Fusion Energy Sciences (FES) ($10M)—FES will continue to support near-term opportunities to identify quantum simulation capabilities that can solve important fusion and plasma science problems; the identification of quantum sensing approaches that can enhance diagnostic capabilities for plasma and fusion science; the use of high energy density physics techniques to form novel quantum materials; and the refining of plasma science tools for simulation and control of quantum systems.
5. High Energy Physics (HEP) ($51.6M)—HEP QIS research includes discovery along HEP mission and foundational QIS, and early-stage research technology via interdisciplinary partnerships. HEP QIS efforts will continue their focus on foundational research connecting physics of the Cosmos with qubit systems, theoretical and computational research, and quantum simulations for particle physics, QIS-enhanced sensing, and experiments for new windows on the dark universe and physics beyond the standard model.
6. Nuclear Physics (NP) ($10.9M)—NP will continue to support emerging opportunities that address topics in fundamental research and applied challenges at the interface of nuclear physics and QIS: development of quantum computation, quantum simulations and atomic simulators, quantum sensing, quantum-enhanced nuclear physics experiments, nuclear clocks and qubits, and mitigation of the effects of radioactivity on superconducting qubits.
7. Isotope R&D and Production Program (IP) ($4.3M)—Activities will continue to focus on developing domestic production capabilities for key isotopes required for QIS systems and removing dependence on foreign supply chains. IP re-established enriched stable isotope production capabilities in the U.S. in 2017; other enrichment technology will continue to be pursued.

Departmental Collaboration
Activities across the Department are supporting the advancement of U.S. economic competitiveness and energy productivity through technology innovations. Collaboration opportunities exist in both research planning as well as conducting joint R&D efforts.

In FY 2022, SC's investment will support continued quantum collaborations in support of a MOU with NNSA and Department of Defense as well as the coordination across the six SC program offices.

Highlights and Major Changes

- Crosscut Objective 1: Oversee the coordination of efforts across the National QIS Research Centers portfolio.
- Crosscut Objective 2: Ensure awareness among SC core basic research programs in QIS to identify synergies and areas for collaboration.
- Crosscut Objective 3: Advance research and technology toward the development of a quantum internet.
- Crosscut Objective 4: Provide a broad user base with access to early-stage quantum testbeds and a wider variety of commercial quantum computers.

Program 'Action Areas':

1. Action Area 1: The National QIS Research Centers portfolio is managed by the Centers Working Group composed of program managers from ASCR, BES, BER, FES, HEP, and NP. In Summer 2021, the Working Group will hold an initial review of the Centers' progress with external reviewers. In FY 2022, the Working Group will continue to meet regularly and evaluate the Centers' progress via reports and reviews.
2. Action Area 2: In FY 2021, a QIS Core Research Working Group was established with representatives from ASCR, BES, BER, FES, HEP, NP and IP. In FY 2022, the Working Group will continue to meet regularly to identify synergies and areas for collaboration in SC program offices' core basic research investments in QIS.
3. Action Area 3: In FY 2021, ASCR, BES, and HEP collaborated on a DOE laboratory program announcement to lay the groundwork for a quantum internet. In FY 2022, ASCR, BES, and HEP will continue to collaborate, and coordinate the progress toward the development of a quantum internet with the other DOE offices.
4. Action Area 4: In FY 2022, ASCR's Quantum Testbeds for Science and the Oak Ridge Leadership Computing Facility Quantum Computing User Program will continue providing access to quantum computing resources to a broad user base. The Quantum Computing User Program will continue negotiating with vendors as new platforms become available. ASCR will partner with SC program offices to understand their specific quantum computing research requirements. SC program offices will conduct outreach to make their funded communities aware of the available quantum computing resources.

Major Changes from FY 2021 Request

- NNSA – no major changes.
- SC – Net increase reflects $ 30.5M increase investment in research for continued early stage research in key quantum technologies and tools as well as to provide access to quantum testbeds and computers, and an increase of $50M in the QIS Centers to fund each center at $25M each.

Safeguards and Security
Crosscut

Program Mission

The Safeguards and Security (S&S) program at headquarters and each DOE field site protects against theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts which may cause damage to national security, program continuity, the health and safety of employees, the public or the environment. The 'crosscut' summarizes the S&S programs that are distributed through the budget volumes. Each program's S&S components are described in the budget justifications for:

- Science
- Weapons Activities
- Defense Nuclear Nonproliferation
- Naval Reactors
- Defense Environmental Cleanup
- Nuclear Energy
- Energy Efficiency and Renewable Energy
- Fossil Energy R&D
- Strategic Petroleum Reserve
- Legacy Management
- Loans Program Office
- Enterprise Assessments
- Environment, Health, Safety and Security
- Energy Information Administration
- Specialized Security Activities
- NNSA Federal Salaries and Expenses
- Chief Financial Officer
- Chief Information Officer

Program Overview

The budget for the direct funded S&S programs is organized to ensure consistency in program and budget execution and ensure management, direction, tracking and monitoring of security costs throughout the Department. Each program budget provides visibility for S&S issues to help management ensure effective and efficient S&S program implementation. Figure 1 shows comparable overall funding for S&S in the FY 2020 Enacted, FY 2021 Enacted, and the FY 2022 Request.

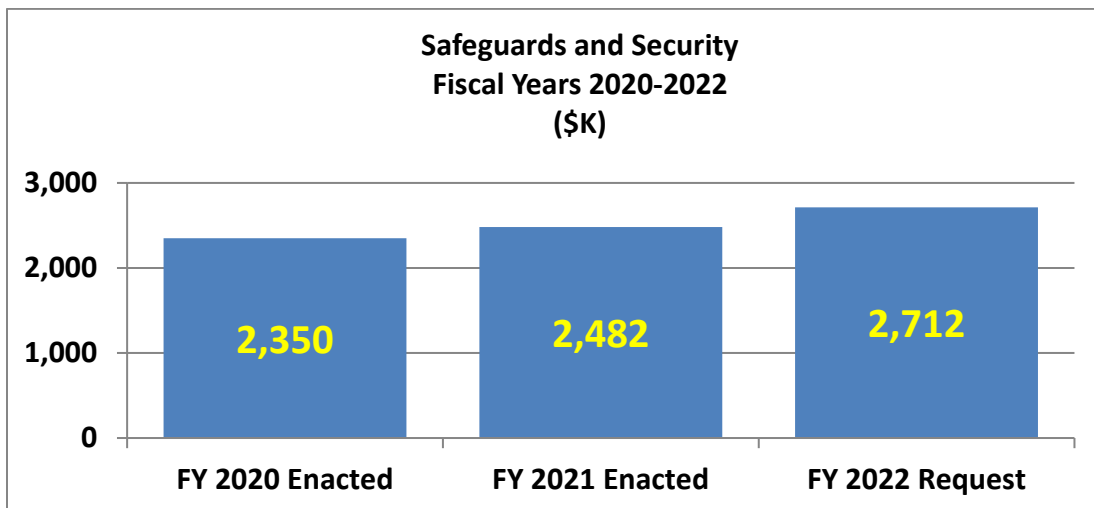**Figure 1: Overall DOE S&S Funding**

Table 1: Functional Components of S&S

The S&S crosscut budget is comprised of the functional components shown in the following table.

Protective Forces	Provides for the protection of special nuclear materials, information, employees, and government property from theft, diversion, sabotage, and malicious destruction.
Physical Security Systems	Addresses access control and interior/exterior intrusion detection systems.
Information Security	Ensures that individuals protect classified matter and sensitive unclassified matter and establishes protection systems that require degrees of protection for each classification level.
Cybersecurity	Assures protection of IT resources and networks, to include modernizing cybersecurity defenses by protecting federal networks, improving information-sharing between the U.S. government and the private sector on cyber issues, and strengthening the United States' ability to respond to incidents when they occur.
Personnel Security	Supports activities associated with the access authorization program.
Material Control and Accountability	Provides assurance that the nuclear materials used and/or stored at DOE facilities are always properly controlled and accounted for.
Program Management	Assures a framework for efficient and effective security operations.
Security Investigations	Provides for background investigations for access authorizations.
Transportation Security	Provides secure transportation of nuclear materials.
Security Infrastructure/ Construction	Provides for update and repair of security-related infrastructure and construction for that purpose.
Specialized Security Activities	Provides highly specialized analyses in support of national security objectives.

Table 2 shows S&S funding by program cost elements; and Table 3 by functional cost elements. Subsequent sections break out each functional element of safeguards and security by program.

Highlights:
In FY 2022, the Department's overall S&S investment (field and HQ) is $2.7 billion, an increase of +$230.6 million, or 9.3%, above the FY 2021 Enacted level.

By functional element, DOE is making strategic investments in Cybersecurity (+$188.7 million, or +41.6%), Protective Forces (+$52.9 million, or +6.7%), and Program Management (+$15.8 million, or +12.2%). In FY 2022, there is a decrease (-$13.5 million, or -26.2%), overall, in security infrastructure/construction, reflecting the completion of specific investments.

By program, there are significant increases from FY 2021 to FY 2022 for Weapons Activities (+$86.5 million, or +6.2%) for investments in cybersecurity activities (+$45.8 million), program management (+$13.1 million), and protective forces (+$43.1 million). Additionally, there are notable increases in the Office of Science (+$49 million, or +40.5%) and the Office of the Chief Information Officer (+$92.5 million or +128.9%) primarily for investments in cybersecurity in response to Executive Order 14028, Improving the Nation's Cybersecurity.

Table 2: S&S Funding by Program ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Safeguards and Security (S&S) by Program					
Science	112,700	121,000	170,000	49,000	40.5%
Weapons Activities (NNSA)	1,284,332	1,391,550	1,478,017	86,467	6.2%
Defense Nuclear Nonproliferation (NNSA)	357	359	369	10	2.8%
Naval Reactors (NNSA)	3,022	2,486	3,049	563	22.6%
Defense Environmental Cleanup	313,097	320,771	316,744	-4,027	-1.3%
Nuclear Energy	153,408	149,800	149,800	0	0.0%
Energy Efficiency and Renewable Energy	10,720	12,950	15,200	2,250	17.4%
Fossil Energy & Carbon Management*	9,432	11,304	12,851	1,547	13.7%
Strategic Petroleum Reserve	30,331	25,262	25,948	686	2.7%
Legacy Management	2,353	2,433	2,244	-189	-7.8%
Loan Programs Office	308	388	388	0	0.0%
Enterprise Assessments	5,741	9,335	9,335	0	0.0%
Environment, Health, Safety and Security	73,364	73,614	74,903	1,289	1.8%
Energy Information Administration	902	920	1,105	185	20.1%
Federal Salaries and Expenses (NNSA)	2,730	2,730	2,822	92	3.4%
Chief Financial Officer	1,300	1,410	1,550	140	9.9%
Chief Information Officer	72,187	71,800	164,340	92,540	128.9%
Specialized Security Activities	273,409	283,500	283,500	0	0.0%
Total, Program S&S	**2,349,693**	**2,481,612**	**2,712,165**	**230,553**	**9.3%**

*Formerly Fossil Energy Research and Development (FYs 2020 & 2021)

Table 3: S&S Funding by Functional Cost Element ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
S&S by Functional Cost Element					
Protective Forces	770,129	785,298	838,154	52,856	6.7%
Physical Security Systems	212,781	198,213	195,120	-3,093	-1.6%
Information Security	70,948	82,596	87,049	4,453	5.4%
Cybersecurity	408,228	453,738	642,439	188,701	41.6%
Personnel Security	73,468	82,765	83,121	356	0.4%
Material Control and Accountability	42,453	54,828	57,227	2,399	4.4%
Program Management	141,306	129,268	145,047	15,779	12.2%
Security Investigations	11,173	11,001	11,534	533	4.8%
Transportation Security	292,780	348,899	330,979	-17,920	-5.1%
Security Infrastructure/Construction	53,036	51,506	37,995	-13,511	-26.2%
Specialized Security Activities	273,409	283,500	283,500	0	0.0%
Total, Functional S&S	**2,349,693**	**2,481,612**	**2,712,165**	**230,553**	**9.3%**

Protective Forces
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Protective Forces					
Science	43,545	44,200	46,710	2,510	5.7%
Weapons Activities (NNSA)	392,617	412,362	455,445	43,083	10.4%
Defense Environmental Cleanup	193,557	188,572	189,257	685	0.4%
Nuclear Energy	79,450	80,812	85,356	4,544	5.6%
Energy Efficiency and Renewable Energy	3,100	3,215	3,470	255	7.9%
Fossil Energy & Carbon Management	2,983	3,072	3,164	92	3.0%
Strategic Petroleum Reserve	21,355	19,113	18,691	-422	-2.2%
Legacy Management	719	649	642	-7	-1.1%
Environment, Health, Safety and Security	32,803	33,303	35,419	2,116	6.4%
Total, Protective Forces	**770,129**	**785,298**	**838,154**	**52,856**	**6.7%**

Mission

The Protective Forces element of field and headquarters S&S provides funding to protect the Department's critical assets, which include nuclear weapons in DOE custody, nuclear weapons components, special nuclear materials, classified information, and DOE facilities against a spectrum of threats, including terrorist activity, sabotage, espionage, theft, diversion, loss, or unauthorized use.

Protective Force programs throughout the complex provide for personnel salaries, wages, and benefits for personnel; management and supervision; and well-maintained and logically deployed equipment and facilities to ensure effective performance of assigned functions and tasks under normal and emergency conditions.

Protective Forces programs include the conduct of access control and security response operations; the physical protection of special nuclear material, classified matter and information, and government property; emergency response forces and tactical assistance during events as well as an on-scene security commander; random patrols; coordination with local law enforcement and protective force elements aimed at providing effective response to emergency situations; random prohibited article inspections; security alarm monitoring and dispatch services; the collection and destruction of classified matter; and testing of the protective force to respond to various event scenarios.

Protective Forces programs maintain a Special Response Team capability to provide resolution of incidents that require effective and timely response with force options that exceed the capability of front-line protective force personnel. This includes prevention, recapture and recovery operations involving the use of special weapons systems and tactics to prevent access to special nuclear material or effect recovery from unauthorized control.

Highlight:
- For Weapons Activities, increase reflects additional security requirements associated with growth across the nuclear security enterprise, in particular the Plutonium Pit Production efforts at Los Alamos.

Physical Security Systems
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Physical Security Systems					
Science	16,960	20,180	22,490	2,310	11.4%
Weapons Activities (NNSA)	149,138	128,894	125,934	-2,960	-2.3%
Defense Environmental Cleanup	26,720	28,504	26,742	-1,762	-6.2%
Nuclear Energy	10,075	10,075	11,575	1,500	14.9%
Energy Efficiency and Renewable Energy	750	815	875	60	7.4%
Fossil Energy & Carbon Management	159	1,195	171	-1,024	-85.7%
Strategic Petroleum Reserve	1,193	1,051	1,075	24	2.3%
Legacy Management	149	120	120	0	0.0%
Environment, Health, Safety and Security	7,637	7,379	6,138	-1,241	-16.8%
Total, Physical Security Systems	**212,781**	**198,213**	**195,120**	**-3,093**	**-1.6%**

Mission

The Physical Security Systems element of field and headquarters S&S provides for the physical protection of special nuclear material and equipment, sensitive information, Departmental property, and unclassified facilities. Included are buildings, fences, barriers, lighting, sensors, surveillance devices, entry control devices, access control systems, explosive detection systems, power systems and other real property and hardware designed for or affecting security. This hardware and equipment are operated and used to support the protection of DOE property and other interests of national security.

Security Systems programs support DOE-wide efforts required to conduct performance assurance testing. These programs also ensure that security alarm systems are operational and functioning in accordance with applicable DOE requirements. Physical Security System programs are also responsible for two subprograms: (1) a barriers, secure storage, and lock program to restrict, limit, delay or deny entry into a designated area; and (2) an entry control and access program that provides positive identification of personnel requiring access to facilities and initial access to facilities in general, ensuring that persons entering or leaving facilities are authorized, and do not introduce prohibited articles into or remove Government property from Departmental facilities.

The budget estimates include all access control administrative activity involving production, accountability and destruction of access authorization badges and firearms credentials. They also include systems components and tamper-safe oversight by monitoring and responding to alarms, determining access, and securing all alarmed structures on site. In addition, this element provides for handling all radio communications for the protection of the facilities.

Highlight:
- For Science, increase reflects continued implementation of Design Basis Threat and Science & Technology Policy mandated physical security modifications at SC laboratories.

Information Security
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Information Security					
Science	4,356	4,420	4,490	70	1.6%
Weapons Activities (NNSA)	44,261	52,776	56,293	3,517	6.7%
Defense Environmental Cleanup	4,933	5,911	5,898	-13	-0.2%
Nuclear Energy	4,674	4,674	6,174	1,500	32.1%
Energy Efficiency and Renewable Energy	500	515	550	35	6.8%
Fossil Energy & Carbon Management	273	319	156	-163	-51.1%
Strategic Petroleum Reserve	251	231	238	7	3.0%
Legacy Management	21	71	71	0	0.0%
Environment, Health, Safety and Security	11,679	13,679	13,179	-500	-3.7%
Total, Information Security	**70,948**	**82,596**	**87,049**	**4,453**	**5.4%**

Mission

The Information Security element of field and headquarters S&S ensures that material and documents that may contain sensitive and classified information are accurately and consistently identified, properly reviewed for content, appropriately marked, and protected from unauthorized disclosure, and ultimately destroyed in an approved manner.

Information Security programs provides for plans, policies, procedures, and training to ensure that all employees are aware of the requirements for the identification, review, classification, declassification, marking, protection and proper disposal of sensitive information and classified material. In addition, operational security considerations are used to preclude inadvertent compromise of classified material.

Highlight:

- No major changes in Information Security funding from FY 2021 Enacted to FY 2022 Request. Overall increase in budget requests in FY 2022 will result in increases in Information Security programs.

Cybersecurity
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Field Cybersecurity*					
Science	33,346	37,520	81,260	43,740	116.6%
Weapons Activities (NNSA)	214,361	251,472	297,243	45,771	18.2%
Defense Environmental Cleanup	42,505	41,460	39,046	-2,414	-5.8%
Nuclear Energy	16,856	16,856	19,812	2,956	17.5%
Energy Efficiency and Renewable Energy	5,200	7,200	9,200	2,000	27.8%
Fossil Energy & Carbon Management	4,416	4,772	7,398	2,626	55.0%
Strategic Petroleum Reserve	3,475	2,664	3,761	1,097	41.2%
Legacy Management	1,097	1,183	1,067	-116	-9.8%
Total, Field Cybersecurity	**321,256**	**363,127**	**458,787**	**95,660**	**26.3%**

*Cybersecurity amounts shown do not include Working Capital Fund or Energy Information Technology System contributions

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Cybersecurity (including Headquarters Offices)					
Field Cybersecurity	**321,256**	**363,127**	**458,787**	**95,660**	**26.3%**
Headquarters Cybersecurity	**86,972**	**90,611**	**183,652**	**93,041**	**102.7%**
Fossil Energy & Carbon Management (HQ only)	920	1,170	1,300	130	11.1%
Loan Program Office	288	288	288	0	0.0%
Enterprise Assessments	5,741	9,335	9,335	0	0.0%
Energy Information Administration	902	920	1,105	185	20.1%
Environment, Health, Safety and Security	5,634	5,688	5,734	46	0.8%
Chief Financial Officer	1,300	1,410	1,550	140	9.9%
Chief Information Officer	72,187	71,800	164,340	92,540	128.9%
Total, Cybersecurity	**408,228**	**453,738**	**642,439**	**188,701**	**41.6%**

Mission

The Cybersecurity element of field and headquarters S&S improves the nation's cybersecurity and protects the federal government networks, in line with Executive Order 14028, Improving the Nation's Cybersecurity. Recent cybersecurity incidents such as SolarWinds, Microsoft Exchange, and the Colonial Pipeline incident are a sobering reminder that U.S. public and private sector entities increasingly face sophisticated malicious cyber activity from both nation-state actors and cyber criminals. These incidents share commonalities, including insufficient cybersecurity defenses that leave public and private sector entities more vulnerable to incidents.

In FY 2022, the Department of Energy is making significant contributions toward modernizing cybersecurity defenses by protecting federal networks, improving information-sharing between the U.S. government and the private sector on cyber issues, and strengthening the United States' ability to respond to incidents when they occur. Investments in Cybersecurity at the Department will focus on the following key areas, as identified in EO 14028:

- Remove Barriers to Threat Information Sharing Between Government and the Private Sector. Ensure that IT Service Providers are able to share information with the government and require them to share certain breach information. Removing any contractual barriers and requiring providers to share breach information that could impact Government networks is necessary to enable more effective defenses of Federal departments, including DOE, and to improve the Nation's cybersecurity as a whole.

- Modernize and Implement Stronger Cybersecurity Standards. Help move DOE enterprise to secure cloud services and a zero-trust architecture, and mandate deployment of multifactor authentication and encryption within a specific time period. Outdated security models and unencrypted data have led to compromises of systems in the

public and private sectors. DOE will increase its adoption of security best practices, by accelerating movement to a zero-trust security model and secure cloud services, and consistently deploying foundational security tools such as multifactor authentication and encryption.

- Improve Software Supply Chain Security. Continue to mature and expand the Information and Communication Technology Supply Chain Risk Management Program to improve the security of software and hardware. Too much of our hardware and critical software is shipped with significant vulnerabilities that our adversaries exploit.

- Improve Investigative and Remediation Capabilities. Improve cybersecurity threat hunting and response through improved logging and data analytics. Create cybersecurity event log and data retention requirements for DOE enterprise. Modernized perimeter sensors, improved data storage and search capabilities will improve the organization's ability to detect intrusions, mitigate those in progress, and determine the extent of an incident after the fact.

The amounts given here are program funds and do not include security elements that are within software applications developed for the Department's programmatic or administrative purposes; whether directly or indirectly funded. They do include IT Security and Compliance entries within the IT Investment portfolio. Highlights of cybersecurity activities can be found within the individual program budget requests.

Field Cybersecurity Highlights:
- Increase for Science will support investments to strengthen protection at federal and M&O sites in the areas of: Cyber Threat Intelligence, Incident Response, Incident Recovery, Novel Security Techniques, Infrastructure Refresh, Industrial Control System Protection, Continuous Diagnostics and Mitigation, and Controlled Unclassified Information Protection. Additionally, the request will support the implementation of the Cyber Security Program Plan and development of a mature, risk-based cyber security program across federal and M&O sites.
- Increase for Weapons Activities reflects investments in Site Infrastructure and Enterprise Operations, including cybersecurity modernization at the Management and Operating (M&Os) contractors and the NNSA Information Assurance Response Center. The increase implements the TEMPEST (electronic and electromechanical telecommunications and automated information processing equipment can produce unintentional, intelligence-bearing emanations) portion of DOE Order 470.6, the sustainment of Cybersecurity Site Infrastructure operations, and Cyber-related requirements associated with implementing the classified infrastructure modernization effort.

Headquarters (HQ) Cybersecurity Highlights:
- Increase for Chief Information Officer reflects dedicated cyber reserve fund for the entire DOE complex to address requirements of Executive Order 14028 Improving the Nation's Cybersecurity.

Personnel Security
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Personnel Security					
Science	5,444	5,500	5,750	250	4.5%
Weapons Activities (NNSA)	39,988	49,226	52,806	3,580	7.3%
Defense Environmental Cleanup	12,590	12,647	12,427	-220	-1.7%
Nuclear Energy	7,714	7,714	4,714	-3,000	-38.9%
Energy Efficiency and Renewable Energy	200	215	230	15	7.0%
Fossil Energy & Carbon Management	225	285	346	61	21.4%
Strategic Petroleum Reserve	580	661	580	-81	-12.3%
Legacy Management	35	75	76	1	1.3%
Environment, Health, Safety and Security	6,692	6,442	6,192	-250	-3.9%
Total, Personnel Security	**73,468**	**82,765**	**83,121**	**356**	**0.4%**

Mission

The Personnel Security element of field and headquarters S&S supports the access authorization program and ensures security sensitivity through security briefings such as the initial refresher and termination briefings, re-orientations, computer-based training, special workshops and classes, publications, closed circuit television programs, signs, posters, and special event days. Support for the access authorization program includes: (1) personnel security assurance program, adjudications, screening, and analysis of personnel security cases for determining eligibility for access authorizations, administrative reviews, and handling of Freedom of Information Act and Privacy Act requests related to security access authorizations; (2) security awareness and education; and (3) activities associated with classified and unclassified visits and assignments by foreign nationals.

Highlights:

- For Weapons Activities, increase reflects additional security requirements associated with growth across the nuclear security enterprise, in particular the Plutonium Pit Production efforts at Los Alamos.
- For Nuclear Energy, decrease reflects the implementation of full cost recovery for security clearance activities by requesting program organizations.

Material Control and Accountability
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Material Control and Accountability					
Science	2,431	2,465	2,500	35	1.4%
Weapons Activities (NNSA)	30,865	40,311	41,534	1,223	3.0%
Defense Environmental Cleanup	4,236	7,176	6,817	-359	-5.0%
Nuclear Energy	4,876	4,876	6,376	1,500	30.8%
Total, Material Control and Accountability	**42,408**	**54,828**	**57,227**	**2,399**	**4.4%**

Mission

The Material Control and Accountability (MC&A) element of field S&S provides assurance that nuclear materials are properly controlled and always accounted for. MC&A provides evidence that all nuclear materials are accounted for appropriately and that theft, diversion, or operational loss has not occurred. MC&A also supports weapons production, nuclear nonproliferation, nuclear materials operations, facility closure, and nuclear critical safety by determining and documenting the amounts of nuclear materials in weapons and packaged items. MC&A administration includes the following: (1) assessing the levels of protection, control and accounting required for the types and quantities of materials at each facility; (2) documenting facility plans for nuclear materials control and accounting; (3) assigning authorities and responsibilities for MC&A functions; (4) ensuring that facility MC&A personnel are trained and qualified to perform their responsibilities; (5) establishing programs to report occurrences such as nuclear material theft, the loss of control or inability to account for nuclear materials, or evidence of malevolent acts; (6) conducting performance testing of required program elements; and (7) establishing facility programs to conduct and document internal assessments of their operations and MC&A programs.

Highlight:

- No major changes in Material Control and Accountability funding from FY 2021 Enacted to FY 2022 Request.

Program Management
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Program Management*					
Science	6,618	6,715	6,800	85	1.3%
Weapons Activities (NNSA)	93,131	79,508	92,611	13,103	16.5%
Defense Environmental Cleanup	22,762	25,742	25,243	-499	-1.9%
Nuclear Energy	8,175	8,175	10,175	2,000	24.5%
Energy Efficiency and Renewable Energy	800	820	690	-130	-15.9%
Fossil Energy & Carbon Management	456	491	316	-175	-35.6%
Strategic Petroleum Reserve	1,713	1,542	1,603	61	4.0%
Legacy Management	332	335	268	-67	-20.0%
Environment, Health, Safety and Security	7,319	5,940	7,341	1,401	23.6%
Total, Program Management	**141,306**	**129,268**	**145,047**	**15,779**	**12.2%**

* In Weapons Activities, titled, *Security Program Operations and Planning.*

Mission

The Program Management element of field and headquarters S&S develops the framework for efficient and effective security operations. This includes the development and updating of S&S plans, conducting vulnerability assessments to determine if assets are at risk, modeling to ensure the plans and operations meet mission objectives, identifying assets that need protection, developing local threat assessments and participating in the S&S quality panel process and security education. In addition, these programs ensure that plans are developed and revised in accordance with DOE requirements, professional and technical training is administered, and Departmental S&S goals and objectives are implemented complex wide.

The programs develop S&S plans or other applicable security plans and implement S&S requirements, conduct surveys to determine whether S&S requirements have been implemented, respond to national and local threats, and perform a vulnerability analysis that measures the risk of S&S assets. Program Management includes participation in the quality panel process, which raises issues from the field to the headquarters managers and ensures that the staff is properly educated in security matters.

Highlight:

- For Weapons Activities, increase reflects requirements associated with growth across the nuclear security enterprise (NSE), including Plutonium Pit Production efforts. Funding also maintains site security plans, risk/vulnerability assessment capabilities, budget development, management of site programs for incidents of security concern, and security awareness programs.

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Security Investigations*					
Weapons Activities (NNSA)	2,311	2,317	2,387	70	3.0%
Defense Nuclear Nonproliferation (NNSA)	357	359	369	10	2.8%
Naval Reactors (NNSA)	3,022	2,486	3,049	563	22.6%
Defense Environmental Cleanup	963	1,656	1,722	66	4.0%
Energy Efficiency and Renewable Energy	170	170	185	15	8.8%
Federal Salaries and Expenses (NNSA)	2,730	2,730	2,822	92	3.4%
Loan Programs Office	20	100	100	0	0.0%
Environment, Health, Safety and Security	1,600	1,183	900	-283	-23.9%
Total, Security Investigations	**11,173**	**11,001**	**11,534**	**533**	**4.8%**

* NE and SC Security Investigations costs for Federal Employees are subsumed within Personnel Security.

Mission

The Security Investigations element of field and headquarters S&S funds background investigations associated with providing access authorizations (security clearances) to DOE Federal and contract personnel who, in the performance of their official duties, require access to classified information or certain quantities of special nuclear material. Background investigations are required by Section 145 of the Atomic Energy Act of 1954, as amended, and Executive Order 12968, Access to Classified Information. The investigations are performed, and access authorizations granted based on 10 C.F.R. 710, Criteria and Procedures for Determining Eligibility for Access to Classified Matter or Special Nuclear Material. Funding provides for initial single scope background investigations, periodic reinvestigations, and initial and reinvestigation national agency checks.

Highlight:

- For Naval Reactors, the increase in funding will help reduce the backlog in security investigations.

Transportation Security
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Transportation Security					
Weapons Activities (NNSA)	292,660	348,684	330,764	-17,920	-5.1%
Defense Environmental Cleanup	120	215	215	0	0.0%
Total, Transportation Security	**292,780**	**348,899**	**330,979**	**-17,920**	**-5.1%**

Mission

Transportation security provides for the secure transport of weapons, weapons components, and nuclear materials to support Stockpile Management and consolidation and disposition of nuclear material within the complex; to meet DOE, DOD, and other customer requirements. This functional component of S&S is funded primarily within NNSA's Secure Transportation Asset (STA) Program.

STA provides safe and secure shipments for Weapons Activities and other Department elements requiring this capability. The STA program supports Departmental initiatives to convert weapons-grade material for use or disposal. STA supports other DOE programs, including Environmental Management; and others, including the National Aeronautics and Space Administration, and international shipments in cooperation with Canada, the United Kingdom, and France.

Highlight:

- The STA FY 2021 budget included replacement aircraft one-time costs and the Baseline Design Review, timeline, and testing results of Test Article 1 (TA1) for the Mobile Guardian Transporter (MGT) was completed hence most of the programmatic decrease in FY 2022.

Security Infrastructure/Construction
Funding Schedule ($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	$ Change FY22 vs. FY21	% Change FY22 vs. FY21
Security Infrastructure/Construction					
Weapons Activities (NNSA)	25,000	26,000	23,000	-3,000	-11.5%
Defense Environmental Cleanup	4,684	8,888	9,377	489	5.5%
Nuclear Energy	21,588	16,618	5,618	-11,000	-66.2%
Strategic Petroleum Reserve	1,764	0	0	0	n/a
Total, Security Infrastructure/Construction	**53,036**	**51,506**	**37,995**	**-13,511**	**-26.2%**

<u>Mission</u>

Security Infrastructure provides critical security infrastructure investments and protection enhancements necessary to ensure adequate protection of DOE sites and personnel.

Highlights:

- For Weapons Activities, decrease reflects availability of carryover balances to fund FY 2022 requirements for the West End Protected Area Reduction (WEPAR) project.
- For Nuclear Energy, decrease reflects the required project funds for Phase IIB offset by the completion of the consolidated training facility at the Central Facilities Area.

R&D and Related Equipment and Construction	(dollars in thousands)				
	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Research and Development					
Basic Research	5,514,398	5,519,584	5,969,489	449,905	8%
Applied Research	8,307,210	7,407,305	7,632,081	224,776	3%
Development	2,972,504	3,728,422	5,204,633	1,476,211	40%
Subtotal, Research and Development	**16,794,112**	**16,655,311**	**18,806,203**	**2,150,892**	**13%**
R&D Related Construction	1,853,021	2,048,049	2,069,924	21,875	1%
R&D Related Equipment	523,363	613,823	634,974	21,151	3%
Total, R&D and Related Equipment and Construction	**19,170,496**	**19,317,183**	**21,511,101**	**2,193,918**	**11%**

Summary

The FY 2022 Request shows an overall increase of $2.2 billion (or 11 percent) in Research and Development (R&D) and Related Equipment and Construction compared with FY 2021 Enacted. The increase in Development of $1.5 billion (or 40 percent) reflects the emphasis on moving R&D efforts through the technology transfer chain to meet the "build back better" goal. The requested establishment of the Office of Clean Energy Demonstration (OCED) and Advanced Research Project Agency ARPA-Climate (ARPA-C), in total a $600 million investment, reflects the urgency attached to the move towards developing clean energy solutions and reducing emissions in line with the President's 2030 and 2050 goals.

The Department has identified challenging goals in the effort to avoid the worst effects of anthropogenic climate change and mitigate the effects of changes that can no longer be avoided. These goals towards decarbonization across all segments of the economy will be managed across the Department through crosscutting activities, enabling synergies that can be developed only through the collaboration and coordination of multiple Department offices. Each R&D related crosscut is described in its own section in the budget justification and new crosscuts have been added in response to the Administration goal of a carbon free economy by 2050 through a concerted effort in transportation, agriculture, industry, and electric power generation. Each DOE office has contributions to the overall success of our R&D efforts. These are summarized as follows.

Office of Science (SC) supports a balanced research portfolio of basic scientific research probing some of the most fundamental questions in areas such as: high energy, nuclear, and plasma physics; materials and chemistry; biological and environmental systems; applied mathematics; next generation high-performance computing and simulation capabilities; and basic research for advancement in new energy technologies. The SC FY 2022 Request increases investments in Administration priorities including basic research on climate change and clean energy, fundamental science to transform manufacturing, and biopreparedness; and a new activity, 'Reaching a New Energy Sciences Workforce (RENEW)', to increase participation and retention of underrepresented groups in SC research activities. The Request also supports ongoing investments in microelectronics, critical materials, quantum information science, artificial intelligence and machine learning, exascale computing, integrated computational and data infrastructure for scientific discovery, and accelerator science and technology. SC continues its support for research in response to the National Isotope Strategy. SC's purpose is to deliver scientific discoveries and major scientific tools that will transform our understanding of nature and advance the energy, economic, and national security of the United States. It is the Nation's largest Federal sponsor of basic research in the physical sciences and the lead Federal agency supporting fundamental scientific research for our Nation's energy future.

The SC portfolio has two principal thrusts: direct support of scientific research and direct support of the design, development, construction, and operation of unique, open-access scientific user facilities. The SC basic research portfolio includes extramural grants and contracts supporting nearly 28,000 researchers located at over 300 institutions and the 17 DOE national laboratories, spanning all fifty states and the District of Columbia. The portfolio of 28 scientific user facilities serves over 36,000 users per year. SC programs invest in foundational science, including basic research for the advancement of clean energy, to transform our understanding of nature and strengthen the connection between advances in fundamental science and technology innovation.

Energy Efficiency and Renewable Energy (EERE) drives the research, development, demonstration, and deployment (RDD&D) of innovative technologies, systems, and practices that will help transition Americans to a carbon-free electricity sector by 2035, and a 100-percent clean energy economy no later than 2050; and ensure that the clean energy economy benefits all Americans, especially those in underserved communities. To achieve this mission, EERE is increasing investment in the integration of clean energy technologies that are ready to be demonstrated and deployed, as well as R&D activities that advance early-stage technologies with a clear path to deployment. EERE's FY 2022 investment strategy focuses on investments in five priority areas central to the U.S. greenhouse gas profile: decarbonizing the electricity sector; decarbonizing transportation across all modes: air, sea, rail, and road; decarbonizing energy-intensive industries; reducing the carbon footprint of buildings; and decarbonizing the agriculture sector, including a focus on the energy-water nexus. The Request prioritizes increased investments in these priority areas critical to reduce emissions in the near term drastically, while investing in research to ensure American leadership and competitiveness in advanced clean energy technology.

Office of Cybersecurity, Energy Security, and Emergency Response (CESER) seeks to accelerate and expand efforts to strengthen the nation's energy sector against cyber threats and mitigate vulnerabilities. CESER's R&D investments aim to bolster critical infrastructure capabilities by developing game-changing cybersecurity risk management tools, technologies, methodologies, and guidance that aid the private sector in securing energy infrastructure for the present and future. These tools and technologies will help energy industry identify, protect, detect, respond, and recover in the face of increasingly advanced cyber threats. In FY 2022 CESER will take on a coordination role to integrate cybersecurity in research and development efforts across DOE's science and energy programs, building cybersecurity into the energy delivery system components. CESER will supplement these efforts with development, demonstration and deployment of crosscutting tools leveraging emerging technologies and techniques such as machine learning, underlying data from cyber-physical systems, and quantum information sciences.

Office of Electricity (OE) funding will support R&D priorities by pursuing research for technologies to improve grid reliability, resilience, efficiency, flexibility, and functionality. Modeling and analytical R&D will support 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 energy infrastructure systems, such as between electricity and natural gas systems. In FY 2022 OE adds Energy Sector Cybersecurity R&D to its portfolio along with associated R&D activities previously funded within CESER. OE is a major contributor to the Grid Modernization Initiative.

Nuclear Energy (NE) supports efforts to move to new and innovative advanced reactors, small modular reactors, and microreactors from the conceptual and development stages into the commercial energy sector. NE executes its mission through investments in early-stage research and development efforts with the national laboratories, U.S. universities, and industry technical organizations, as well as through partnerships with the U.S. industry and commercial stakeholders to develop and demonstrate advanced reactor technologies and designs. NE focuses on three major mission areas: the nation's existing reactors, the development of advanced nuclear reactor concepts, and fuel cycle technologies. Investments in these areas leverage the tremendous innovation capacity of the United States' National Laboratories, universities, and advanced reactor developers to transform America's power sector. Safe and secure nuclear energy delivers carbon-free power continuously, with high reliability, over long periods of time. It is a part of the energy mix that is needed to decarbonize the energy sector over time and take us to the goal of zero greenhouse gas production. To further the decarbonization goal, research in NE will be directed towards enabling the production of usable Hydrogen at nuclear plants as an energy storage mechanism.

Fossil Energy and Carbon Management (FE&CM) supports increased funding for a revitalized perspective on fossil energy that advances carbon reduction and mitigation in sectors and applications that are difficult to decarbonize, including the industrial sector, with technologies and methods such as carbon capture and storage, hydrogen, and direct air capture – all while ensuring that overburdened communities are protected from increases in cumulative pollution. The Request will fund DOE's role in supporting the new Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization. The FE&CM Request will help fulfill President Biden's 'build back better' objective in a way that supports communities left behind, workers translating their skills to new positions in various areas, such as, building carbon capture and hydrogen systems on existing industrial and power plant facilities, and reinforcing existing pipelines to minimize methane emissions. FE&CM's Request, its new name indicative of a new approach

responsive to its research imperatives, shows increases for Carbon Capture, Carbon Utilization, Carbon Storage and Carbon Dioxide Removal.

Advanced Research Projects Agency – Energy (ARPA-E) supports the delivery of innovative, investable opportunities to the commercial sector. ARPA-E will continue to deliver value to the U.S. economy with continued emphasis on maintaining a diverse portfolio of projects. These projects cover a broad range of energy topics, with a growing focus on additional scale-up of the most promising projects that have demonstrated success in technical development, project management, and definition of commercial pathways. ARPA-E executes its budget through funding opportunity announcements that address applications that are not represented in its present portfolio and develops new opportunities opened by the outcomes of previous programs.

Advanced Research Projects Agency-Climate (ARPA-C) will invest in innovations necessary to achieve net zero climate-inducing emissions by 2050 and develop adaptation and resilience actions to mitigate the effects of a changing climate. ARPA-C will harness innovation to solve the global climate crisis while enhancing the economic and energy security of the United States through development of new technologies that will lead to economic opportunities for American workers, through the public and private sectors. ARPA-C will identify and promote revolutionary advances in climate-related applied sciences, translating scientific discoveries and cutting-edge innovations into products, services, and systems that the market, government agencies or private organizations can adopt. It will also accelerate transformational technological advances in areas where industry by itself is not likely to invest due to technical and financial uncertainty. ARPA-C will not seek to duplicate the basic research and applied research within federal government programs but rather seek to implement technology applications that can be demonstrated over a predictable period time.

Office of Clean Energy Demonstrations (OCED) will initiate and manage a multi-year series of competitive solicitations. It will work to accelerate the maturation of near- and mid-term clean energy technologies and systems to achieve rapid commercial adoption and increased availability. OCED's approach will be informed by existing clean energy innovation initiatives across DOE's diverse program and functional offices, sites and associated National Laboratories. OCED will issue initial competitive solicitations for commercial-scale energy storage demonstrations, and issue at least one technology neutral commercial-scale demonstration solicitation per year focused on a crosscutting energy challenge.

National Nuclear Security Administration supports key R&D investments in science and technology innovation to support the stewardship of the nuclear weapons stockpile; to modernize the nuclear security enterprise; to protect the United States from nuclear threats; to enable science-based certification of the stockpile; and to provide the Navy with nuclear reactors that meet complex evolving requirements to provide nuclear power for the U.S. Navy. The reduction in R&D reflects the completion of activities and emphasis on development and production of deliverables. R&D funding contributes directly and crucially to U.S. nuclear security.

Administrative and Support Functions: The Department's funding estimates of R&D activities include those administrative and support functions that are necessary to the success of the R&D programs consistent with government-wide and international reporting practices. These include program direction, safeguards and security, and infrastructure costs. The following table details funding of R&D in the budget by categories; basic, applied, development, equipment, and related construction; and program office.

	(dollars in thousands)				
Basic Research	**FY 2020 Enacted**	**FY 2021 Enacted**	**FY 2022 Request**	**FY 2022 vs FY 2021**	**% Change**
Cybersecurity, Energy Security and Emergency Management	1,308	1,962	0	-1,962	-100%
Defense Nuclear Nonproliferation	138,744	168,137	187,512	19,375	12%
Electricity	15,404	14,146	16,723	2,577	18%
Science	5,324,920	5,335,339	5,765,254	429,915	8%
Fossil Energy and Carbon Management	34,022	0	0	0	N/A
Subtotal, Basic Research	**5,514,398**	**5,519,584**	**5,969,489**	**449,905**	**8%**

(dollars in thousands)				
Applied Research	**FY 2020 Enacted**	**FY 2021 Enacted**	**FY 2022 Request**	**FY 2022 vs FY 2021**	**% Change**
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Advanced Research Projects Agency-Climate			100,000	100,000	N/A
Advanced Research Projects Agency-Energy	212,500	213,500	250,000	36,500	17%
Cybersecurity, Energy Security and Emergency Management	18,742	33,010	0	-33,010	-100%
Defense Environmental Cleanup	9,900	11,550	9,240	-2,310	-20%
Defense Nuclear Nonproliferation	170,053	200,698	198,951	-1,747	-1%
Electricity	67,881	56,453	90,804	34,351	61%
Energy Efficiency and Renewable Energy	1,162,325	1,293,975	1,322,147	28,172	2%
Fossil Energy and Carbon Management	646,411	691,633	822,020	130,387	19%
Nuclear Energy	735,684	791,239	953,075	161,836	20%
Weapons Activities	5,283,714	4,115,247	3,885,844	-229,403	-6%
Subtotal, Applied Research	**8,307,210**	**7,407,305**	**7,632,081**	**224,776**	**3%**

(dollars in thousands)				
Development	**FY 2020 Enacted**	**FY 2021 Enacted**	**FY 2022 Request**	**FY 2022 vs FY 2021**	**% Change**
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Advanced Research Projects Agency-Climate			100,000	100,000	N/A
Advanced Research Projects Agency-Energy	212,500	213,500	250,000	36,500	17%
Cybersecurity, Energy Security and Emergency Management	15,691	23,547	70,000	46,453	197%
Defense Environmental Cleanup	20,100	23,450	18,760	-4,690	-20%
Defense Nuclear Nonproliferation	84,158	97,091	99,370	2,279	2%
Electricity	70,584	75,587	78,794	3,207	4%
Energy Efficiency and Renewable Energy	794,507	710,254	1,576,067	865,813	122%
Naval Reactors	1,112,259	1,140,270	1,246,109	105,839	9%
Nuclear Energy	359,895	265,806	209,461	-56,345	-21%
Office of Clean Energy Demonstrations			400,000	400,000	N/A
Weapons Activities	302,810	1,178,917	1,156,072	-22,845	-2%
Subtotal, Development	**2,972,504**	**3,728,422**	**5,204,633**	**1,476,211**	**40%**

(dollars in thousands)				
Subtotal, R&D	**FY 2020 Enacted**	**FY 2021 Enacted**	**FY 2022 Request**	**FY 2022 vs FY 2021**	**% Change**
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Advanced Research Projects Agency-Climate			200,000	200,000	N/A
Advanced Research Projects Agency-Energy	425,000	427,000	500,000	73,000	17%
Cybersecurity, Energy Security and Emergency Management	35,741	58,519	70,000	11,481	20%
Defense Environmental Cleanup	30,000	35,000	28,000	-7,000	-20%
Defense Nuclear Nonproliferation	392,955	465,926	485,833	19,907	4%
Electricity	153,869	146,186	186,321	40,135	27%
Energy Efficiency and Renewable Energy	1,956,832	2,004,229	2,898,214	893,985	45%
Fossil Energy and Carbon Management	680,433	691,633	822,020	130,387	19%
Naval Reactors	1,112,259	1,140,270	1,246,109	105,839	9%
Nuclear Energy	1,095,579	1,057,045	1,162,536	105,491	10%
Office of Clean Energy Demonstrations			400,000	400,000	N/A
Science	5,324,920	5,335,339	5,765,254	429,915	8%
Weapons Activities	5,586,524	5,294,164	5,041,916	-252,248	-5%
Subtotal, R&D	**16,794,112**	**16,655,311**	**18,806,203**	**2,150,892**	**13%**

Research and Development

(dollars in thousands)

R&D Related Equipment	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Defense Nuclear Nonproliferation	0	14,748	14,847	99	1%
Energy Efficiency and Renewable Energy	10,517	8,574	35,734	27,160	317%
Fossil Energy and Carbon Management	29,000	29,000	46,000	17,000	59%
Naval Reactors	15,000	1,000	6,900	5,900	590%
Science	217,526	239,552	208,391	-31,161	-13%
Weapons Activities	251,320	320,949	323,102	2,153	1%
Subtotal, R&D Related Equipment	**523,363**	**613,823**	**634,974**	**21,151**	**3%**

(dollars in thousands)

R&D Related Construction	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Defense Nuclear Nonproliferation	17,900	0	0	0	N/A
Electricity	1,105	25,137	50,062	24,925	99%
Energy Efficiency and Renewable Energy	41,744	30,675	46,048	15,373	50%
Naval Reactors	238,000	330,000	390,325	60,325	18%
Nuclear Energy	65,000	11,000	98,400	87,400	795%
Science	1,380,554	1,343,109	1,298,355	-44,754	-3%
Weapons Activities	108,718	308,128	186,734	-121,394	-39%
Subtotal, R&D Related Construction	**1,853,021**	**2,048,049**	**2,069,924**	**21,875**	**1%**

(dollars in thousands)

R&D and R&D Related Equipment and Construction	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Advanced Research Projects Agency-Climate			200,000	200,000	N/A
Advanced Research Projects Agency-Energy	425,000	427,000	500,000	73,000	17%
Cybersecurity, Energy Security and Emergency Management	35,741	58,519	70,000	11,481	20%
Defense Environmental Cleanup	30,000	35,000	28,000	-7,000	-20%
Defense Nuclear Nonproliferation	410,855	480,674	500,680	20,006	4%
Electricity	154,974	171,323	236,383	65,060	38%
Energy Efficiency and Renewable Energy	2,009,093	2,043,478	2,979,996	936,518	46%
Fossil Energy and Carbon Management	709,433	720,633	868,020	147,387	20%
Naval Reactors	1,365,259	1,471,270	1,643,334	172,064	12%
Nuclear Energy	1,160,579	1,068,045	1,260,936	192,891	18%
Office of Clean Energy Demonstrations			400,000	400,000	N/A
Science	6,923,000	6,918,000	7,272,000	354,000	5%
Weapons Activities	5,946,562	5,923,241	5,551,752	-371,489	-6%
Total, R&D and R&D Related Equipment and Construction	**19,170,496**	**19,317,183**	**21,511,101**	**2,193,918**	**11%**

Infrastructure

Infrastructure funding is managed within several programs and includes funding for capital equipment, maintenance and repair, minor construction, line item construction, and excess facilities. This funding includes both direct funding and indirect funding – funding through laboratory overhead.   The DOE program offices and 17 National Laboratories are working to research, develop, and deploy the clean energy technologies of the future, including battery storage, renewable power, electric vehicles, carbon capture, and resilient grid infrastructure. DOE will also use its expansive loan authority to invest in American, and its regulatory authority to innovate in advanced building technologies, and energy efficient appliances. DOE prioritizes infrastructure investments to reduce safety risk and mission risk to include climate risk while improving sustainability and return on investment working toward meeting the Department's sustainability and climate action goals. The 'crosscut' summarizes the infrastructure funding that is distributed through the budget volumes.

Descriptions of each program's Infrastructure components can be found in the budget justifications for:
• Defense and Non-defense Environmental Cleanup
• Defense Nuclear Nonproliferation
• Electricity
• Energy Efficiency and Renewable Energy
• Enterprise Assessments
• Fossil Energy Research and Development
• Legacy Management
• Naval Reactors
• Nuclear Energy
• Science
• Strategic Petroleum Reserve
• Weapons Activities

Table 1 provides a department-wide summary of infrastructure funding by Program, while Table 2 provides the breakout by category of expenditure. All entries in these tables are in thousands.

Table 1. Overall DOE Infrastructure Funding by Program (FY 2020 – FY 2022)

Infrastructure by Program	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Defense Environmental Cleanup	1,946,504	1,910,728	1,795,503	-115,225	-6.03%
Defense Nuclear Nonproliferation[1]	449,489	245,022	217,826	-27,196	-11.10%
Electricity	1,000	23,000	47,000	24,000	104.35%
Energy Efficiency and Renewable Energy	64,737	76,303	93,896	17,593	23.06%
Enterprise Assessments	1,670	1,720	1,771	51	2.97%
Federal Salaries and Expenses	782	13,000	0	-13,000	-100.00%
Fossil Energy Research and Development	23,156	22,960	44,820	21,860	95.21%
Legacy Management	4,774	4,935	5,506	571	11.57%
Naval Reactors	386,484	417,593	501,860	84,267	20.18%
Nuclear Energy	96,581	72,010	89,229	17,219	23.91%
Science	1,993,859	2,026,804	1,886,528	-140,276	-6.92%
Strategic Petroleum Reserve	484,392	39,580	35,672	-3,908	-9.87%
Weapons Activities	2,968,951	4,418,592	4,312,089	-106,503	-2.41%
Total, Infrastructure	**8,422,379**	**9,272,247**	**9,031,700**	**-240,547**	**-2.59%**

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[1] FY 2020 includes $220 million for termination of the Mixed Oxide (MOX) Fuel Fabrication Facility project under Line-Item Construction. The proposed cancellation of prior year balances for the MOX project is not included in the FY 2022 column.

Table 2. Overall DOE Infrastructure Funding by Category (FY 2020 – FY 2022)

Infrastructure Category[2]	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Capital Equipment					
Defense Nuclear Nonproliferation	70,690	65,023	59,063	-5,960	-9.17%
Energy Efficiency and Renewable Energy	10,080	20,887	29,970	9,083	43.49%
Naval Reactors	10,980	1,000	7,000	6,000	600.00%
Nuclear Energy	5,396	-	-	0	0.00%
Science	217,526	239,552	208,391	-31,161	-13.01%
Strategic Petroleum Reserve	3,152	6,795	4,209	-2,586	-38.06%
Weapons Activities	810,415	1,103,982	1,125,677	21,695	1.97%
Subtotal, Capital Equipment	**1,128,239**	**1,437,239**	**1,434,310**	**-6,052**	**-0.20%**
Excess Facilities					
Defense Environmental Cleanup	65,000	35,000	93,381	58,381	166.80%
Fossil Energy Research and Development	125	45	40	-5	-11.11%
Naval Reactors	28,129	22,596	40,858	18,262	80.82%
Nuclear Energy	945	660	836	176	26.67%
Science	1,948	1,349	1,291	-58	-4.30%
Weapons Activities	39,484	44,215	43,976	-239	-0.54%
Subtotal, Excess Facilities	**135,631**	**103,865**	**180,382**	**76,517**	**73.67%**
Line Item Construction[3]					
Defense Environmental Cleanup	1,117,605	1,078,158	903,999	-174,159	-16.15%
Defense Nuclear Nonproliferation	299,000	148,589	156,000	7,411	4.99%
Electricity	1,000	23,000	47,000	24,000	104.35%
Energy Efficiency and Renewable Energy	-	-	8,000	8,000	100.00%
Naval Reactors	282,600	334,000	395,425	61,425	18.39%
Nuclear Energy	25,450	26,000	41,850	15,850	60.96%
Science	1,318,829	1,262,945	1,220,050	-42,895	-3.40%
Strategic Petroleum Reserve	450,000	0	0	0	0.00%
Weapons Activities	1,232,444	2,002,215	1,933,352	-68,863	-3.44%
Subtotal, Line Item Construction	**4,726,928**	**4,874,907**	**4,705,676**	**-169,231**	**-3.47%**
Maintenance and Repair[45]					
Defense Environmental Cleanup	662,536	726,759	643,354	-83,405	-11.48%
Energy Efficiency and Renewable Energy	14,647	16,605	17,296	691	4.16%
Enterprise Assessments	1,670	1,720	1,771	51	2.97%

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[2] Does not include annual lease costs

[3] Reflects Total Project Costs (TPC) for each Line Item Construction Project

[4] Maintenance and Repair and Minor Construction are actual amounts for FY 2020 and planned amounts for FY 2021 and FY 2022.

[5] Includes both direct-funded dollars and indirect-funded dollars.

Fossil Energy Research and Development	15,659	10,915	19,780	8,865	81.22%
Legacy Management	4,774	4,935	5,506	571	11.57%
Naval Reactors	15,495	18,592	21,977	3,385	18.21%
Nuclear Energy	43,202	45,350	46,543	1,193	2.63%
Science	285,309	322,714	303,867	-18,847	-5.84%
Strategic Petroleum Reserve	31,240	32,785	31,463	-1,322	-4.03%
Weapons Activities	561,940	769,236	808,342	39,106	5.08%
Subtotal, Maintenance and Repair	**1,636,472**	**1,949,611**	**1,899,899**	**-49,712**	**-2.55%**
Minor Construction					
Defense Environmental Cleanup	101,363	70,811	154,769	83,958	118.57%
Defense Nuclear Nonproliferation	79,799	31,410	2,763	-28,647	-91.20%
Energy Efficiency and Renewable Energy	40,010	38,811	38,630	-181	-0.47%
Federal Salaries and Expenses	782	13,000	-0	0	0.00%
Fossil Energy Research and Development	7,372	12,000	25,000	13,000	108.33%
Naval Reactors	49,280	41,405	36,600	-4,805	-11.60%
Nuclear Energy	21,588	-	-	0	0.00%
Science	170,247	200,244	152,929	-47,315	-23.63%
Weapons Activities	324,668	498,944	400,742	-98,202	-19.68%
Subtotal, Minor Construction	**795,109**	**906,625**	**811,433**	**-82,192**	**-10.50%**
Total, Infrastructure	**8,422,379**	**9,272,247**	**9,031,700**	**-227,547**	**-2.59%**

Capital Equipment

Capital equipment funding includes both the cost of equipment acquired by purchase and fabricated by a site/facility management contractor that exceed the capitalization threshold of $500,000. Included in the capital equipment funding are major items of equipment (MIEs). MIEs are listed individually in each program's budget justification.

Minor Construction

Minor Construction funding includes all minor construction projects. A Minor Construction Project is any construction project not specifically authorized by law for which the approved total estimated cost does not exceed the minor construction threshold [50 United States Code (USC) 2743[6]]. Minor Construction Projects including Accelerator Improvement Projects (AIPs), Direct-Funded Projects like General Plant Projects (GPPs) and Indirect-Funded Projects (such as Institutional GPPs (IGPPs)) that exceed $5M are listed individually in each program's budget justification.

Line Item Construction

Line Item Construction funding includes all construction projects specifically authorized by law for which the approved total estimated cost exceeds the minor construction threshold [50 US Code 2741]. The funding captured in this crosscut includes the annual total project costs – both total estimated costs and other project costs. The individual line item construction projects can be found in both the programs' construction projects summary and the individual project data sheets.

Maintenance and Repair

The Department'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 are intended to improve asset condition and maintain operability. This excludes maintenance of excess facilities (including high-risk excess facilities) necessary to minimize the risk posed by those facilities prior to disposition.

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[6] 50 USC 2743 only applies to projects authorized under annual National Defense Authorization Acts.

Excess Facilities

Excess Facilities are facilities no longer required to support the Department's needs, present or future missions or functions, or the discharge of its responsibilities. The funding to deactivate and dispose (D&D) of excess infrastructure, including stabilization and risk reduction activities at high-risk excess facilities, resulting in surveillance and maintenance cost avoidance and reduced risk to workers, the public, the environment, and programs is included. Also included is the maintenance of excess facilities (including high-risk excess facilities) necessary to minimize the risk posed by those facilities prior to disposition.

Small Business Innovation Research/Small Business Technology Transfer (SBIR/STTR)

(dollars in thousands)

SBIR/STTR	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021	% Change
Advanced Research Projects Agency-Climate			6,570	6,570	N/A
Advanced Research Projects Agency-Energy	14,235	14,308	16,900	2,592	18%
Cybersecurity, Energy Security and Emergency Management	1,305	2,298	1,276	-1,022	-44%
Defense Environmental Cleanup	1,095	1,278	1,022	-256	-20%
Defense Nuclear Nonproliferation	11,308	13,273	13,975	702	5%
Electricity	4,931	4,646	6,133	1,487	32%
Energy Efficiency and Renewable Energy	78,326	65,783	96,143	30,360	46%
Fossil Energy and Carbon Management	15,137	15,226	19,215	3,989	26%
Nuclear Energy	22,285	18,893	21,995	3,102	16%
Office of Clean Energy Demonstrations			14,107	14,107	N/A
Science	181,413	181,981	195,613	13,632	7%
Total, SBIR/STTR	**330,035**	**317,687**	**392,949**	**75,262**	**24%**

The Department of Energy manages two separate Small Business Innovation Research (SBIR) & Small Business Technology Transfer (STTR) programs, one administered by the Office of Science and the other by the Advanced Research Projects Agency – Energy (ARPA-E). The Office of Science has managed the DOE SBIR and STTR programs for the Department since the SBIR program was created in 1982 and the STTR program was created in 1992. The ARPA-E SBIR/STTR programs were created in FY 2012 to manage ARPA-E's SBIR & STTR allocations independently. Advanced Research Projects Agency – Climate (ARPA-C) is newly formed in FY 2022 and will also create a stand-alone SBIR/STTR program to provide additional support for R&D projects for small businesses.

The SBIR/STTR Reauthorization Act of 2011 reauthorized the SBIR and STTR programs and provided for annual increases phased in over six years. The Act directs DOE to expend not less than the percentages specified for nonexempt extramural R&D. The percentages are 3.2% for SBIR and 0.45% for STTR programs, for a total of 3.65% assessed for all contributing programs. The above table shows only the total by program with the precise splits by program determined in execution. The required percentages for SBIR and STTR are met on a Department-wide basis. By statute, "amounts obligated for Atomic Energy Defense Programs solely for Weapons Activities or for Naval Reactor Programs" are exempt [15 USC 638(e)(1)].

DOE SBIR/STTR Programs Office

The SBIR/STTR Programs Office works collaboratively with participating offices to administer the programs: seven R&D program offices within the Office of Science; the Offices of Cybersecurity, Energy Security and Energy Preparedness, Electricity, Energy Efficiency and Renewable Energy, Fossil Energy and Carbon Management, Nuclear Energy, and Defense Environmental Cleanup; and Defense Nuclear Nonproliferation within the National Nuclear Security Administration. Each office makes awards commensurate with its allocation and collaborates with other offices during execution as necessary.

The participating programs are responsible for topic selection, reviewer assignment, award selection, and project oversight. Each program office considers its high priority research needs and program mission, as well as the Department's goals for the program in developing research topics. The specific research topics selected for the SBIR and STTR programs are developed by the Department's technical program managers.

The SBIR/STTR Programs Office is responsible for issuing topics and solicitations, managing the peer review and award selection process, working with the Science Office of Acquisition and Assistance to award SBIR/STTR Phase I and Phase II grants, issuing annual reports to the U. S. Small Business Administration, performing outreach, and setting overall policy for the Department regarding the two programs.

In the implementation of SBIR/STTR, DOE assesses each program office at the minimum required percentages for both SBIR and STTR to meet expenditure requirements.   DOE's current methodology is to vary the allocations such that each office will make the same total SBIR and STTR contribution, but the amounts given to SBIR and STTR will be adjusted to provide executable amounts, while in total DOE will meet the expenditure requirements for both SBIR and STTR. While STTR

assessments might be too small to allow for a range of funding opportunities, when combined in execution from multiple programs the amounts permit DOE to meet its STTR requirement on a DOE-wide basis.

ARPA-E SBIR/STTR Program

ARPA-E executes its SBIR/STTR programs separate from the DOE-wide SBIR/STTR program. The ARPA-E SBIR/STTR program employs the same rigorous merit review, accelerated contracting through awarding Phase I/II/IIs simultaneously, funding, and active project management as all other ARPA-E programs. The ARPA-E SBIR/STTR Program focuses on targeted, mission-relevant areas where the agency assesses that small business provides the best opportunity for innovative technology development.

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 22 vs. FY 21 ($ Change)
Advanced Research Program Agency-Energy	**32,000**	**0**	**TBD***	**TBD***
Energy Efficiency and Renewable Energy	**538,658**	**534,102**	**782,912**	**+248,810**
Advanced Manufacturing	395,000	396,000	550,500	+154,500
Building Technologies	0	0	4,016	+4,016
Bioenergy Technologies	22,400	15,500	24,000	+8,500
Hydrogen and Fuel Cell Technologies	29,000	28,000	31,000	+3,000
Solar Energy Technologies	60,000	42,500	96,000	+53,500
Strategic Programs	-	540	-	-540
Vehicle Technologies	25,000	31,000	50,000	+19,000
Water Power Technologies	-	3,850	9,500	+5,650
Wind Energy Technologies	7,258	16,712	17,896	+1,184
National Nuclear Security Administration	**66,910**	**111,908**	**115,000**	**+3,092**
Advanced Manufacturing	66,910	111,908	115,000	+3,092
Nuclear Energy	**17,000**	**24,000**	**3,000**	**-21,000**
Crosscutting Technology Development	0	3,000	3,000	0
Transformational Challenge Reactor	17,000	21,000	0	-21,000
Office of Science	**0**	**0**	**26,000**	**+26,000**
Basic Energy Sciences	0	0	17,000	+17,000
Biological and Environmental Research	0	0	5,000	+5,000
Fusion Energy Sciences	0	0	3,000	+3,000
Isotope R&D and Production	0	0	1,000	+1,000
Total, Advanced Manufacturing Initiative	**654,568**	**670,010**	**926,912***	**+256,902***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Summary

In FY 2022, the Department of Energy (DOE) continues its support for the Advanced Manufacturing Initiative (AMI). This initiative encompasses multiple offices across DOE that sponsor research, development, deployment and demonstration (RDD&D) to foster the innovations required to sustainably manufacture the clean energy technologies needed for the industrial, transportation, and buildings sectors, as well as the energy production and delivery systems needed to power these sectors in the future. Advanced Manufacturing (AM) is the engine that will drive the transition to a decarbonized future, new jobs, and U.S. manufacturing competitiveness. Crosscut activities will enable new and improved materials, processes, and systems across supply chains and product lifecycles. AM is critical for a transformation of the national and global energy systems - including decarbonization of the industrial sector and production of new clean energy technologies - to meet our climate goals, and create a competitive, resilient, agile manufacturing sector.

The Advanced Manufacturing Initiative has the following objectives:
- Decarbonize the industrial sector.
- Advance the materials and production processes for energy conversion, utilization, storage, and management technologies and systems.

- Improve resiliency and agility of material supply chains needed for energy products and technologies.
- Accelerate the transition from technology innovation to demonstration and commercialization.
- Make knowledge and transformational tools accessible across manufacturing organizations and develop a diverse future manufacturing workforce.

Participating offices within DOE include Advanced Research Projects Agency – Energy (ARPA-E), Energy Efficiency and Renewable Energy (EERE), Nuclear Energy (NE), the National Nuclear Security Administration (NNSA) and Science (SC). The following is a summary of program activities to support this initiative in FY 2022:

Overview
ARPA-E: $TBD
ARPA-E funds early-stage research and development programs focused on non-traditional approaches and high-risk/high-impact concepts. Funding is determined annually based on programs developed through office and stakeholder priorities. Examples include:
- Accelerating innovative concepts such as: supporting the development of new approaches and technologies for the design and manufacture of high-temperature, high-pressure, efficient, and compact heat exchangers and funding the development and demonstration of ultrahigh temperature materials targeting gas turbine applications in the power generation and aviation industries.
- Specific programs relevant to Advanced Manufacturing include: Solicitation on Topics Informing New Program Areas – Topology Optimization and Additive Manufacturing For Performance Enhancement Of High Temperature And High Pressure Heat Exchangers (TINA-Topology) program and Ultrahigh Temperature Impervious Materials Advancing Turbine Efficiency (ULTIMATE).

EERE: $782.9M
- **Advanced Manufacturing Office: $550.5M:** AMO supports the decarbonization of the industrial sector and is addressing the climate crisis by driving the innovation that can lead to a more resilient and competitive domestic manufacturing sector that also provides economic opportunities across diverse communities. Manufacturing innovations are required to deliver the clean energy technologies needed to decarbonize other sectors as well, including transportation, buildings, and the electric grid. AMO actively partners with industry to ensure that new energy technologies invented in the U.S. ultimately result in the manufacture of products in the U.S. in support of the Administration priority to deliver an equitable, clean energy future for all Americans. With this approach, AMO will drive the manufacturing innovations needed to support the goal of net-zero greenhouse gas emissions, economy-wide, by 2050 while also investing in the economic engine of American-made energy technology that brings economic prosperity and jobs at a local community level.

  A major focus of the AMO Request is a significant increase for support of industrial decarbonization activities, including research and demonstrations, to address large opportunities and enable an accelerated timeline for achieving carbon emission reductions. Opportunities also exist to advance new manufacturing technologies and improve energy efficiency and reduce carbon emissions in existing manufacturing processes and operations. There is also a need to enable value chains to be nimble, responsive, and adaptive to disruption, change, and opportunity. In FY 2022 efforts will focus on accelerating carbon emission reductions especially in hard to decarbonize industries such as steel, cement, and ammonia manufacturing, including a partnership with Hydrogen Technologies on the use of R&D for steel and ammonia manufacturing using hydrogen.

  The Request also supports materials innovation, including advances that improve domestic availability of materials and resources through resilient and secure supply chains. Specific focus areas include sustainable manufacturing, materials that enable decarbonization, and critical materials supply, substitution, and reuse. In addition, the Request supports advances in materials broadly applicable to energy technologies including energy conversion materials, materials for extreme or harsh conditions, and nanomaterials. The Request also increases support in energy systems advancing both: 1) systems related to energy conversion, utilization, storage, and management within industrial facilities, and 2) production processes of these energy systems to be used in manufacturing and other sectors, As developing a domestic workforce is critical to ensure a strong

manufacturing base, the Request increases the support for multi-level workforce development activities and focused assistance to energy-intensive manufacturing sectors. Activities will include making knowledge and transformational tools accessible to diverse manufacturing organizations and developing the future manufacturing workforce.

- **Bioenergy Technologies: $24.0M:** The Request supports the development of valuable chemicals and materials that can replace petrochemicals with renewable alternatives and help enable the production of biofuels. This work includes R&D on bioderived polymers and plastics that provide performance advantages to traditional materials. Specifically, this includes support for technoeconomic and lifecycle analyses to focus efforts on plastic reduction and substitution strategies with the greatest impact on greenhouse gas emissions and targeting plastics with low recycling rates and increased emphasis on industry partnerships to increase adoption and scale-up of advanced, high-value bioproducts to reduce greenhouse gas emissions from chemicals production and grow the supply chain of biomass feedstocks. The Request deemphasizes R&D to convert lignin to products in favor of strategies that convert lignin to sustainable aviation fuels.
- **Building Technologies: $4.0M:** Program priorities include a broad portfolio of research, development, demonstration, and deployment projects in building technologies sector. This includes increased support in the Request for the Advanced Building Construction Initiative which provides an avenue to dramatically expand U.S. leadership in the manufacturing of modular construction, development of low carbon materials, and pre-fabrication of building components (e.g., facades) that can achieve zero, or near-zero, energy retrofits of existing buildings with less disruption and greater performance.
- **Hydrogen and Fuel Cell Technologies: $31.0M:** The Request includes support for efforts focused on demonstrating use of green hydrogen as a feedstock or direct reducing agents to decarbonize steel and ammonia production in partnership with the Advanced Manufacturing Office as well as electrolyzer and fuel cell manufacturing R&D, quality control and diagnostics efforts. These efforts support the office's reprioritization in FY 2022 towards accelerated target-driven RD&D to achieve a hydrogen cost of $2/kg by 2025 from electrolysis (modeled cost at high volumes) versus roughly $5/kg today and 80/kW fuel cell system cost (modeled cost at high volumes) by 2030, versus nearly $200/kW today.
- **Solar Energy Technologies: $96.0M:** The Request includes a new effort targeting innovative approaches to building- integrated photovoltaics, in coordination with the Building Technologies Office. The Request also supports new rounds of the American-Made Solar Prize to incentivize and transition new solar technologies into prototypes ready for real world validation, and other prize competitions to spur U.S. business innovation in solar. Other efforts supported in the Request to enhance U.S. solar manufacturing include continued support for the American-Made Network to provide prize winners commercialization resources, a new, cross-cutting initiative designed to support a qualified clean energy manufacturing workforce and connect trainees with the industry, and continued support for the Incubator program to accelerate the prototyping and development of new solar energy technologies for commercialization and domestic manufacturing.
- **Vehicle Technologies: $50M:** The Request supports: new joining technologies for multi-material structures required in order to incorporate lightweight polymer matrix composites, aluminum, and magnesium into the vehicle assembly for increasing fuel economy and reducing the environmental impact of vehicles; scalable processing methods to locally enhance the properties of aluminum and magnesium, battery materials scale-up at National Laboratories, and battery processing science and engineering dedicated to solid state materials processing.
- **Water Power Technologies: $9.5M:** The Request initiates support for the demonstration of cold spray technologies, an advanced manufacturing technique for hydropower turbine cavitation repair as well as continued support for hydropower technology manufacturing at the Manufacturing Demonstration Facility at Oak Ridge National Laboratory. The Request also supports efforts associated with technologies, materials, and approaches to advance the readiness of all marine energy technologies, including university and lab research into novel materials (flexible materials and piezoelectric), composites, coatings, and advanced manufacturing techniques.
- **Wind Energy Technologies: $17.9M:** The Request supports efforts in carbon fiber materials design for targeted performance enhancement, manufacturing and additive design enabled by 3D printing, and 3D printed core structures for wind turbine blades. The Request also supports advanced materials and manufacturing R&D to reduce full lifecycle costs and address existing challenges for wind (enable continued

scaling and through light weighting; improve reliability of turbines; advanced manufacturing/design to overcome transportation constraints; address materials & supply chain issues).

NE: $3.0M:

In FY 2022, the Crosscutting Technology Development's (CTD) Advanced Materials and Manufacturing Technologies (AMMT) program supports the development of technology-based solutions for advanced materials and manufacturing technologies for use in the deployment of advanced nuclear reactors and sustainment of the existing fleet. The program has investments in areas such as Laser Powder Bed Fusion, Powder Metallurgy/Hot Isostatic Pressing of large components, digital integration frameworks, as well as the scientific and engineering expertise needed to maintain and enhance U.S. nuclear leadership.

NNSA: $115.0M:

Advanced Manufacturing
- Accelerate the use of additive manufacturing as an agile production process for stockpile components.
- Invest in digital manufacturing to enhance process control diagnostics and supply chain risk mitigation.
- Invest in the design for manufacturing initiative.
- Support key manufacturing technologies that are replacing obsolete materials and processes on a timeline to support the W87-1 and future systems.
- Advance qualification and certification methods to use AM-produced parts in the active stockpile.
- Transition AM machine capabilities to a production environment to deliver AM parts to the stockpile.
- Leverage scientific knowledge for new qualification and certification methods to enable delivery of AM components intended for the W87-1 Modification Program.
- Conduct testing to confirm components manufactured with new production methods improve performance margins.
- Develop material recyclability processes to reuse scrap material and reduce supply chain risk.

SC: $26.0M

The Office of Science will support underpinning efforts in fundamental research to transform advanced manufacturing.
- **Basic Energy Sciences (BES): $17M:** The recent BES workshop on Basic Research Needs for Transformative Manufacturing complements prior SC workshops and provides priority research directions and opportunities that form the basis for this initiative. Critically, new investments in manufacturing science will be enabling for other science and technology initiative areas within DOE, with a focus that includes the science for scale-up from initial discoveries to bridge the gap to applied research and commercial application.
- **Biological and Environmental Research (BER): $5M:** New approaches and systems will support biomanufacturing, especially with respect to genome-enabled engineering and design of biomaterials. These approaches and challenges are informed by the 2018 BER workshop on Genome Engineering for Materials Synthesis.
- **Fusion Energy Sciences (FES): $3M:** The 2018 Fusion Energy Sciences Advisory Committee (FESAC) Report on Transformative Enabling Capabilities for Efficient Advance Toward Fusion Energy highlighted the promise of novel synthesis, manufacturing, and materials design to enable fusion energy systems for the future. These new technologies are critical to enable design of materials capable of sustaining the extreme conditions expected in fusion reactors as well as other applications in extreme environments. FES will initiate an effort on utilizing additive manufacturing technology for fusion systems (such as shaped tungsten wall tiles and other plasma-facing components).
- **Isotope R&D and Production: $1M:** Development of multiscale models and tools, coupled with co-design research and methodologies, will accelerate the transition from discovery, to design, to development, to scale-up to transform isotope production/purification techniques. Advanced targetry, additive manufacturing, robotics and the development of advanced tools and machinery will promote the strength of domestic supply chains for critical isotopes for research and applied technologies.

Departmental Collaboration

The AMI pursues manufacturing innovations to advance DOE's mission. The participating Offices regularly engage at a technical level to share status, progress, and gaps. DOE also meets regularly with other agencies involved in advanced manufacturing through the National Science and Technology Council Subcommittee on Advanced Manufacturing. To further strengthen coordination and collaboration across DOE, an Advanced Manufacturing Crosscut team will be established to be led by the Advanced Manufacturing Office in EERE. Plans include collaborative workshops, technical coordination on funding opportunity announcements, and joint proposal peer reviews for solicitations.

In FY 2022, NE's advanced manufacturing activities will focus on the highest priorities needed to propel advanced reactor R&D and technology developers towards commercialization. NE will identify approaches and candidate tool sets that could accelerate the use of new materials and production technologies in nuclear systems to enhance the economics and performance of the existing reactor fleet and advanced reactor concepts.NE plans to increase intra-department collaboration with EERE's AMO and NNSA.

In FY 2022, NNSA's advanced manufacturing activities will be accelerated, with significant potential to save on future production costs, including replacing obsolete and hazardous materials; and modernizing NNSA's production capabilities. NNSA will focus on the applicability and viability of additively manufactured energetics, metals, and new types of plastics; and acceleration of advanced manufacturing processes, diagnostics development, and production simulation.

In FY 2022, SC will support efforts for fundamental science leading to transformational manufacturing. The opportunities for underpinning science for manufacturing crosses many SC activities, including biomanufacturing, next-generation microelectronics fabrication, innovations for accelerator technology, science to transform "traditional" chemical and materials manufacturing, materials for extreme environments, and isotope production and purification, to name a few. Central to the discovery and application of transformative science are computational tools and a system-based co-design approach to integration of experiments, predictive theory, and artificial intelligence and machine learning that cross the interfaces among components in manufacturing systems.

The recent SC BES workshop on Basic Research Needs for Transformative Manufacturing complements prior SC workshops and provides priority research directions and opportunities that form the basis for this initiative. Critically, new investments in manufacturing science will be enabling for other science and technology initiative areas within DOE, with a focus that includes the science for scale-up from initial discoveries to bridge the gap to applied research and commercial application.

The 2018 SC FESAC Report[1] on Transformative Enabling Capabilities for Efficient Advance Toward Fusion Energy highlighted the promise of novel synthesis, manufacturing, and materials design to enable fusion energy systems for the future. These new technologies are critical to enable design of materials capable of sustaining the extreme conditions expected in fusion reactors as well as other applications in extreme environments.

SC will interact with technology offices to ensure close coordination of FY 2022 funding opportunities to ensure maximum impact of funded research on technology challenges. Research opportunities will include a focus on Experimental Program to Stimulate Competitive Research regions as well as broad outreach to minority serving institutions.

FY 2022 Key Objectives (Planned)
- Strengthen Cross-DOE Coordination and Collaboration: Ensure an integrated approach including clearly defined "swim lanes" and "relay points," integrated systems analysis, workshops and

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[1] https://science.osti.gov/-/media/fes/fesac/pdf/2018/TEC_Report_15Feb2018.pdf

Principal Investigator meetings, community/stakeholder engagement, and data/information sharing.

- Support Decarbonizing the Industrial Sector and Pursue Manufacturing Clean Energy Technologies. Support manufacturing in contributing at its full potential to decarbonizing the economy and improving economic competitiveness.
- Support Fundamental and Applied Research, Development, Demonstration, and Deployment: Build an integrated set of investments across the full innovation pipeline, with added attention to demonstrations and incubators.
- Address the Full Supply Chain and Product Lifecycle: Target program to address technical gaps and barriers across supply chains and lifecycles, including recycling.
- Strive for Manufacturing Sector Agility and Cybersecurity: Utilize information technology, computational, and other advances to enable a manufacturing sector that is responsive to opportunity and disruption, while ensuring cybersecurity.
- Conduct Systems Analysis: Conduct life cycle, resource, regional, and techno-economic analyses to guide the portfolio and strategy.
- Support Workforce/Science, Technology, Engineering and Mathematics and Diversity, Equity, and Inclusion: In collaboration with education and manufacturing sector stakeholders, identify priority skills and career paths for a diverse future workforce at multiple levels.
- Improve manufacturing processes R&D effort through High Performance Computing for manufacturing;
- Apply modeling, simulation, and data analysis to industrial processes and products to lower production costs and shorten the time to market;
- Conduct manufacturing analysis and R&D related to recycling/upcycling of plastics as part of the Plastics Innovation Challenge;
- Address supply chain challenges for critical and rare-earth materials by diversifying supply of, developing substitutes for, and driving recycling, reuse, and more efficient use of these materials;
- Advance certification and qualification methods to widen the use of AM-produced parts in the active stockpile;
- Incorporate next generation digital manufacturing methods through use of computational simulations and model-based designs;
- Implement new, strategically radiation-hardened microelectronics production capabilities to enable new systems architectures; and
- Develop new energetic materials formulations that are safer to produce and replace legacy materials that are no longer commercially available.
- Competitively award research on nuclear component manufacturing, fabrication, and plant construction of advanced reactor technologies.

Major Changes from FY 2021 Enacted
- EERE: Significant increases across all EERE Technology Offices focusing on the manufacturing innovations to decarbonize industrial sector, production of energy technologies including components and systems along the value chain, and production of hydrogen and low-carbon chemicals and intermediates from renewable resources. EERE's Request supports RD&D, technical assistance, and workforce development activities including:
  - Developing novel materials with improved properties, as well as the materials' production processes, including the sustainable use of materials and resources through resilient and secure supply chains and across product lifecycles. EERE will expand on its work in critical materials to drive technologies towards industry adoption.
  - Advancing new manufacturing technologies and improving energy efficiency and reducing carbon emissions in existing manufacturing processes and operations. New activities represent a significant increase in RDD&D of industrial decarbonization technologies, including demonstrations in energy-intensive sectors, such as steel, chemicals, and concrete/cement.
  - Advancing manufacturing systems related to energy conversion, utilization, storage, and management to be used in manufacturing and other sectors. Key areas of focus will include overcoming the

manufacturing barriers of innovative integrated energy storage systems that meet the performance requirements for multiple applications, including for grid applications and vehicles.

- Investing in RDD&D across multiple offices in EERE including additive manufacturing of clean energy technologies, manufacturing of hydrogen and fuel cell systems, reduction of critical materials, and steel and ammonia production.
- Pursuing RD&D of solar thermochemical processes and components for the manufacture of solar-derived industrial products, chemicals, and fuels. Activities will include leveraging CSP technologies to support decarbonization of the industrial sector through research and development of solar thermochemical processes and components to produce solar-derived industrial products, chemicals, and fuels.
- Through the Manufacturing and Competitiveness program, catalyzing new businesses featuring innovative manufacturing technologies and processes for solar-derived industrial products, chemicals, and fuels. This includes the 17th round of the successful Incubator program, which provides early-stage assistance to small businesses developing and validating technology prototypes.
- Developing chemicals, intermediates, and materials from biomass and waste resources as renewable, low-carbon alternatives to fossil-derived incumbents.
- Validating technology performance to attract subsequent private sector funding to scale into production.
- Advancing manufacturing and quality control techniques for electrolyzers and fuel cell components.
- Addressing safety, codes, standards.
- Developing a diverse and competitive manufacturing workforce. EERE will strengthen and expand existing workforce development programming to increase diversity at all levels, improve career paths, and further support entrepreneurship.

- NE: Acknowledging the tremendous recent advances that have been made in microreactor research and development, the Transformational Challenge Reactor subprogram will be ending in FY 2021. NE plans to consolidate and integrate the cutting-edge research previously pursued through the Advanced Methods for Manufacturing topic area, the Nuclear Materials Discovery and Qualification initiative, and the crosscutting research previously performed under the Transformational Challenge Reactor into the CTD - AMMT program to consolidate all relevant technologies under one program.

- NNSA: Net increase of +$3.1 million reflects additional investments to: leverage embedded sensors to study long-term aging effects of AM materials and components, increase efforts to address materials obsolescence issues in the nuclear security enterprise, increase advancements in manufacturing diagnostic tools, increase development of advanced production methods, and introduce new manufacturing techniques into production lines and ensure materials and components produced by novel manufacturing processes meet design requirements.

- SC: New research direction for the core SC programs; previous research funded by the CARES Act demonstrated the impact of BES user facilities on manufacturing research, accelerating transition of national lab activities to industrial settings for COVID-19 technologies. Research will support new approaches and systems to support biomanufacturing, especially with respect to genome-enabled engineering and design of biomaterials. Research will support the development of transformative target manufacturing for isotope production. Research will support advanced manufacturing as it applies to materials for extreme environments, including fusion energy and other applications. Fundamental research supported by SC will not overlap, but will be synergistic with the technology offices, ensured through close coordination. The longer-term will see evolution of research directions in response to technology evolution and transition of promising innovations to relevant technology offices for further development.

Exascale Computing Initiative Crosscut

Funding by Appropriation and Program
($K)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY22 vs FY21 ($ Change)
SC-ECP (17-SC-20)	$188,735	$168,945	$129,000	-$39,945
Argonne Leadership Computing Facility (ALCF)	$150,000	$150,000	$150,000	—
Oak Ridge Leadership Computing Facility (OLCF)	$125,000	$120,000	$125,000	+$5,000
Basic Energy Sciences	$26,000	$26,000	$26,000	—
Biological and Environmental Research	$15,000	$15,000	$15,000	—
Total, SC Exascale[1]	**$504,735**	**$479,945**	**$445,000**	**-$34,945**
Advanced Simulation and Computing (ASC)				
-Advanced Technology Development & Mitigation (ATDM)	$174,825	$40,000	$40,000	—
ECP Focus Area 1: Applications	*$30,000*	*$15,000*	*$15,000*	*—*
ECP Focus Area 2: Software	*$15,000*	*$15,000*	*$15,000*	*—*
ECP Focus Area 3: Hardware	*$40,000*	*—*	*—*	*—*
ECI Stockpile Simulation	*$35,005*	*$10,000*	*$10,000*	*—*
ECI Stockpile Computing	*$54,820*	*—*	*—*	*—*
- Defense Applications and Modeling (DAM)	—	$28,000	$18,000	-$10,000
- Computational Systems and Software Environment (CSSE)	$84,478	$124,000	$145,000	+$21,000
Exascale System	*$84,478*	*$100,000*	*$125,000*	*+$25,000*
Next-Generation Computing Technologies	*—*	*$24,000*	*$20,000*	*-$4,000*
- Facility Operation and User Support (FOUS)	—	$3,000	$14,000	+$11,000
- Exascale Class Facility Modernization (18-D-620)[2]	$50,000	$29,200	—	-$29,200
Total, NNSA Exascale	**$309,303**	**$224,200**	**$217,000**	**-$7,200**
Total, ECI	**$814,038**	**$704,145**	**$662,000**	**-$42,145**

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[1] The SC-ECP project was initiated in FY 2017 and in FY 2018 funds to prepare the LCFs for deployment of at least one exascale system were included in ECI. Only a portion of the OLCF funds is shown because they are also operating Summit which is a 200 PF pre-exascale system; funding for the ALCF is primarily focused on the delivery of the exascale system. BES investments in computational materials and chemistry applications are also included in ECI but not shown on the table for FY 2017 and beyond.

[2] In FY 2021, ASC will exist as a subprogram to the higher-level Stockpile Research, Technology, and Engineering Program. At that time, ECFM will fall under Programmatic Construction within Infrastructure and Operations.

Summary:

The Exascale Computing Initiative (ECI) is a partnership between the Office of Science (SC) and the National Nuclear Security Administration (NNSA) to develop and deploy three exascale-capable computing systems with an emphasis on sustained performance for relevant applications and analytic computing to support DOE missions. In 2015, the National Strategic Computing Initiative (NSCI) was established to maximize the benefits of HPC for U.S. economic competitiveness, scientific discovery, and national security and within NSCI DOE has the responsibility for executing a joint program focused on advanced simulation through an exascale–capable computing program, which will emphasize sustained performance and analytic computing to advance DOE missions. The computing industry has reached a point where the continued improvement in processing performance requires technological breakthroughs to mitigate memory bottlenecks, reduce power consumption, and solve unique problems of computing at unprecedented scales. As a result, DOE's approach in ECI is aimed not simply at realizing a single, albeit exceptional, computing performance objective, but rather at setting the U.S. on a new design trajectory to support a broad spectrum of capabilities over the succeeding years. It is imperative for the United States to retain its primacy in HPC to ensure its national security, economic prosperity, technological strength, and scientific and energy research leadership to prevent other nations with demonstrated commitment to HPC investment to take the lead not only in high-end computing but also eventually in science, national defense, and energy innovation, as well as in the commercial computing market.

Crosscut Objectives:

ECI is currently comprised of three components: the Exascale Computing Project (ECP) which is focused on the research, development, and deployment of the exascale applications and software ecosystem; additional investments by NNSA and other SC Program offices for their mission-specific work; and the actual exascale system procurements and deployment at Argonne, Lawrence Livermore, and Oak Ridge National Laboratories. The DOE ECP is organized around three technical focus areas: 1) Application Development, targeting specific R&D activities and outcomes that address critical DOE applications and grand challenge problems; 2) Software Technology, with efforts that span low-level operational software to high-level applications development environments, including the software infrastructure to support large data management and workflows; and 3) Hardware and Integration, which supports vendor-based R&D efforts and the integration of ECP with the facilities projects that are delivering the exascale systems.

- *Crosscut Objective 1:* By September 30, 2021, begin deployment (receiving and installing hardware) of at least one Exascale Computing system (DOE Agency Priority Goal).
- *Crosscut Objective 2:* ECP Application Development – Develop and enhance the predictive capability of applications critical to DOE in national security, clean energy, earth systems chemistry and materials.
- *Crosscut Objective 3:* ECP Software Technologies- Deliver expanded and vertically integrated software stack to achieve full potential of exascale computing.
- *Crosscut Objective 4:* ECP Hardware and Integration- Integrate delivery of ECP products on targeted systems at leading DOE HPC facilities.
- *Crosscut Objective 5:* In the 2022-2023 timeframe begin deployment of DOE's two additional exascale systems to support DOE's mission in scientific discovery and national security.

Program 'Action Areas':

1. *Action Area 1:* NNSA and DOE/SC will continue their close partnership to meet the ECI goals and objectives.
2. *Action Area 2:* In this focus area, ASCR will continue testing applications critical to the scientific and energy missions of the Department and other Federal agencies on Frontier while preparing for the delivery of Aurora.
3. *Action Area 3:* NNSA is responsible for determining the scope and management of the stockpile simulation application development activities. The accuracy of the NNSA weapon codes underpins confidence in the U.S. nuclear deterrent and must be improved to ensure continued future confidence in the nation's stockpile.

4. *Action Area 4:* In partnership with NNSA, investments in the Software Technology focus area will provide the required software that effectively bridges between the other focus areas of the ECP. The ECP software technology effort will continue to debug the software stack, as needed, on the first exascale system (Frontier at Oak Ridge National Laboratory (ORNL)) and prepare for deployment on two additional exascale systems planned for deployment in the 2021-2023 timeframe.

5. *Action Area 5:* Continue the support of the close integration between ECP and DOE HPC facilities, while deploying application and the software stack on the exascale platforms.

6. *Action Area 6:* SC: Basic Energy Sciences (BES) and Biological and Environmental Research (BER) exascale application development. Within this focus area BES is responsible for determining the scope and management of the Functional Material and Computational Chemistry programs and BER is responsible for determining the scope and management of the Earth Systems Modeling programs.

7. *Action Area 7:* ASCR will complete final acceptance testing of Frontier at ORNL and begin the deployment (installation and testing) of Aurora at Argonne National Laboratory (ANL).

8. *Action Area 8:* Funding continues to support projects at the NNSA Labs for an enduring U.S. HPC ecosystem via inter-agency collaborations with the National Cancer Institute.

9. *Action Area 9:* In FY 2022, NNSA will sustain the transferred Advanced Technology Development and Mitigation (ATDM) next-generation codes and associated capabilities (to ASC Defense Applications and Modeling portfolio in FY 2021) to directly support the annual assessment activities.

10. *Action Area 10:* NNSA will embark on a multi-year, non-recurring engineering collaboration and system build partnership with selected exascale system vendor, HPE, to ensure the 2023 exascale system will be a highly capable and productive computing resource for the Stockpile Stewardship Program.

11. *Action Area 11:* In FY 2022, NNSA will sustain its CSSE next-generation computing technologies, transferred from ATDM in FY 2021, to ensure the tri-lab software stack will run efficiently on El Capitan.

Program Organization:

1. SC ($445M): See action areas, 1, 2, 4, 5, 6 and 7 above.

2. NNSA ($217M): See action areas 1, 3, 8, 9, 10, 11 above.

ECP is being executed within a tailored project framework that follows the principles of DOE Order 413.3B, which defines critical decision points, overall project management, and requirements for control of a baselined schedule and cost. A single federal project director (FPD) from the ORNL Site Office has overall responsibility for execution of the project and the FPD reports to the cognizant SC and NNSA Headquarters program offices and are accountable to an Acquisition Executive, as defined in DOE Order 413.3B. Project execution is governed by a baselined schedule and cost envelope, using Office of Science processes, and follow defined processes for change control and management of contingency per the established ECP performance baseline.

Because of the breadth and complexity of the research and development of the applications, software environment and hardware technologies, along with the deployment of usable exascale computers for DOE, an Integrated Project Team (IPT) has been established through an IPT charter with defined roles and responsibilities. The IPT supports the FPD who leads the IPT through the lifetime of the project.

Information Technology (IT)
($K)

FY 2021 Enacted	FY 2022 Request
$ 1,415,773	$1,604,866

Overview

As directed in OMB Circular A-11 (2020) Section 51.3, the Department of Energy's (DOE) IT Budget by appropriation is presented below. In FY 2022, DOE plans to spend $1.605 billion on information technology (IT), an increase of 13.4 percent or $189 million from FY 2021. In alignment with the Executive Order 14028, Improving the Nation's Cybersecurity, the Department is making significant contributions toward modernizing cybersecurity defenses by protecting federal networks, improving information-sharing between the U.S. government and the private sector on cyber issues, and strengthening the United States' ability to respond to incidents when they occur.

DOE Information Technology (IT) Funding by Appropriation

The following IT Funding by Appropriation table is derived from federally directed spending amounts reported in DOE's FY 2022 IT Portfolio. DOE distinguishes between IT investments directed and funded by programs from their appropriated budgets (i.e., federally-directed) and Management and Operating (M&O) contractor-directed and funded IT projects which use overhead or a portion of mission work funding provided by DOE programs to fund IT (i.e., contractor-directed). Investments utilizing both types of funding are included in DOE's annual IT Portfolio submission to OMB, which totals $3.245 billion for FY 2022 (https://itdashboard.gov/drupal/summary/019).

Information Technology (IT) Funding by Appropriation

In Thousands ($K)[1,2]

Appropriation	FY 2020 Actuals	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs. FY 2021 Enacted	% Change
National Nuclear Security Administration					
Defense Nuclear Nonproliferation	32,782	37,833	37,811	(22)	-0.1%
Federal Salaries and Expenses	5,560	6,620	6,545	(76)	-1.1%
Naval Reactors	105,426	135,193	142,087	6,894	5.1%
Weapons Activities	483,431	561,180	576,270	15,090	2.7%
Subtotal, NNSA	**627,199**	**740,827**	**762,712**	**21,886**	**3.0%**
Environmental and Other Defense Activities					
Defense Environmental Cleanup	95,808	107,452	115,487	8,035	7.5%
Other Defense Activities	48,959	51,011	48,900	(2,111)	-4.1%
Subtotal, Environmental & Other Defense Activities	**144,767**	**158,462**	**164,387**	**5,924**	**3.7%**
Energy Programs					
Advanced Research Projects Agency - Energy	-	178	-	(178)	0.0%
Advanced Tech. Vehicles Manufacturing Loan Program	1,060	647	690	43	6.6%
Cybersecurity, Energy Security, & Emergency Response	-	310	319	9	2.9%
Electricity	1,934	2,125	1,820	(305)	-14.4%
Energy Efficiency and Renewable Energy	38,682	46,404	49,189	2,785	6.0%
Energy Information Administration	18,013	18,013	22,670	4,657	25.9%
Fossil Energy and Carbon Management	50,600	48,606	53,471	4,865	10.0%
Non-defense Environmental Cleanup	5,565	5,565	3,586	(1,979)	-35.6%
Northeast Home Heating Oil Reserve	323	336	350	14	4.2%
Nuclear Energy	7,309	7,150	7,299	149	2.1%
Nuclear Waste Disposal	3,368	3,709	750	(2,959)	-79.8%
Science	55,554	56,751	105,381	48,630	85.7%
SPR Petroleum Account	377	377	377	-	0.0%
Strategic Petroleum Reserve	1,249	1,294	1,324	31	2.4%
Technology Transitions	610	619	698	79	12.8%
Title 17 Innovative Tech. Loan Guarantee Program	4,070	4,084	4,326	242	5.9%
Tribal Indian Energy Loan Guarantee Program	216	249	264	15	6.0%
Subtotal, Energy Programs	**188,930**	**196,416**	**252,513**	**56,098**	**28.6%**
Departmental Administration					
Departmental Administration	156,272	158,089	250,822	92,733	58.7%
Chief Financial Officer (CFO)	9,418	9,826	10,329	503	5.1%
Chief Information Officer (CIO)	140,200	140,200	232,258	92,058	65.7%
Other DA Accounts	6,654	8,063	8,235	173	2.1%
Office of the Inspector General	1,755	1,401	1,454	54	3.8%
Subtotal, Departmental Administration	**158,027**	**159,489**	**252,276**	**92,787**	**58.2%**
Working Capital Fund (WCF)[3]	79,382	83,198	92,395	9,197	11.1%
Energy Information Technology System (EITS)[4]	82,027	77,381	80,583	3,202	4.1%
Total, Department of Energy	**1,280,333**	**1,415,773**	**1,604,866**	**189,093**	**13.4%**

[1] Includes Federally directed IT Spending only (i.e., spending directed and funded by DOE programs). The total does not include IT spending directed by M&O contractors using overhead funding.

[2] Power Marketing Administration (PMA) IT spending is not included due to the minimal impact on the Department's budget. PMAs are primarily funded by collections.

[3] CIO, CF, Office of Management, Office of the Chief Human Capital Officer, and Inter-Agency investments utilize WCF funding.

[4] EITS and WCF customer costs are excluded from Program's IT spend reporting to avoid double counting.

Highlights and Major Changes

Details on substantial IT spending changes from FY 2021 to FY 2022 are described by appropriation below.

Office of the Chief Information Officer (CIO)
In FY 2022, CIO is requesting an increase for a cyber reserve to address immediate SolarWinds-related incident response and recovery needs. The funding request targets critical cybersecurity needs across DOE, prioritizing basic cybersecurity enhancements, including: cloud security, Security Operations Center (SOC) enhancements, encryption, Multi-Factor Authentication (MFA), increased logging functions, and enhanced monitoring tools. DOE's maturation levels were reviewed to determine the most critical gaps that require additional funding.

National Nuclear Security Administration (NNSA)
In FY 2022, Weapons Activities increases are primarily due to the SAFER (Safety, Analytics, Forecasting, and Evaluation Reporting) project moving from the pilot to the production phase. The project will provide a system that incorporates the wide variety of information from multiple databases to enable the complex to efficiently capture, organize and share information to improve facility performance, operability and safety. NNSA sites will develop and install data connections and a server that enable near real-time data to automatically feed directly into SAFER.

Naval Reactors increases are due to the transition of unclassified work from the classified to the unclassified network. This project was accelerated into a single year to build out the unclassified network and was also expanded to support offsite work due to the COVID-19 pandemic.

Defense Environmental Cleanup, Non-Defense Environmental Cleanup, and Nuclear Waste Disposal (EM)
Environmental Management (EM) is funded, in part, by the Defense Environmental Cleanup appropriation. (NOTE: EM is also funded by the Non-defense Environmental Cleanup and Nuclear Waste Disposal appropriations.) EM's federally directed IT spending in Defense Environmental Cleanup will increase by 7% from FY 2021 to FY 2022 to support EM strengthening its cybersecurity posture to address emerging cybersecurity threats, at EM Field Sites and Headquarters. The expanded cybersecurity funding addresses all areas of cyber risk, particularly mobile device management, data safeguarding, and cloud security. Non-Defense Environmental Cleanup and Nuclear Waste Disposal are decreasing in FY 2022 due to costs being consolidated under Defense Environmental Cleanup.

Energy Efficiency and Renewable Energy (EERE)
In FY 2022, EERE is requesting increases for cybersecurity and Operations & Maintenance costs. Specifically, the funding increase in EERE's IT Security and Compliance Standard Investment will provide additional security engineers, analysts, forensic services, and appliances at the National Renewable Energy Lab (NREL).

Energy Information Agency (EIA)
EIA will continue comprehensive IT modernization efforts and will continue to invest resources to address aging infrastructure, new compliance requirements, increased licensing costs, and increased Operating & Maintenance costs associated with legacy applications. EIA anticipates higher costs in FY 2022 due to contract transitions and cloud initiatives.

Fossil Energy and Carbon Management (FECM)
Within the FY 2022 Budget Request, the increase includes operation and enhancement of the FECM 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. National Energy Technology Laboratory will use the FY 2022 increase to support the resolution of long-standing Plan of Action & Milestones directly related to Federal Information Security Modernization Act requirements with particular emphasis on activities with significant Continuous Diagnostics and Mitigation overlap. These remediation efforts will include the deployment of next-generation firewalls to support improved network management and security capabilities.

Science

In FY 2022, Science will use the increase in IT for cybersecurity enhancements, records management, Internet Protocol Version 6 (IPv6) implementation, and hardware and software refresh. The request will support $43.74 million in investments to strengthen protection at federal and Management & Operating (M&O) sites in the areas of: Cyber Threat Intelligence, Incident Response, Incident Recovery, Novel Security Techniques, Infrastructure Refresh, Industrial Control System Protection, Continuous Diagnostics and Mitigation, and Controlled Unclassified Information Protection. Additionally, the request will support the implementation of the Cyber Security Program Plan and development of a mature, risk-based cyber security program across federal and M&O sites. In FY 2022, Science will also use the requested increase to comply with federal records requirements, including joint OMB memorandum M-19-21, Transition to Electronic Records, and 44 USC 33, Disposal of Records, and National Archives and Records Administration. Science will also continue working with stakeholders to digitize paper records and implement an electronic Records Management solution. Science will also continue work on IPv6 implementation in compliance with OMB memorandum M-21-07, Completing the Transition to 1Pv6. The request will also be utilized to refresh legacy infrastructure equipment, laptops, and mobile devices.

Energy Sector Cybersecurity
($K)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 22 vs. FY 21 ($ Change)
Cybersecurity, Energy Security, and Emergency Response	**117,000**	**139,100**	**110,000**	**-29,100**
Risk Management Technology & Tools	117,000	139,100	110,000	-29,100
Information Sharing, Partnerships and Exercises				
Response and Restoration				
Electricity				
Cyber R&D	0	0	25,000	+25,000
Energy Efficiency and Renewable Energy	**37,868**	**32,351**	**17,070**	**-15,281**
Advanced Manufacturing Office (AMO)	14,000	14,000	0	-14,000
Bioenergy Technologies (BETO)	200	200	200	0
Building Technologies (BTO)	7,250	7,250	3,870	-3,380
Federal Energy Management Program (FEMP)	1,834	2,071	2,500	+429
Hydrogen and Fuel Cell Technologies (HFTO)	1,000	1,000	1,000	0
Solar Energy Technologies (SETO)	7,000	4,000	3,500	-500
Vehicle Technologies (VTO)	4,000	2,000	2,000	0
Water Power Technologies Office (WPTO)	750	1,300	1,500	+200
Wind Energy Technologies Office (WETO)	1,834	530	2,500	+1,970
Nuclear Energy	**5,000**	**5,000**	**10,000**	**+5,000**
Fossil Energy and Carbon Management	**920**	**1,170**	**1,300**	**+130**
Chief Information Officer	**1,553**	**1,303**	**1,553**	**+250**
Total, Energy Sector Cybersecurity	**162,341**	**178,924**	**164,923**	**-14,001**

Overview

The U.S. Department of Energy's (DOE's) FY 2022 budget request is aligned with the National Cyber Strategy and demonstrates the Administration's commitment to strengthening the Nation's cybersecurity capabilities and addressing the most pressing cyber threats. The FY 2022 budget supports DOE's responsibilities as Sector-Specific Agency (SSA) for cybersecurity for the energy sector, as established under the Fixing America's Surface Transportation (FAST) Act of 2015, and as the Sector Risk Management Agency under NDAA FY21. As SSA/SRMA, DOE works closely with the critical infrastructure lead, the U.S. Department of Homeland Security (DHS), and our other federal partners including law enforcement and the intelligence community, as well as stakeholders across industry, and state and local governments, to

secure the Nation's critical energy infrastructure from cyber threats and attacks.

<u>Departmental Collaboration</u>

As adversaries increase the frequency and sophistication of their malicious cyber activities, the Department has increased investment in cybersecurity to identify solutions to reduce risk for the energy sector, as well as the enterprise systems supporting the Department's internal operations. The FY 2022 request builds upon the vision for the establishment of the Office of Cybersecurity, Energy Security and Emergency Response (CESER) and the administration's priorities for secure and resilient energy delivery system.

Highlights and Major Changes

<u>Office of Cybersecurity, Energy Security, and Emergency Response</u>

The FY 2022 CESER budget request supports:

- CESER is lead for energy sector cybersecurity initiatives across the Department. In FY 2022, CESER will make investments in the following programmatic areas of Risk Management Tools & Technologies:

- ADVANCED CYBERSECURITY TOOLS & TECHNOLOGIES FOR THE SECTOR
  Develop, demonstrate, deploy, and transition to practice next generation technology and tools for broad adoption in energy industry. These tools will focus on protection, monitoring, detection, response, containment, forensics, and recovery. The request supports competitive Funding Opportunity Announcements (FOA) and Lab Research Calls for the development of such tools for Information Technology (IT) and Operational Technology (OT) spaces. The request also supports the Grid Modernization Laboratory Consortium (GMLC) initiatives.

- ADVANCED THREAT MITIGATION
  Enhance the speed and effectiveness of government and private sector bi-directional machine-to-machine threat information sharing and analysis. This initiative will use the latest available technology and architecture together with innovative partnerships in the energy sector to promote enhanced cyber protection for the sector. The vision is to dramatically increase the visible footprint across the energy sector infrastructure and to gain a higher level of threat detection capability. The request will allow for near-real-time capability for energy owners and operators, analyze their data, identify adversary activities, and execute mitigative measures.

- CYBER RISK ASSESSMENT TOOLS
  Develop and transition to practice tools, guidance, and practices that help energy organizations' understanding and management of cybersecurity risk to systems, people, assets, data, and capabilities. The CESER Cybersecurity Capability Maturity Model (C2M2) and energy sector Cybersecurity Framework profiles initiatives improve understanding of cybersecurity capabilities, gaps and challenges facing electricity, oil, and natural gas sectors. These tools connect business context, critical resources and functions, and the related cybersecurity risks to enable an organization to focus and prioritize its cybersecurity efforts, consistent with its risk management strategy and business needs.

- RESEARCH & DEVELOPMENT COORDINATION
  Coordinate with DOE applied program offices to streamline Research and Development (R&D) of cybersecure energy delivery systems preventing redundancies and gaps across electricity, fossil fuels, nuclear, and renewable technologies.

- SITUATIONAL AWARENESS TOOLS
  The funding will enable CESER to continue providing visibility in sector threat environment and supplementing that with analytical capability to support the sector. This funding will enable expansion of CRISP and associated information sharing and situational awareness tools

  CYBER TESTING FOR RESILIENT INDUSTRIAL CONTROL SYSTEMS (CyTRICS)CyTRICS is the Department of Energy's program for cybersecurity supply chain vulnerability testing, digital subcomponent enumeration, and mitigation.

CyTRICS partners across energy sector stakeholders to identify threat-informed, high priority operational technology (OT) components, perform expert testing, share information about vulnerabilities in the digital supply chain, and inform improvements in component design and manufacturing. FY2022 funding will enable inclusion of two additional testing Labs (NREL and ORNL) and scaling up cyber supply chain testing of digital components in renewables and distributed energy systems. CyTRICS includes integrated cyber supply chain programs for the energy sector that leverage outputs of cyber vulnerability testing. These include integration with intelligence community programs, DOE CIO cyber supply chain programs, energy sector demonstration projects for automated generation and exchange of hardware and software bills of materials, and digital subcomponent supply chain illumination tools.

CAPACITY BUILDING, TRAINING, AND EXERCISES
In support of CESER's energy disruption and emergency response efforts from a cyber incident, this program will conduct cyber exercises with interagency stakeholders, SLTT partners, and industry through leading events such as Liberty Eclipse, as well as by expanding technical training such as Cyber Strike and the Operational Technology (OT) Defender Fellowship, which offers middle and senior-level OT security managers in the U.S. energy sector an opportunity to more fully understand the cyber strategies and tactics that adversarial state and non-state actors use in targeting U.S. energy infrastructure. CESER will also expand the CyberForce Competition to include a series of continuous events throughout the year and explore the potential for internship and job opportunities for participants in the Federal and industry workforce.

CYBER INCIDENT RESPONSE
CESER will develop and expand capacity and capability to provide cyber incident response technical assistance to complement response efforts from interagency partners with analysis and expertise unique to the energy sector or when other resources are not available. This will include a training program for cyber responders, equipment, and forensic capabilities as required, and deep knowledge of energy management systems (e.g., distributed energy resources, grid SCADA controls, etc.). Additionally, CESER will establish a mechanism to quickly leverage technical resources and capability of DOE's National Laboratories, Power Marketing Administrations (PMAs), and other resources to be utilized during a cyber incident response that requires federal support.

Major Changes from FY 2021 Request
Cybersecurity R&D efforts of energy delivery system components have been reassigned from CESER CEDS to DOE applied program and science offices. CESER CEDS will coordinate with the other offices to streamline Research and Development (R&D) of cybersecure energy delivery systems preventing redundancies and gaps across electricity, fossil fuels, nuclear, and renewable technologies. CESER will also continue to focus on research, development, and demonstration of cyber risk management tools and technologies and bolstering cybersecurity R&D workforce development.

Electricity (OE)

The FY 2022 Budget request transfers responsibility for R&D for energy sector cybersecurity associated with electricity delivery systems from the Office of Cybersecurity, Energy Security, and Emergency Response (CESER) to OE, providing an opportunity to strengthen the relationship with other OE research for accelerated results. CESER retains lead responsibility for crosscutting cybersecurity issues that span beyond electricity delivery systems, as well as for coordinating energy sector cybersecurity activities across the Department.

OE's new Cyber R&D program requests $25.0 million to accelerate and expand efforts to strengthen electricity infrastructure against cyber threats while mitigating vulnerabilities. Working closely with the energy sector and our government partners, the request focuses on accelerating game-changing R&D to mitigate cyber incidents in today's systems and to develop next-generation resilient electricity delivery systems. The resilient electricity delivery systems will be designed, installed, operated, and maintained to survive a cyber incident while sustaining critical functions.

Office of Energy Efficiency and Renewable Energy

In FY 2022, EERE requests $17.1 million for high priority RD&D with a clear path to deployment, technical assistance, and Development best practices to identify and mitigate cyber risks. Work supported by EERE complements the DOE Multiyear Plan for Energy Sector Cybersecurity and includes the following:

- Analysis of cybersecurity risks in integrated biorefineries, and other investments in the Bioenergy Technologies portfolio, to ensure projects are identifying risks and taking necessary precautionary measures. The Request supports efforts to develop and implement findings and recommendations throughout laboratory project portfolio and competitive solicitations.
- Cybersecurity work though the Building Technologies the Grid-interactive Efficient Buildings (GEB) Initiative. In addition to improving the energy efficiency of the overall building, this research focuses on making equipment more intelligent through next-generation sensors, controls, connectivity, and communication.
- Technical Assistance for facility related control systems and the integration of Distributed Energy Technologies and Integration to assist with climate adaptation and electrification strategies in Federal buildings and other installations through the Federal Energy Management Program.
- Continued support for Hydrogen at Scale (H2@Scale) investments which include a cybersecurity component. H2@Scale is a concept that explores the potential for wide-scale hydrogen production and utilization in the United States to enable resiliency of the power generation and transmission sectors, while also aligning diverse multibillion dollar domestic industries, domestic competitiveness, and job creation.
- Integration of cybersecurity into relevant distributed energy resource controls, bulk power system protections, and other Grid Modernization Lab Consortium activities supported by Solar Energy Technologies.
- Sustained support for cyber physical security of the charging of Plug-in Electric Vehicles (PEV) and the interface between PEV charging and the electric grid through Vehicles Technologies.
- Continued development of digital tools and a pilot program to simulate hydropower cyber-attack and subsequent recovery by Water Power Technologies.
- Support for efforts focused on setting up wind plant communication, control, and power system co-simulation environment and conducting wind plant cybersecurity assessment and risk mitigation through Wind Energy Technologies.

Office of Nuclear Energy

In FY 2022, NE requests $10 million for the Nuclear Energy Enabling Technologies (NEET) Crosscutting Technology Development (CTD) subprogram to conduct research and development on methods to incorporate cybersecurity by design into advanced reactor concepts, advanced control architectures including autonomous and remote operations, standards for reducing supply chain risks, and the cost-effective integration of nuclear safety risk management with cybersecurity risk management.

Office of Fossil Energy and Carbon Management (FECM)

In FY 2022, the Office of Fossil Energy and Carbon Management (FECM) (Headquarters) request $1.3 million 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).

Office of the Chief Information Officer

In FY 2022, CIO requests $1.553M for the DOE Spectrum Management Program to manage DOE radio frequency spectrum-dependent resources for NNSA, Power Marketing Administrations (PMAs), Office of Secure Transportation, and National Laboratory spectrum-dependent assets. As the 9th largest holder of radio frequencies with more than 7,300 individual radio assignments, the Program provides technical, logistical, and administrative support, as well as ongoing oversight and advocacy at an inter-agency level in the National Capital Region. Critical DOE missions and essential functions utilizing Spectrum services include the National Power Grid, Interstate Electricity Transmission, Satellite Missions, Nuclear Emergency Search, Radiological Assistance, Secure Transportation and Safeguards, and Protective Force Communications.

Critical Minerals & Materials
Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY 2021 ($ Change)
Advanced Research Program Agency-Energy	**8,922**	**1,000**	**TBD***	**TBD***
Advanced Research Program Agency-Energy	8,922	1,000	TBD*	TBD*
Energy Efficiency and Renewable Energy	**74,200**	**104,300**	**160,150**	**+55,850**
Advanced Manufacturing	55,000	45,000	70,000	+25,000
Geothermal Technologies	200	4,300	2,150	-2,150
Hydrogen & Fuel Cell Technologies	19,000	25,000	31,000	+6,000
Vehicle Technologies	0	30,000	57,000	+27,000
Fossil Energy and Carbon Management	**23,000**	**23,000**	**48,000**	**25,000**
Fossil Energy and Carbon Management Research, Development, Demonstration and Deployment	23,000	23,000	48,000	25,000
Nuclear Energy	**0**	**1,000**	**0**	**-1,000**
Crosscutting Technology Development	0	1,000	0	-1,000
Office of Technology Transitions	**0**	**100**	**100**	**0**
Science	**0**	**17,000**	**25,000**	**+8,000**
Basic Energy Sciences	0	17,000	25,000	+8,000
Grand Total	**106,122**	**146,400**	**233,250***	**87,850***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Overview

Critical minerals and materials are important for energy technologies and subject to supply risk. As the global demand for clean energy technology ramps up, the demand for these minerals and materials is increasing rapidly. Underpinning our ability to meet our economic, national security, and climate goals is the need for a reliable, resilient, and secure critical material and mineral supply chain. These supply chains range from rare earth elements (REE) for permanent magnets in electric vehicle (EV) motors and wind turbines, to cobalt, lithium, manganese, nickel, and graphite for EV and grid batteries, to platinum group metals in fuel cell catalysts and catalytic convertors. The development of a sustainable, safe, and robust domestic supply chain for critical minerals and materials can also create jobs, support the manufacturing economy, and aid in just transition for coal and fossil-based communities.

The Department of Energy (DOE) addresses these challenges and opportunities through the Critical Minerals and Materials crosscut. DOE supports the elevation, coordination, and augmentation of existing activities, as well as the development of new activities, within the three pillars that ground DOE's strategy for bolstering the critical minerals and materials supply chain: diversify supply in a safe, sustainable, and environmentally just way, develop substitutes, and improve reuse and recycling.

Current DOE investments within the Office of Science (SC), Office of Energy Efficiency and Renewable Energy (EERE), and Office of Fossil Energy and Carbon Management (FECM) support these three pillars across the full lifecycle of critical minerals and materials, from extraction to processing and manufacturing to recycling and reuse. EERE and FECM support Applied research, development and demonstration (RD&D) across these topics, while SC provides the necessary fundamental research and world-class user facilities necessary to complete much of the work in this topic area. Both EERE and FECM are increasing their focus on investments that are targeted to accelerate the transition from research to commercialization. Examples of current applied RD&D activities across the supply chain include:

- **Extraction:** EERE and FECM support extraction efforts both through the identification of geographically-distributed domestic critical minerals resources (such as geothermal brines or coal byproducts and wastes) and the energy-efficient and low-impact extraction of critical materials from a variety of conventional and unconventional feedstocks (including clays, brines, produced water, coal byproducts and wastes, and mine tailings). Where appropriate, these activities are also coupled with remediation of legacy mine sites.
- **Processing:** EERE and FECM support critical mineral and material processing through RD&D on innovative separation and refining that range in technology and scale from localized mobile modular systems that process roughly 1 ton/day of material to more centralized facilities that produce tens of thousands of tons of material per year.
- **Manufacturing:** EERE supports critical minerals and materials manufacturing through RD&D on metallization, magnet manufacturing, battery manufacturing, and catalyst manufacturing to grow capabilities that support a manufacturing ecosystem that is innovative and resilient. EERE supports RD&D on developing material, component, and system level alternates for key energy applications.
- **Reuse & Recycling:** EERE supports recycling RD&D, particularly for magnets and batteries, as well as novel second-use applications of electric vehicle batteries for grid-scale electricity storage.

The DOE FY 2022 Budget Request, with coordinated efforts among the participating programs, will track these and many other programmatic investments, roles, and responsibilities of the Advanced Research Program Agency-Energy (ARPA-E), EERE, FECM, SC, Office of Nuclear Energy (NE), and the Office of Technology Transitions (OTT) for the Critical Minerals and Materials Crosscut.

Advanced Research Program Agency-Energy (ARPA-E): $TBD
FY 2022 Key Objectives (Planned):
- ARPA-E is developing programs for transformational research across a wide range of energy technologies and applications. The assessment process for new programs is now underway and any potential future investments in Critical Minerals will be determined in FY 2022.

Major Change from FY 2021 Enacted
- In FY 2021, critical materials projects were allocated through ARPA-E's Supporting Entrepreneurial Energy Discoveries (SEED) program.

Office of Energy Efficiency and Renewable Energy (EERE): $160.2M
FY 2022 Key Objectives (Planned):
- **Advanced Manufacturing (AMO) $70.0M**: The FY 2022 Budget Request supports research, development, demonstration, and deployment (RDD&D) to diversify domestic critical material resources, separation, and processing; develop alternatives to these materials; and improve reuse/recycling. In FY 2022, AMO will continue funding high priority critical materials RD&D in an integrated and coordinated program. This includes increased funding to enable accelerated validation and adoption of critical material technology through support to the National Laboratories and through other funding opportunity announcements.
- **Geothermal Technologies $2.15M**: The Request continues support for research and development (R&D) to extract lithium from geothermal brines. Geothermal brines, especially in the Salton Sea in California, could provide 40% of the global need for lithium, including all electric vehicle needs.
- **Hydrogen and Fuel Cell Technologies $31.0M**: The Request includes increased support to reduce platinum-based catalysts through support for the Electrocatalysis Consortium (ElectroCat), an initiative to accelerate the development of catalysts made without platinum group metals (PGM-free) for use in fuel cell applications across multiple sectors, and support for high priority electrolyzer R&D to reduce use of precious metals in hydrogen production.
- **Vehicle Technologies $57.0M:** The Request supports efforts to develop non-cobalt/non-nickel lithium battery cathodes; recycle lithium batteries to capture critical minerals from spent batteries; reduce or eliminate rare earth materials in electric drive motors and reduce or eliminate platinum group metals needed for engine emissions aftertreatment systems.

Major Changes from FY 2021 Enacted:
- EERE is shifting towards the integration of clean energy technologies that are ready to be demonstrated and deployed as well as R&D activities that advance early-stage technologies with a clear path to deployment in order to transition Americans to a 100 % clean energy economy no later than 2050. Therefore, the Budget Request increases funding for

high priority efforts in battery technologies critical to decarbonize transportation across all modes and in energy storage more broadly to support decarbonization of the electricity sector. As part of this emphasis, the Budget Request focuses on increasing funding to enable eliminating dependence on critical materials such as cobalt, nickel, and graphite.

Office of Fossil Energy and Carbon Management (FECM): $48M

FY 2022 Key Objectives (Planned):

- The FY 2022 Budget Request of $48 million will be used to further advance facilities to produce 1-3 metric tons/day of high purity, commercial grade REEs and other critical minerals (CMs), which will form next stage development to broadly enable extraction of REEs and other CMs from unconventional feedstocks (such as coal refuse and acid mine drainage) towards commercial industry adoption.
- Funding would be applied to further regional basin projects (the Carbon Ore, Rare Earth and Critical Minerals (CORE-CM) Initiative), and the development of transformational technologies for individually separated highly purified, individual CMs/REEs, including reduction to metals and alloying.
- Funding will continue to support the maturation of transformational separation and extraction technologies, characterization of CMs/REEs, machine learning and optimization modeling. Modeling and validation of models for optimization and efficiency improvements would improve process economics and are a necessary step in design and operation of larger scale facilities with continuous production.
- Funding would be applied to further Carbon Ore to Products projects focused on the development of existing and new technologies to turn coal waste and refuse into synthetic graphite and to deploy these technologies in economically distressed power plant and coal communities.
- The development of a sustainable, safe, and robust domestic supply chain for critical minerals and materials can also create jobs and aid in a just transition for coal and fossil-based communities. These communities have expertise that could be transferrable to technology development throughout the supply chain:
  - Upstream unconventional technology and technique development from resource characterization and prediction, through novel extraction from sources such as acid mine drainage, refuse, geothermal and produced water brines
  - Midstream technology development for environmentally sustainable, efficient, and cost-effective extraction, processing, refining of resources from unconventional and secondary sources
  - Downstream technology development for the transformation of carbon ore to synthetic graphite and graphene for battery anodes as well as graphene for quantum dots for use in solar cells.

Major Change from FY 2021 Enacted:

- Change in funding is the combination of two previous budget lines "Advanced Coal Processing and Critical Minerals" into Minerals Sustainability.

Office of Nuclear Energy (NE): $0

Major Change from FY 2021 Enacted:

- In FY 2021, NE allocated $1 million to competitively award research in non-uranium critical minerals, such as cobalt, indium, and several heavy rare earths.
- No funding is requested in FY 2022.

Office of Science: $25M

For many years, SC has supported foundational theoretical and experimental science related to understanding unique chemistry and properties associated with rare-earth elements, substitution for platinum group catalysts, and novel battery chemistries. New research directions emphasize the full breadth of the crosscut.

- SC-supported research has focused on understanding of the role of REEs, platinum group elements (PGE), and other critical elements in the determination of the properties of materials and molecules at length scales ranging from electronic to atomic and microstructural scales, and on advancing geoscience and separation science to enhance the extraction and chemical processing of critical elements.
- Research will expand understanding of the REE and PGE chemistry, including selective separations from solutions, and dynamics and reactivity at mineral-water interfaces during extraction and recovery.

- Emphasis will be on integration of the related fields of synthesis, characterization, predictive theory/modeling, and data science to advance understanding of the role of REE, PGE and other critical elements in the determination of the properties of functional materials such as magnets and catalysts, and on the use of such knowledge to reduce, eliminate, or find substitutes for critical materials in energy-relevant technologies.
- SC operates major x-ray, neutron, nanoscience, and high-performance computing user facilities that provide advanced synthesis, fabrication, characterization, and computational capabilities to this community for basic, applied, and industrial research.

Office of Technology Transitions: $100K
- Conduct critical materials market analysis to assess the dynamics affecting companies along the value chain and identify opportunities for the commercialization of DOE-developed technologies.

Energy Storage Grand Challenge

Funding by Appropriation and Program Control
($ Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 vs FY2021 ($ Change)
Advanced Research Program Agency-Energy	**40,803**	**820**	**TBD***	**TBD**
Advanced Research Program Agency-Energy	40,803	820	TBD*	TBD
Clean Energy Demonstrations	**0**	**0**	**386,500**	**+386,500**
Electricity	**56,000**	**80,000**	**119,000**	**+39,000**
Energy Storage: Research	55,000	57,000	72,000	+15,000
Energy Storage: Grid Storage Launchpad	1,000[1]	23,000	47,000	+24,000
Energy Efficiency and Renewable Energy	**259,478**	**347,292**	**465,400**	**+118,108**
Advanced Manufacturing	23,500	25,000	41,000	+16,000
Building Technologies	24,250	25,250	26,000	+750
Geothermal Technologies	8,800	6,515	5,000	-1,515
Hydrogen and Fuel Cell Technologies	36,000	117,000	127,000	+10,000
Solar Energy Technologies	30,000	17,000	23,500	+6,500
Strategic Programs	0	1,235	7,000	+5,765
Vehicle Technologies	117,000	135,000	183,000	+48,000
Wind Energy Technologies	8,228	2,792	16,900	+14,108
Water Power Technologies	11,700	17,500	36,000	+18,500
Fossil Energy and Carbon Management	**4,500**	**5,000**	**7,000**	**+2,000**
Nuclear Energy	**0**	**4,000**	**164,000**	**+160,000**
Technology Transitions	**100**	**100**	**100**	**+0**
Science	**24,088**	**24,088**	**24,088**	**+0**
Total, Energy Storage Grand Challenge	**384,969**	**461,300**	**1166,088**	**+705,608**

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

<u>Summary:</u>
The Energy Storage Grand Challenge (ESGC) is a comprehensive crosscutting initiative to coordinate the Department of Energy's (DOE's) ongoing research, development, and demonstration efforts in energy storage with the goal of accelerating the development, commercialization, and utilization of next generation energy storage technologies at the scale necessary for the U.S. to reach its decarbonization goals. Energy storage technologies are critical to decarbonizing the energy sector, whether for the power sector, transportation, buildings, or industrial end use. Fully decarbonizing the grid alone is likely to require hundreds of gigawatts of new energy storage, with a range of technologies that can provide everything from immediate response to the ability to discharge continuously for weeks or longer. Existing technologies must be demonstrated and validated for new uses, and new technologies must be developed, proven safe and effective, and commercialized within the next 5-10 years if the U.S. will achieve its ambitious decarbonization goals.

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[1] Includes $1,000,000 of enacted appropriation for GSL plus $4,000,000 from an approved reprogramming into the project to fully fund the design phase in FY 2020 at $5,000,000.

Crosscut Objectives:

ESGC has two primary R&D objectives. It is important to note that these can be met by many technologies, and the more different technologies that meet them, the greater the likelihood that the full range of attributes needed to ensure reliability, flexibility, equity, and resilience in the energy sector will be met.

- *Objective 1:* $0.05/kWh levelized cost of storage for long duration stationary applications, a 90% reduction from 2020 baseline costs by 2030.[2,3,4] Achieving this levelized cost target would support the Administration's 2035 and 2050 decarbonization goals and facilitate commercial viability for storage across a wide range of uses, including:
  - Meeting load during periods of peak demand,
  - Grid preparation for fast charging of electric vehicles, and
  - Applications to ensure reliability of critical infrastructure, including communications and information technology.
- *Objective 2:* Reduce EV battery cell cost by 50 percent to $60/kWh manufactured cost for a battery cell by 2030 for a 300-mile range electric vehicle to achieve cost parity with internal combustion engine vehicles. Advances in battery production for transportation applications are anticipated to continue benefitting production, performance, and safety of similar technologies used in batteries for stationary applications.

Coordination Efforts

Pursuant to the Department of Energy Research and Innovation Act, the Department has established Science and Energy Tech Teams, including for ESGC, convene the key elements of DOE that support R&D activities, coordinate their strategic research priorities, and identify potential crosscutting opportunities in both basic and applied science and technology.

The ESGC is a crosscutting effort co-chaired by the Offices of Electricity (OE) and Energy Efficiency and Renewable Energy (EERE). The ESGC was officially launched in January 2020. DOE hosted multiple public stakeholder workshops in the spring of 2020. The draft ESGC roadmap was released in July 2020, with public comments accepted through August 2020. The ESGC team developed and published a final roadmap in December 2020[5] for future efforts to support alignment of work across offices and is developing an implementation plan in accordance with Congressional guidance.

FY 2022 Program Highlights:

ESGC supports energy storage technologies across the full value chain, from basic and applied research through analysis, demonstration, and full integration into the power and end-use sectors. The program is organized around the following five primary tracks:

- *Technology Development* focuses on evaluating, demonstrating, and validating different technologies for different specific end-use applications. This includes the first round of a demonstration program prioritizing use cases where storage can improve equity outcomes in the power system. The request also initiates a new Rapid Operational Validation Initiative, which will provide lab and field validation of performance according to the metrics developed in the Policy and Valuation track. Finally, the request includes support for the Grid Storage Launchpad at Pacific Northwest National Laboratory and the Advanced Research on Integrated Energy Systems platform at National Renewable Energy Laboratory, new signature capabilities that will accelerate the deployment of advanced energy storage materials, components, and systems.

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[2] The levelized cost of storage (LCOS) is a function of a storage asset's capital and operating costs as well as its operational profile and energy output over its useful lifetime. Because LCOS has multiple drivers, meeting the ESGC's LCOS goal can be accomplished in multiple ways. For example, economies of scale can reduce capital costs, improved manufacturing processes and materials can increase asset lifespan, and/or new sensors and software can optimize the operation of the system while minimizing maintenance and reducing operating costs.

[3] Long duration storage refers to systems capable of providing storage for more than 10 hours.

[4] Baseline cost estimates assume a 100 MW-10-hour system and come from the *2020 Grid Energy Storage Technology Cost and Performance Assessment*, U.S. Department of Energy, 2020.

[5] DOE Energy Storage Grand Challenge Roadmap
https://www.energy.gov/sites/default/files/2020/12/f81/Energy%20Storage%20Grand%20Challenge%20Roadmap.pdf

- **Manufacturing and Supply Chain** focuses on strengthening the domestic production of energy storage technologies, with secure supply chains free from critical materials, and ensuring sustainable recycling and end-of-life options. This includes strengthening the domestic production of current and emerging energy storage technologies by advancing research, development, and demonstration for processing of materials used in energy storage systems, manufacturing methods for system components, and systems integration and assembly.
- **Technology Transition** focuses on commercializing energy storage technologies through public-private partnerships, bankable business models, technology standards, pro forma contracts, and the dissemination of high-quality market data. DOE will conduct market and supply chain analysis to identify and pursue commercialization, demonstration, and partnership opportunities.
- **Policy and Valuation** will provide data, tools, and technical analysis that help policymakers and other energy system decision-makers maximize the value of energy storage to the power, industrial, and transportation systems. This includes providing technical assistance to support evaluating storage technologies, designing clean energy deployment programs, formulating market and policy solutions, and developing enhanced planning processes for state and local governments, regulators, system operators, utilities, and local communities transitioning to a carbon-free electric sector by 2035 and ne-zero emissions, economy-wide, by no later than 2050.
- **Workforce Development** focuses on investing in a skilled, diverse workforce for the expanding energy storage industry. DOE will deliver a report that provides a landscape analysis of the U.S. Energy Storage workforce, highlighting DOE's capabilities and opportunity spaces in building a robust and diverse future workforce.

Advanced Research Program Agency-Energy (ARPA-E): $TBD
FY 2022 Key Objectives (Planned)
- ARPA-E is developing programs for transformational research across a wide range of energy technologies and applications. The assessment process for new programs is now underway and any potential future investments in ESGC will be determined in FY 2022.

Major Change from FY 2021 Enacted:
- In FY 2021, energy storage projects were funded through ARPA-E's Supporting Entrepreneurial Energy Discoveries program.

Office of Clean Energy Demonstrations (OCED): $386.5 million
OCED will support a multi-year series of competitive solicitations in collaboration with the private sector to conduct demonstrations. The OCED is envisioned to issue at least one technology neutral commercial-scale demonstration solicitation per year focused on crosscutting energy challenge.
- In FY 2022, the solicitation will focus on commercial scale energy storage and will scope crosscutting topics for future solicitations.

Office of Electricity (OE): $119.0 million
OE's Energy Storage program is designed to develop new and advanced technologies that will ensure a more flexible, resilient, and equitable North American power grid. The request features an expanded focus to include key reliability issues in non-battery technologies, novel storage technologies that can cost-effectively provide longer discharge durations (12+ hours continuously), and storage systems that may enable seasonal shifting of electrical energy usage. The request also supports funding to complete construction for an OE Grid Storage Launchpad (GSL) project aimed at accelerating materials development, testing, and independent evaluation of battery materials and battery systems for grid applications.
FY 2022 Key Objectives (Planned):
- Achieve performance and cost improvements in aqueous soluble organic flow battery technologies; zinc-manganese dioxide batteries; sodium ion batteries technologies; and power conversion technologies for batteries.
- Continued refinement and validation of open-source software tools and analytical models for optimal value, sizing, and location, based on field deployments.

- Support installation, integration, and validation of four additional electrical energy storage projects that highlight longer term (6+ hour) storage applications for both defense critical infrastructures and local resiliency requirements.
- Expand R&D efforts on non-battery storage technologies as potential grid scale energy storage solutions.

Major Changes from FY 2021 Enacted:
- Supports continued deployment and validation of long duration (6+ hour) storage technologies for defense critical infrastructures and integration of new generation sources.
- Supports deployment, valuation, and performance validation of electrical energy storage systems for rural co-operatives, municipalities, and utilities.
- Continues R&D efforts focused on next-generation storage technologies (battery and non-battery) including enhanced safety, reliability, and performance testing, and storage valuation tools and methodologies for grid applications.
- Supports a FOA targeting innovative, late-stage, long-duration energy storage technologies to provide a pathway for demonstration and deployment of novel, mature storage technologies that provide substantial benefit to the electric grid, equitably serve communities, and encourage U.S. manufacturing innovation.
- Provides final construction funding for the GSL.

Office of Energy Efficiency and Renewable Energy (EERE): $465.4 million
Many EERE programs are deeply engaged in energy storage research and lead the Department's efforts on lithium-ion batteries, pumped storage hydropower, thermal energy storage, and hydrogen technologies, as well as efforts to increase flexibility from power generation and controllable loads. EERE leads advanced manufacturing and recycling efforts across most forms of electrochemical and thermal storage and leads the development of tools and analysis to understand storage's role in renewable energy integration in the grid, building and industrial decarbonization, and sustainable transportation.

In FY 2022, EERE offices will continue to lead R&D focused on next generation lithium-ion batteries as well as lithium metal, solid state, and next generation battery technologies and eliminate dependence on critical materials such as cobalt, nickel, and graphite, reducing battery supply chain concerns by 2030. Additionally, EERE offices in collaboration with the OE will fund projects to overcome the manufacturing barriers associated with integrated energy storage systems for multiple applications including grid and vehicles and conduct analysis to better understand supply chain vulnerabilities and adoption behavior for energy storage systems. As shown in the funding table above, across the EERE programs, there is a significant total increase of $118 million for ESGC in FY 2022 over the FY 2021 Enacted level.

Office of Fossil Energy and Carbon Management (FECM): $7 million
The ESGC activity takes a technology agnostic approach to energy storage with an emphasis on long-duration energy storage that is scalable from small applications to full-scale commercial power plants. To achieve this objective, the program focuses on the integration of long-duration energy storage technologies with a variety strategic of fossil assets. Co-locating energy storage with some strategic fossil assets provides many benefits including improved asset flexibility and efficiency, improved grid reliability, and reduced greenhouse gas emissions. Additionally, energy storage enables applications that support pathways to decarbonization. For example, the integration of hydrogen energy storage system with a hydrogen turbine power production. Analytical results and stakeholder input suggest this activity will emphasize energy storage technologies that are thermal, chemical (including hydrogen), mechanical, or long-duration electrochemical (e.g., flow battery) in nature.

In FY 2022, the Budget provides $7 million to refine Use Cases indicated in the ESGC Roadmap and their associated metrics, fund R&D to enhance domestic energy storage supply chain competitiveness, and support feasibility studies of co-located energy storage technologies with fossil assets. The Department is received a robust response to this activity's inaugural funding opportunity announcement.

The FECM energy storage activities are documented in the ESGC roadmap and regularly communicated among the Department's participating offices.

Office of Nuclear Energy (NE): $164M

NE supports research and development (R&D) to enable flexible plant operation while utilizing the full capacity of a nuclear plant.

- **Integrated Energy Systems:** The request supports activities in energy system modeling and simulation to develop a modeling framework for economic dispatch optimization of integrated energy systems; energy distribution R&D to characterize and verify performance of thermal energy distribution systems; energy storage R&D to evaluate performance, reliability, and cost for thermal, geothermal and electro-chemical energy storage systems; energy conversion R&D to assess thermal storage capacity and efficiency of energy conversion with heat pump cycles, chemical systems, and turbomachinery. Integrated energy systems will explore opportunities for producing energy products (such as ammonia, liquid transportation fuels, hydrogen or heat) with higher temperature reactors and with smaller reactors located closer to industrial/chemical plants.
- **Light Water Reactor Sustainability (LWRS) Program:** The LWRS Program will demonstrate the production of energy products such as hydrogen, ammonia, liquid transportation fuels, or heat with the ability to provide demand response dispatch capabilities for electric grid power generation.
- **Advanced Reactor Demonstration Program:** Research, development, and demonstration of the Natrium reactor, a sodium-cooled fast reactor combined with a molten salt energy storage system designed by TerraPower and GE-Hitachi, that will allow the plant to provide flexible electricity output that complements variable renewable generation such as wind a solar.

Office of Technology Transitions (OTT): $0.1 million

- Produce Energy Storage Market Report to characterize current state of energy storage sector and identify opportunities for technology commercialization and adoption.
- Lead outreach with industry and interagency partners to identify and collaborate in opportunities to commercialize energy storage technologies.
- Enhance external access to DOE's energy storage-related experts, facilities, and intellectual property.

Major Changes from FY 2021 Enacted:
- None. The FY 2022 request for OTT supports ongoing work at a flat funding level.

Office of Science (SC): $24.088 million*

The SC supports foundational, crosscutting, fundamental energy storage research, including the Joint Center for Energy Storage Research Hub and Energy Frontier Research Centers, that underpin the technology offices activities. The SC research supports innovative, field-leading research that is not technology-specific. Core research activities include crosscutting science that is relevant to electrochemical energy storage as well as hydrogen and fuel cells. The research emphasizes understanding of electrochemical phenomena and discoveries of new materials and chemistries for these technologies. Research grants and national laboratory research support postdoctoral, graduate, and undergraduate research activities. Other programs include support of graduate student internships at national laboratories, as well as Small Business Innovation Research topics in membranes for electrochemical systems. SC user facilities host broad community research and industrial users who advance energy storage technologies.

Major Changes from FY 2021 Enacted:

*In the table shown above, SC funding is limited to the funding provided for the Batteries and Energy Storage Hub. The total SC-Basic Energy Sciences funding provided for energy storage research related to the ESGB (Hub, Energy Frontier Research Centers, and core research) was ~$66M in FY 2020 and is projected to be at approximately that level for FY 2021 Current (currently ~$50M with additional awards projected before the end of the fiscal year). For FY 2022, pending appropriations, increased investment in these research areas is anticipated.

Advanced Microelectronics
(Dollars in Thousands)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 22 vs. FY 21 ($ Change)
Advanced Research Projects Agency-Energy (ARAP-E)	**275**	**1,498**	**TBD***	**TBD***
Projects	275	1,498	TBD*	TBD*
National Nuclear Security Agency (NNSA)	**114,300**	**137,577**	**133,007**	**-4,570**
Weapons Activities	114,300	137,577	133,007	-4,570
Nuclear Energy (NE)	**8,000**	**7,000**	**10,000**	**+3,000**
Nuclear Energy Enabling Technologies	8,000	7,000	10,000	+3,000
Office of Science (SC)	**5,000**	**30,182**	**47,701**	**+17,519**
Advanced Scientific Computing Research	0	5,182	5,183	+1
Basic Energy Sciences	5,000	15,000	30,000	+15,000
Fusion Energy Sciences	0	5,000	5,000	0
High Energy Physics	0	5,000	7,000	+2,000
Nuclear Physics	0	0	518	+518
Total, Advanced Microelectronics	**127,575**	**176,257**	**190,708***	**+15,949***

*ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

The Advanced Microelectronics initiative supports multi-disciplinary activities that provide the needed advances for future computing, communication, and sensors and detectors that are critical for national priorities in energy and for leadership in advanced research over a wide range of fields. Microelectronics are the building blocks of every technology-based priority, including high-performance computing (HPC), Artificial Intelligence (AI), cybersecurity, autonomous vehicles, quantum information science (QIS), systems of systems, the electricity grid, and the global technical, financial, and energy infrastructure on which the U.S. relies. Access to trusted and assured microelectronics is an Administration priority for both national and economic security. These investments will lead to new computing systems needed to maintain the continued upward trajectory in performance that Moore's Law[1] scaling has historically provided for computing. Sustained and rapid progress in microelectronics science and technology is thus essential to push the boundaries of science within DOE, and more significantly, to continue to lead the global information and power technology revolution.

Overview

DOE's basic and applied research programs have always been at the cutting edge of microelectronics, making major contributions to the scientific understanding, materials, and advanced instrumentation that enabled innovations to promote scaling. Microelectronic circuits have a strong history of dramatically improving the performance, functionality, and reliability of national security platforms as well as other systems for basic research and energy applications, including energy storage technologies. Adding microscale sensors, photonics, and micro-electro-mechanical systems (MEMS) to such platforms enables even further improvements.

Device scaling within the integrated circuits that have powered the exponential advances in technology over the past fifty years is approaching its physical and economic limits. Yet, the growth of data-centric computing and sensor networks is redefining computing workloads and microelectronics needs. In addition, greatly improved microelectronics are needed for the nation's electricity grid if it is to be energy-efficient, resilient to natural phenomena and intentional attack, and agile in adapting to fluctuations in demand and power generation. Sustained and rapid progress in microelectronics science and technology from millivolt to megavolt scales is thus essential to push the boundaries of science that will continue to lead the global information and power technology revolution.

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[1] Moore's Law is an observation that the number of transistors within an integrated circuit doubles about every two years, leading to an increase in performance of integrated circuits.

For computation and massive data, co-design, which involves multi-disciplinary collaboration that takes into account the interdependencies among materials discovery, chemical processing, device physics, architectures, and the software stack, will be essential if DOE is to deploy exascale systems and beyond that meet its future needs and those of the Nation. Furthermore, transformation of power electronics and the electricity grid into a modern, agile, resilient, and energy-efficient system will require advances in new microelectronics materials, and their integration within a co‑design framework. More generally, materials science for next-generation microelectronics will provide the needed advances in sensors, detectors, devices, and processors that are critical for national priorities in energy and for leadership in advanced research over a wide range of fields. These advances are complementary to the Federal emphasis on QIS and quantum computing.

In addition, advances in microelectronics are critical to improve monitoring and real-time management of nuclear energy facilities and to develop and demonstrate new digital instrumentation and control for future nuclear plants. NE competitively awards innovative R&D to U.S. industry, U.S. universities, and national laboratories to develop solutions to crosscutting nuclear energy technology challenges. The Advanced Sensors and Instrumentation (ASI) program within the Crosscutting Technology Development (CTD) subprogram in Nuclear Energy Enabling Technologies (NEET) conducts research to develop and deploy innovative and advanced sensors and instrumentation technologies that address critical technology gaps for monitoring and controlling advanced reactors and fuel cycle facilities. Advanced sensors, digital monitoring and control, nuclear plant communication and advanced concepts of operation are four strategic instrumentation and control (I&C) areas of research that represent key capabilities for nuclear energy systems and fuel cycle facilities.

DOE also supports advanced microelectronics R&D activities in support of its mission as a steward of the U.S. nuclear stockpile. The Microsystems Engineering Sciences and Applications (MESA) Complex, a 400,000-square-foot facility at Sandia National Laboratories (SNL) designed to integrate the scientific disciplines needed to produce functional, robust, and integrated microsystems, is a key component of NNSA's support for advanced microelectronics. MESA has developed and delivered microelectronic products for over three decades. This expertise has also been applied to other national security needs. These include ensuring the nonproliferation of nuclear weapons and materials, reducing the threat from chemical and biological weapons, and providing advanced custom designs for other agencies involved in national defense. Sandia's Application-Specific Integrated Circuit (ASIC) development team also provides custom microelectronic products and engineering services that fulfil the needs of a diverse set of customers.

NNSA's support for advanced microelectronics also includes the Saturn accelerator at SNL. Saturn is a modular, high-power, variable-spectrum, x-ray simulation source. Saturn can be operated with two different bremsstrahlung diodes or any one of several plasma radiation sources. The diodes and sources provide x-ray radiation environments with enhanced simulation fidelity based on fast rise time, short pulse duration, and tailored spectral content. Saturn's major function has been to produce x-rays to test the effectiveness of the countermeasures that are used to protect electronics and other materials against x-ray radiation from nuclear weapons.

Coordination Efforts
NNSA, NE and SC convene working groups focused on Advanced Microelectronics and jointly host workshops and road mapping activities that support early-stage R&D on the most promising materials in this focused area. NNSA coordinates across the interagency through the Executive Office of the President National Science and Technology Council (NSTC) Semiconductor Research and Development Working Group and through partnerships across the DoD OUSD Strategic Radiation Hardened Electronics Council.

Highlights of the FY 2022 Congressional Request
SC supports basic research aligned to microelectronics in key technical areas supported including materials, chemistry, and fundamental device science; component integration, architecture, and algorithms; and next-generation tools for synthesis, fabrication, and characterization of devices and systems. Such research will continue

in FY 2021 and is informed by community strategic planning efforts including the Basic Research Needs for Microelectronics report.[2]

Moreover, the Request provides funding for multidisciplinary microelectronics research supported by the Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), Fusion Energy Sciences (FES), and High Energy Physics (HEP) programs. This research will accelerate the advancement of microelectronic technologies in a co-design innovation ecosystem in which materials, chemistries, devices, systems, architectures, algorithms, and software are developed in a closely integrated fashion.

NNSA requires a trusted supply of specialized microelectronics for weapon deployability. Since 1988, the Sandia National Laboratories' (SNL) MESA Complex has been the enduring lead institution for trusted and strategic radiation-hardened microelectronics. Increased facility obsolescence drives NNSA investment for sustainment and modest modernization. NNSA is committed to sustaining MESA through 2040, including facility, equipment, and technological upgrades to advance functionality for programs of record. FY 2022 – FY 2026 funding profile is required to sustain operations and maintenance (O&M), facilities and infrastructure (F&I), tools and equipment (T&E) recapitalization, production support (PS) and research and development (R&D) for the W80-4, B61-12, W87-1, and future systems.

NE, under its Advanced Sensors and Instrumentation ASI program, will continue to conduct research of unique sensor and instrumentation technologies needed to monitor and control new advanced reactors and fuel cycle facilities. The ASI Program has spurred innovation in the measurement science field by funding research to advance the nuclear industry's monitoring and control capability. These capabilities are crucial in developing research solutions that enable reduced costs, improved efficiencies, and increased safety for both current and advanced reactors operations. They also serve a vital role in Materials Test Reactors to measure environmental conditions of irradiation-based experiments, and to monitor aspects of fuel and materials behavior used to develop and qualify new fuels and materials for future nuclear energy systems. The goal is to provide new capabilities for measurement and control and address R&D needs for successful deployment.

FY 2022 Funding ($198.8M)
NNSA: Weapons Activities ($133M)
- In addition to bolstering in-house capability, NNSA continues to partner with institutions to conduct materials research and with commercial manufacturers to conduct evaluation of disruptive technologies that withstand known and postulated future threat environments.

NE: Nuclear Energy Enabling Technologies (NEET) ($10M)—Crosscutting Technology Development (CTD) ($10M) NE will support R&D of unique sensor and instrumentation technologies needed to monitor and control new advanced reactors and fuel cycle facilities.
- CTD will continue to conduct research on advanced sensors and instrumentation for nuclear applications.
- The request will also competitively award new fully funded R&D projects in the ASI areas applicable to next generation reactor and fuel cycle technologies.

Science ($47.7M)
Five program offices (ASCR, BES, FES, HEP, and NP) will continue to partner to support multi-disciplinary microelectronics research to accelerate the advancement of microelectronic technologies in a co-design innovation ecosystem in which materials, chemistries, synthesis and fabrication, devices, systems, architectures, algorithms, and software are developed in a closely integrated fashion. Emphasis will be on basic research to advance new materials,

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[2] https://science.osti.gov/-/media/bes/pdf/reports/2019/BRN_Microelectronics_rpt.pdf

chemistry, synthesis, and fabrication; new computing paradigms and architectures; integrated sensing, edge computing, and communications; and microelectronics resilience in high radiation or cryogenic environments.

Key Accomplishments and Objectives

<u>FY 2021 Key Accomplishments</u>
ARPA-E
- Awarded funding to select small businesses for microelectronics projects through ARPA-E's Supporting Entrepreneurial Energy Discoveries (SEED) program

NNSA
- Provide maintenance and repair and support operations of the MESA facility at Sandia.
- Complete six to eight inch wafer conversion and qualification for War Reserve production.
- Continue process development for CMOS8.
- Develop trusted radiation-hardened microelectronics to sustain the current stockpile and support future stockpile needs.
- Begin the acquisition of a Heterogeneous Integration Facility (HIFac)
- Commission a Commercial Off The Shelf (COTS) Transformation Initiative (CTI)

Nuclear Energy
- Continue to research new sensors to improve monitoring and real-time management of nuclear energy facilities.
- Competitively award new projects to develop and demonstrate new digital instrumentation and control for future nuclear plants.

Science
- ASCR, BES, HEP and FES will partner to support multi-disciplinary microelectronics research. Informed by community strategic planning efforts including the Basic Research Needs for Microelectronics workshop, key technical areas will include materials, chemistry, and device physics; component integration, architecture, and algorithms; and next-generation tools for synthesis, fabrication, and characterization of devices and systems.

<u>FY 2022 Key Objectives (Planned)</u>
ARPA-E
- ARPA-E is developing programs for transformational research across a wide range of energy technologies and applications. The assessment process for new programs is now underway and any potential future investments in Advanced Microelectronics will be determined in FY 2022.

NNSA
- NNSA High priority technological advancements for the W87-1 and future systems include bus-based data and power distribution as well as the use of processors, field programmable gate arrays (FPGAs) and general purpose processors, in place of application specific integrated circuits (ASICs), developed on a CMOS8 (180nm) baselined production line by FY 2026.

Nuclear Energy
- Continue to research new sensors to improve monitoring and real-time management of nuclear energy facilities.
- Competitively award new projects to develop and demonstrate new digital instrumentation and control for future nuclear plants.

Science
- Continue support for ASCR, BES, HEP, and FES partnerships initiated in FY 2021 to support multi-disciplinary microelectronics research. Informed by community strategic planning efforts including the Basic Research Needs for Microelectronics workshop, key technical areas will include materials, chemistry, and device physics;

component integration, architecture, and algorithms; and next-generation tools for synthesis, fabrication, and characterization of devices and systems.

- BES will continue to support two EFRCs initiated in FY 2020.
- HEP will provide initial support for R&D for detector materials, devices, advances in front-end electronics, and integrated sensor/processor architectures.
- FES will support research on low-temperature plasmas and other plasma-based technologies to advance the fabrication of microelectronic and optoelectronic devices.
- NP will support research and development of detector materials, devices, advances in front-end electronics, and integrated sensor/processor architectures.
- SC intends to continue basic research in Heterogeneous Integration Facility for microelectronics. There is no change in funding.

Artificial Intelligence and Machine Learning

Funding by Appropriation and Program Control

($K)

Appropriation and Program Control	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 22 vs. FY 21 ($ Change)
Advanced Research Projects Agency - Energy	0	500	TBD*	TBD*
Artificial Intelligence and Technology Office	2,500	2,500	1,500	-1,000
Chief Information Officer	1,800	2,510	0	-2,510
Cybersecurity, Energy Security and Emergency	4,100	0	0	0
Electricity	5,625	5,012	3,000	-2,012
Energy Efficiency and Renewable Energy	42,983	46,805	62,746	+15,941
Environment, Health, Safety and Security	0	1,400	1,400	0
Environmental Management	4,000	4,000	4,000	0
Fossil Energy Research and Development	29,900	31,900	45,000	+13,100
National Nuclear Security Administration	75,118	76,600	77,703	+1,103
Nuclear Energy	4,425	3,725	3,450	-275
Science	71,000	124,354	128,626	+4,272
Total, AI Initiative	**241,451**	**299,306**	**327,425***	**+28,619***

* ARPA-E funding is determined annually based on programs developed through office and stakeholder priorities. Therefore, funding for FY 2022 is not available at this time.

Summary

The understanding and advancement of Artificial Intelligence (AI) technologies are progressing rapidly with the potential to revolutionize many DOE missions in energy, science and national security. In FY 2022, DOE is requesting more than $327 million to support a variety of AI-related activities, including fundamental research in AI, activities involved in the coordination and planning of AI R&D, and the use of AI tools. Included in this funding is support for the exploration of machine learning (ML), natural language processing, knowledge representation and reasoning, and computer vision, along with the safety, security, robustness, and explain-ability of AI systems.

Overview

Ensuring continued American leadership in AI is a priority of the Administration. DOE's 40-year record of scientific discovery and technology innovation has secured and advanced America's energy, economic and national security. With its world-class science and technology enterprise, DOE is specially positioned to push the frontiers of AI for America's national security, economic competitiveness, and technological leadership. Across the DOE enterprise researchers are applying AI to challenges in ways that will alter the energy, science and national security landscape.

ARPA-E

As defined by its authorization under the America COMPETES Act, the Advanced Research Projects Agency – Energy (ARPA-E) catalyzes transformational energy technologies to enhance the economic and energy security of the United States. ARPA-E funds high-potential, high-impact energy projects that are too risky to attract private sector investment but could significantly advance the ways to generate, store, distribute and use energy. In FY 2019 ARPA-E selected $80 million in AI/ML projects across three FOAs: Design Intelligence Fostering Formidable Energy Reduction and Enabling Novel Totally Impactful Advanced Technology Enhancements (DIFFERENTIATE); Generating Electricity Managed by Intelligent Nuclear Assets

(GEMINA); and NEXT-generation energy technologies for Connected and Automated on-Road vehicles (NEXTCAR). These three programs seek to:

- Enhance the pace of energy innovation by incorporating machine learning into the energy technology development process.
- Develop digital twin technology for advanced nuclear reactors and transform operations and maintenance (O&M) systems in the next generation of nuclear power plants by applying AI, advanced control systems, predictive maintenance, and model-based fault detection.
- Enable technologies that use connectivity and automation to co-optimize vehicle dynamic controls and powertrain operation, thereby reducing energy consumption of the vehicle.

Consistent with the ARPA-E's authorization, DIFFERENTIATE, GEMINA, and NEXTCAR contain high-potential, high-impact energy projects that are too risky to attract private sector investment but could significantly advance the way AI is incorporated into the energy technology development process, nuclear reactor O&M, and vehicle technology and energy consumption.

ARPA-E is developing programs for transformational research across a wide range of energy technologies and applications. The assessment process for new programs is now underway and any potential future investments in AI will be determined in FY 2022.

Artificial Intelligence and Technology Office (AITO)

In September 2019, DOE established AITO to serve as the Department's hub for the development, coordination, and execution of the agency's efforts as a world-leading enterprise in scientific and technological discovery, and to accelerate the development, delivery, and adoption of AI and related technologies. AITO will assist DOE's diverse program and functional offices, sites and associated National Laboratories on identifying and enhancing vital applications to core missions across the Department, while building on current Federal investments, and breaking new ground in Science and Technology innovation. As a supplement to AI coordination activities, AITO will conduct strategic AI portfolio alignment and partner to support addressing the high demands for AI support to Program Offices and National Laboratories in the areas of:

- Applying AI for DOE-wide efficiencies that will address the department goals to include the climate crisis;
- AI training to cultivate an AI-ready workforce;
- Providing insights, advisory services and AI business translation for trusted AI outcomes, risk management, ethical outcomes and data management to be applied towards improving AI and machine learning portfolio management;
- Leading select, complex, multi-organizational AI programs and/or products for DOE.

AITO accelerates the development, delivery, and adoption of AI by coordinating and conducting strategic portfolio alignment, efforts across DOE, and implements the Secretary's vision for cross-cutting, mission-relevant AI projects that are aligned with the Office of Science and Technology Policy AI strategic priorities. AITO will engage programs, functional offices, sites, and associated National Laboratories for development and oversight of funded AI projects for transparency, shared learning, and to ensure that DOE's AI efforts align and fulfil the priorities outlined in the National Artificial Intelligence Research and Development Strategic Plan.

Office of the Chief Information Officer (OCIO)

No funding is requested for the OCIO in FY 2022.

Cybersecurity, Energy Security and Emergency (CESER)

CESER is not requesting funding for AI in FY 2022.

Office of Electricity (OE)

In FY 2022, OE is requesting $3M to focus on applying existing AI technologies to power system modeling and sensing and on curating datasets that support those activities.

Energy Efficiency and Renewable Energy (EERE)

EERE's total request for FY 2022 AI activities is $62.7M, distributed among eight programs as follows: Bioenergy Technologies ($8.0M), Building Technologies ($17.1M), Geothermal Technologies ($2.0M), Hydrogen and Fuel Cell Technologies ($6.0M), Solar Energy Technologies ($3.5M), Vehicle Technologies ($10.5M) Water Power Technologies ($2.4M), and Wind Energy Technologies ($13.2M).

Bioenergy Technologies (BETO) uses AI and ML to develop new catalysts, develop new organisms using synthetic biology tools, model biomass feedstocks as they undergo preprocessing, and model bioenergy technology systems to support scale-up. In FY 2022, BETO is deemphasizing the use of AI/ML for modeling and simulation fuel quality characteristics and their impacts on combustion performance due to the completion of R&D activities under the Co-Optimization of Fuels and Engines initiative and increasing AI/ML to support scale-up of sustainable aviation fuels. The Request will also increase emphasis on work to enable preprocessing of municipal solid waste as a conversion-ready feedstock to produce sustainable aviation fuels and high-value co-products.

Building Technologies (BTO) supports a portfolio of AI research which includes intelligent technologies, robotics, sensors, human-AI interface, machine learning, autonomous systems, data sciences that inform AI and large-scale data analytics. This research leverages machine learning throughout the building lifecycle from advanced construction and retrofits to intelligent building energy management. In support of these applications, BTO will continue to support a robust portfolio of projects focused on making buildings more intelligent through advanced controls for building automation systems to make buildings more efficient, more responsive to occupant needs and productivity requirements, and to the grid. This includes developing new control strategies that leverage machine learning, improve autonomy and responsiveness to occupant needs, and adapt to changing conditions. BTO also supports improved sensing and analytic capabilities for building automation including the curation of data sets for training and testing of AI algorithms. In addition, BTO will continue to invest in R&D for robotics to lower the cost of construction and retrofits, as well as the disruption associated with building retrofits. The Request will also support research using AI driven technologies to perform construction quality assurance and building energy audits. Geothermal Technologies continues work at the Request in machine learning for geothermal energy focused on reducing the risks of geothermal exploration using intelligent machines to assist in finding hidden geothermal resources. Further leveraging machine learning research to identify geothermal resources and improve hydrothermal operations and methods will help meet Administration decarbonization goals by directly enabling deployment of carbon-free geothermal energy production, contributing 30 Gigawatts of energy by 2050.

Geothermal Technologies continues work in machine learning for geothermal energy focused on reducing the risks of geothermal exploration using intelligent machines to assist in finding hidden geothermal resources. Further leveraging machine learning research to identify geothermal resources and improve hydrothermal operations and methods will help meet Administration decarbonization goals by 2050.

Vehicle Technologies supports the development of AI-based "Digital Twin" models of regional transportation systems that can be used for real-time cyber-physical control. These digital twins leverage high-performance computing capabilities and the National Laboratories and enable real-time control decisions for the transportation infrastructure that can achieve 20 percent energy savings at the regional level. Additionally, EEMS funds National Laboratory work to automate the development of neural networks to accelerate the pace of development for automated vehicle sensing, perception, and control systems. The Request also supports the Partnership to Advance Combustion Engines (PACE) National Laboratory consortium, which is using artificial intelligence to optimize engine design to increase fuel economy and reduce emissions. To develop effective AI tools, it is critical to first have detailed, high-fidelity data for training. PACE is working to develop high-fidelity simulation tools for engine combustion and validating these simulations with experiments using unique diagnostic tools. Advanced computational fluid dynamics software that can leverage future Leadership Computing Facilities are being applied to engine simulation.

Solar Power Technologies supports efforts to enable AI/ML to enable photovoltaic deployment. The Request will support the application of AI/ML in topics such as irradiance forecasting, energy storage integration, and distributed energy resource control coordination.

Water Power Technologies uses AI for more efficient use of installed hydrosensors, assessing dam safety, and powertrain condition. The Request expands digitalization research to modernize the existing hydropower fleet through the use of advanced sensors and AI.

Wind Energy Technologies supports efforts leveraging AI/ML techniques to develop prognostic health management tools, failure analysis and mitigation, and O&M optimization to decrease unplanned maintenance and mean time between failures of wind turbines. The Request also supports the use of AI for design, optimization and operation improvements of turbine and hybrid system controls and the use of AI to generate rapid operational wind and power forecast predictions from new neural-network-based weather forecasting models. Such activities reflect the prioritization of RDD&D innovations to drive cost effective land-based wind deployment.

Environment, Health, Safety and Security (EHSS)

In FY 2022 EHSS is requesting $1.4M for the Advanced Computer Tools to Identify Classified Information (ACTICI) initiative. ACTICI is a machine learning initiative to develop advanced computer tools to identify classified information embedded in electronic documents and augment human classification reviews. The goals of the program are to develop and deploy advanced tools that can automatically identify the subject areas of a document, determine whether a document needs a classification review, determine if the document is classified, determine which parts of the document are sensitive, and determine which classification guides are applicable.

Environmental Management (EM)

In FY 2022, a total of $4M is requested for EM AI activities to continue to enhance and deploy technology and workforce advancements in AI areas (e.g. big data, machine learning, training, robotics/remote/autonomous systems for inspection, long-term monitoring, decision making) to meet critical EM mission cleanup and closure needs.

Fossil Energy and Carbon Management (FECM)

In FY 2022, a total of $45M is requested for FECM AI activities, an increase of $13.1M or 40% from the FY 2021 enacted level.

In the Carbon Storage subprogram, FY 2022 activities will initiate deployment and testing of new AI/ML tools and storage technologies being developed under the Science-informed Machine learning to Accelerate Real-Time decisions for Carbon Storage (SMART-CS) initiative. In FY 2021, the program issued the SMART Visualization Platform (VP) Prize Challenge, with $1.5M in prize funding to focus on bringing the subsurface to life through the development of an innovative, user-friendly, intuitive and attractive visualization solution that can be readily accessible by scientists, engineers, subsurface operators, and decision makers, and that works in unison with the DOE's SMART Initiative. These activities will support deployment and testing of promising AI/ML-based technologies for: 1) visualization at relevant scales and machine learning method(s) for real-time visualization; 2) development of real-time history matching capabilities that utilize data from autonomous monitoring platforms; and 3) assessment of enabling smart sensor systems and data processing platforms. Additional activities include R&D to advance sensing and data telemetry capabilities, and high priority studies on fault/fracture networks characterization, stress state, fluid/pressure migration, and wellbore integrity monitoring that advance adaptive reservoir management capabilities and risk reduction.

For Advanced Energy and Hydrogen Systems, FECM will use AI to focus on Research, Development, Demonstration, and Deployment (RDD&D) on low-cost and reliable multi-sensing wired and wireless technologies to measure temperature, pressure and gas species that, with additional investment by industry, could be capable of providing real-time information critical to the operation, optimization, reliability and efficiency of the next-generation of power systems. Advances in RDD&D will enable industry to shift from the current time-based preventive maintenance schedules to ones focused on condition-based maintenance with improved reliability and overall plant economics. Advanced sensors can also be used to monitor and identify transients associated with a cyber-attack, providing increased asset security and grid stability. Novel instrumentation

that can withstand harsh environments has the ability to replace process conditions with actual measurements which can facilitate faster/safer response times. National Lab RDD&D will focus on advanced data analytics and controls development for condition-based maintenance, building off lessons learned from testing at existing fleet power plants emphasizing integration of materials lifetime modeling and control algorithms. In FY 2021, National Energy Technology Laboratory (NETL) researchers, in collaboration with the University of Pittsburgh, successfully embedded multiple distributed fiber optic sensors into Solid Oxide Fuel Cells, multi-cell test to achieve a previously unattainable degree of spatial resolution in temperature measurement.

Funding for Crosscutting Research will continue funding DOE National Laboratory RDD&D, including existing modeling and analysis projects funded under the Grid Modernization Initiative; and the NETL-led Institute for the Design of Advanced Energy Systems, in collaboration with Sandia National Laboratory and Lawrence Berkeley National Laboratory, which develops process systems engineering tools and optimized approaches in the conceptual design and process intensification of innovative systems. The Multiphase Flow with Interphase exchanges element, led by NETL, will also support computational efforts, including ML, in collaboration with industry, to gain deep insight into plant operation to improve performance outcomes and reduce unexpected forced outages. Private industry will also use the latest computational tools to mitigate degradation mechanisms imposed by an aging coal fleet and load following to enhance flexibility and extend plant life. In addition, through the Critical Minerals subprogram, FECM will continue to enable future commercial technologies while minimizing land disturbance and maximizing environmental stewardship. This will be accomplished through technology development and validation—including machine learning and artificial intelligence, small- and large-scale pilot projects—including public-private partnerships, and existing basin partnerships developed through Carbon Ore Rare Earth-Critical Mineral Initiative.

National Nuclear Security Administration (NNSA)

NNSA's FY 2022 request includes AI/ML activities in both Weapons Activities (Advanced Simulation and Computing) and in Defense Nuclear Nonproliferation (DNN Research and Development and Nonproliferation and Arms Control) for a total of $77.7M.

Weapons Activities:

Within the last decade, the confluence of higher computer processing power, networking performance, and storage platforms has enabled the fields of AI/ML to rapidly expand. Using AI/ML, scientists and engineers from a variety of disciplines are finding ways to accelerate their research and development, as well as solve problems which were not easily solvable by conventional means. The Advanced Simulation and Computing (ASC) program will continue to partner with the external community, including other organizations within DOE, other Government agencies, industry, academia, and small businesses, as it executes its AI/ML research and development strategy of applying promising, emerging AI/ML technologies to stockpile stewardship mission.

The FY 2022 ASC request is $50M with the following focus areas:

- Application of physics-informed ML methodologies to multiscale simulation, materials modeling, nuclear data evaluation, turbulence simulations, and radiographs analysis and data-driven approaches that can explain the underlying physics, developing physically accurate models that require fusing a variety of sparse experimental data with synthetic data generated by detailed physics simulation and learning of relevant material behavior.
- Creation of specialized computing applications, that include optimizing the use of high-performance computing (HPC) systems and operational data, to enable faster turnaround for answering nuclear security questions.
- Development of ML methods for calibration of parameters for strength, turbulence, and artificial viscosity models in NNSA weapons codes.
- Creation of ML workflows to utilize multisource, multi-fidelity data for answering mission-relevant questions from experimental facilities, next-generation computer architectures, algorithm development and simulation data collection.

Artificial Intelligence and Machine Learning **FY 2022 Congressional Budget Justification**

- Development of ML techniques to detect patterns and predict behavior in scientific data, to understand and improve large-scale system behavior, to automate geometry and mesh design for complex structures, and to understand implications on the use of ML with respect to data correctness, application performance, and various uncertainties that impact decision making.

Defense Nuclear Nonproliferation (DNN):

The DNN R&D request for FY 2022 includes $25M to develop the next generation of AI methods and technologies to enable early detection of foreign proliferation activities. DNN R&D will advance the state-of-the-art to build AI systems that are explainable, secure, trustable and suitable for the high-consequence domain of proliferation detection. These novel AI solutions overcome current gaps in commercially-developed AI systems that limit their usefulness when applied to national security missions. DNN R&D will focus on four key areas:

- Methods to Detect Low-Yield Nuclear Testing: Develop customized ML methods to improve capabilities to detect and monitor foreign low-yield nuclear testing by integrating disparate data sources including models, sensitive collections, and publicly available data.
- Reveal Indicators of Nuclear Proliferation: Use AI and data-intensive computing to reveal new indicators (or patterns of indicators) of proliferation activities to increase the probability of detecting material diversion or misuse of a safeguarded facility.
- Nuclear Nonproliferation Automated Data Analysis: Develop novel AI/ML techniques to automate data analysis and enable nuclear proliferation analysts to easily sort through massive data volumes to identify anomalies for further investigation and to enhance laboratory analysis of nuclear material samples collected as part of nuclear nonproliferation missions.
- Systems to Continuously Monitoring Nuclear Facilities: Build custom AI/ML systems to demonstrate dynamic, continuous monitoring of nuclear facilities via autonomous network of sensors.

The DNN Nonproliferation and Arms Control (NPAC) request for FY 2022 includes $2.7M to support projects that will help guide the development path of machine learning in safeguards and enable the International Atomic Energy Agency and others to implement international nuclear safeguards to achieve international nonproliferation objectives more efficiently and effectively. NPAC will focus its activities around two primary areas:

- **Deep Learning Algorithms to Enhance Image-review Software for Surveillance Cameras**: NPAC will assess the potential for advanced image recognition and tracking algorithms using emerging machine learning techniques as applied to safeguards surveillance data and review.
- **Machine Learning Approaches for Safeguards:** NPAC is supporting projects that evaluate the potential safeguards benefits and challenges of artificial intelligence, machine and deep learning applications in workflows related to information analysis and the review of safeguards surveillance system data. Other realistic applications could include the review of remote monitoring systems, material balance evaluations, and facility-level sensor integration.

Nuclear Energy (NE)

In FY 2022, a total of $3.45M is requested for NE AI activities to continue to enhance and deploy technology advancements in AI areas (e.g. big data, machine learning, training, robotics/remote/autonomous systems for inspection, long-term monitoring, decision making) to support the future deployment of advanced reactor technologies and to improve the economic competitiveness of the existing fleet of nuclear power reactors. The most pressing needs for nuclear energy include the development and utilization of technologies to support predictive maintenance and online monitoring to modernize the existing fleet of nuclear power reactors and deploy advanced reactors. Advancements in the development and application of ML techniques will support the acceleration of new nuclear materials qualification. Lastly, the use of ML and deep neural networks methods and techniques will support the development of modeling and simulation codes.

Office of Science (SC)

AI/ML represent a paradigm shift for scientific computing and discovery. SC recognizes the power that AI/ML have to accelerate progress in scientific research and missions by developing new data analysis tools and integrating data focused approaches with our more traditional R&D ecosystem. SC is uniquely positioned to not only benefit from but also advance current AI activities to maintain U.S. leadership in science and drive U.S economic competitiveness.

Departmental Collaborations:

- Under the FY 2020 joint Laboratory Program Announcement LAB 20-2261: Data, Artificial Intelligence, and Machine Learning at DOE Scientific User Facilities, , Basic Energy Sciences (BES), High Energy Physics (HEP), and Nuclear Physics (NP) programs combined to make 14 awards totaling $37.2 million over three years (FY 2020-FY 2022).
- Advanced Scientific Computing Research (ASCR) program will continue collaborations and co-design activities with the other SC and DOE programs to broaden the applicability of AI and big data solutions across a range of applications and scientific user facilities.
- BER program leverages models and data provided by other agencies, in particular National Oceanic and Atmospheric Administration, National Aeronautics and Space Administration, National Science Foundation, and United States Geological Survey. BER also coordinates its AI/ML research through the US Global Change Research Program and other National Science and Technology Council subcommittees.
- Several AI/ML topics are of interest and coordinated across SC programs, particularly those in accelerator and detector controls systems and other real-time applications. Collaboration and coordination with recently announced NSF AI Institutes, particularly in the area of software development, is being explored.

Program Organization:

1. ASCR ($58.8M): Key AI contributions will be new AI/ML tools that are robust, understandable, and repeatable for use in scientific simulations and data analysis at SC's Scientific User Facilities. In FY 2022, ASCR continues its support for the AI Initiative, including foundational research in applied mathematics to improve the reliability, robustness and interpretability of AI/ML for modeling, simulations, and decision support; and computer science research to develop an intelligent operating system stack, software tools and data methods to ensure that data is findable, accessible, interoperable and reusable and benchmark data to verify and validate emerging AI tools and methods. Awards in FY 2020 and FY 2021 continue to advance these fields.

2. BES ($20M): Advance the use of modern data science approaches to accelerate discovery in chemical and materials sciences and to maximize the user facilities operations and scientific output. In FY 2022, BES continues its support for the AI Initiative including research to advance the use of modern data science approaches to accelerate discovery in chemical and materials sciences and to maximize the production, analysis, and control of data generated at scientific user facilities and to optimize the facilities' scientific output. Awards from FY 2020 and FY 2021 funding opportunities continue to advance these fields.

3. BER ($3.0M): In FY 2022, BER continues its support for the AI Initiative to advance climate change modeling and prediction of extreme events. Specifically, the research develops training data for finely resolved watershed processes, using a combination of scale-aware process interactions in heterogeneous and data sparse regions, that in turn will utilize machine learning to constrain prediction uncertainties over a variety of environmental conditions. Robust data analytics will also be developed to quality-controlled data to users, to assist evaluation of subsurface water availability.

4. Fusion Energy Science (FES) ($7.0M): In FY 2022, FES continues its support for the AI Initiative to accelerate progress in several mission areas, including magnetic fusion, materials science, and high-energy-density plasma science. Program activities include:

- Predict key plasma phenomena and plant states.

- Optimize active plasma control augmented by AI/ML.
- Provide plasma diagnostics that are enhanced by AI/ML methods.
- Utilize extraction of models from experimental and simulation data.
- Develop extreme data algorithms able to handle the amount and rate of data generated by fusion simulations and experiments at both existing and planned fusion user facilities.

5. HEP ($35.8M): HEP continues to work with ASCR, via Scientific Discovery through Advanced Computing SciDAC-4, and as a participant with BES and NP in the FY 2020 FOA for AI/ML for Facilities, in which three HEP grants were awarded. HEP plans to continue to partner with ASCR for SciDAC-5 in FY 2021-2022. Long-term future work through partnerships involving detectors and facilities and enabling the use of HPC centers for AI/ML are natural points of collaboration. In FY 2022, HEP continues its support for the AI Initiative. Program activities include:

- Intelligent pattern recognition for reconstructing neutrino events in modern, high-granularity detectors, with many of these techniques also running in collider detector tracking algorithms for use in the future High Luminosity era of the Large Hadron Collider.
- "Real-time" AI/ML for fast decision-making in high-background or "noisy" environments. These edge computing techniques are particularly relevant for detector "trigger" algorithms.
- Advanced data analytics exploit deep learning to search for rare events, such as Higgs boson decays.
- Modeling and optimizing techniques such as long short-term memory for accelerator beam cooling and controls.
- Feedback algorithms for controlling complex detector conditions and performing data quality monitoring
- Generative modeling techniques to shorten run-times for collider simulations, while remaining faithful to the salient physics, as well as similar tools for cosmological structure formation simulations.
- Physics in Machine Learning / Neural Networks to build in conservation laws and general physics behavior into simulation and reconstruction tasks.
- Uncertainty Quantification in predictive and analytical results to perform true systematic uncertainty propagation through complicated deep learning machinery.

6. NP ($4.0M): In FY 2022, NP increases efforts to pioneer sensor and algorithm developments targeted towards fully integrating AI/ML into the every-day fabric of nuclear physics research and facility operations. Specifically, efforts will be expanded to acquire and analyze data useful for training automated systems capable of independent decision tree navigation for controls, accelerators, and detectors. As part of this effort research will explore new avenues in optimization, efficient surrogate models, data analytics, and inverse problems. Progress in this area will in turn enable pilot platforms targeting automated optimization of accelerator systems availability, performance and operation. In another important direction, efforts will be devoted to integrating AL/ML capabilities into advanced design tools, reducing the development time from concept to fully optimized models for complex detector systems and instruments. Finally, significant effort will be devoted to incorporation of AI/ML algorithms in data analysis to identify and interpret subtle, near-indiscernible correlations in nuclear physics research data, accelerating the search for new physics in the highly complex aftermath of subatomic collisions at accelerator laboratories.

The SC will continue to advance the use of AI/ML through investments from its program offices. SC has also established an AI crosscutting team with representatives from each program office to coordinate AI related activities and identify areas of possible collaboration.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)
Based on January 2021[8] data and allocated by Program Office
Contractor Pensions and Other Postretirement Benefits

This section of the budget provides projected costs of contractor defined benefit (DB) pension plan contributions and other postretirement benefit reimbursements. The DB pension plan contributions are provided in Section I below for FY 2020 through FY 2022 by plan. The section also shows the allocations of those contributions to the following Department of Energy (DOE) Departmental Elements:[a]

- National Nuclear Security Administration (NNSA)
- Office of Environmental Management (EM)
- Office of Science (SC)
- Office of Energy Efficiency and Renewable Energy (EERE)
- Office of Nuclear Energy (NE)

Information regarding projected reimbursements for other postretirement benefits (primarily medical) is provided in Section II below.

Contractors that manage and operate DOE's laboratories, weapons plants, and execute environmental cleanup projects at various government-owned sites and facilities are contractually required by DOE to assume sponsorship of the existing contractor DB pension plans and other postretirement benefit plans for incumbent employees. DOE reimburses the costs of the contractors' contributions to DB pension plans and the benefits paid from other postretirement benefit plans. These costs are typically allocated as indirect costs, though DOE does directly pay some costs.[b]

Due to the timing of the required annual valuation for the contractor DB pension plans, the actual amount of the contractors' annual contributions to these DB pension plans that DOE will reimburse each fiscal year will not generally be known until after budget development. Budgetary line items that include DOE reimbursement of contractor contributions to DB pension plans assume an indirect rate anticipated to be sufficient to meet reimbursement requirements. In the case of plans covering contractor employees whose costs are reimbursed by various programs, the allocation of contributions among NNSA, the Program Offices, and Reimbursable Work is done based on each site's best estimate of the allocation of work based on current and anticipated work for the various parties that the site serves.[c]

The American Rescue Plan Act (ARPA) became law in March 2021 and embedded within was the Butch Lewis Emergency Pension Relief Act, which supersedes previous funding relief legislation and includes several changes which affect the funding of qualified defined benefit plans. In general, the provisions affecting multiemployer plans will not affect the two multiemployer pension plans which are included in this report. However, the changes affecting single and multiple employer plans will significantly reduce expected minimum required contributions in the future. The changes associated with APRA are not included here because the contractors have a number of decisions to make regarding implementation as well as open questions which will need to be addressed by the Internal Revenue Service.

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[a] Tables include projected contributions from "Reimbursable Work" and "Other" entities (e.g., DOE departmental administration, classified programs, etc.). Reimbursable Work also includes the costs associated with the Naval Reactors contractor's plans covered by its contract with the Department of the Navy.

[b] The NNSA legacy University of California (UC) plans and the East Tennessee Technology Park Pension Plan for Grandfathered Employees rely on direct costs. For FY 2022, NNSA and EM will directly fund the reimbursement of the unfunded liability of the Savannah River Nuclear Solutions pensions plan.

[c] These allocations were provided by the contractors to the DOE in January 2021. The allocation percentages for FY 2020 are based on work performed for the first nine months of the fiscal year and the final allocations may be different. The allocation percentages for FY 2021 and FY 2022 represent contractors' expectation of work for FY 2021 and FY 2022 as of January 2021.

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

Section I - Contractor DB Pension Plan Contributions[d]

DOE reimburses contractors for pension contributions at levels that are at least equal to the minimum required by the Employee Retirement Income Security Act (ERISA). The minimum required contribution (MRC) is determined on a plan year basis. Only two of the contractor plans have a plan year that coincides with the federal fiscal year and, therefore, the majority of fiscal year pension allocations are spread across two plan years. At a minimum, plan sponsors of single or multiple employer plans[e] in which the plan assets were less than liabilities in the prior year must make quarterly contributions during the plan year with the first contribution due 3½ months after the beginning of the plan year and any outstanding amount due 8½ months after the plan year ends.

Contractors develop long-term projections of future asset investment returns that affect estimates of future MRCs for each plan. Asset returns that are higher or lower than the projected long-term investment returns affect future MRCs, though the provisions of ERISA ensure that these effects are somewhat smoothed by allowing recognition over a two (single/multiple) or a five-year period (multiemployer/state). In calendar year 2020, equity and bond market returns were positive and will equal or exceed most contractors' expected asset return for 2020. The actual investment returns in calendar year 2020 will predominantly affect MRCs beginning in Fiscal Year 2022 though there could be some impact in FY 2021 depending on the funded status of the plan. DOE evaluated the impact of the actual calendar year 2020 investment returns on the individual DB plans as part of its annual pension plan review process. The FY 2022 contribution budget amounts reflect the better than expected asset return.

Reimbursement of contractor costs in excess of the MRC requires specific approval. Reimbursements requested in excess of the MRC are reviewed by the cognizant program office, the Office of the Chief Financial Officer, the Office of Management, and the Office of the General Counsel through an annual pension management plan process. Table 1 provides information related to plans where funding in excess of the MRC was requested during FY 2020, and it includes the MRC, the contribution approved, and the actual amount contributed during FY 2020. In FY 2020, through the annual pension management plan process, requests by contractors for reimbursement of contributions in excess of the MRC for 15 plans were approved. Contributions in excess of the MRC were approved primarily to minimize volatility for future payments and mitigate increases in future contribution requirements.

Table 1: FY 2020 Contributions in Excess of the MRC ($K)

Plan	Program Office	FY 2020 Congressional Budget Justification	FY 2020 Estimated Minimum Required Contribution	Preliminary Additional Amount Requested in Year of Execution	Amount Reported in September 2020	Final FY 2020 Amount Approved and Contributed
Pension Plan for Eligible Bettis Employees and Retirees	NA	30,700	-	30,700	30,700	30,700
Pension Plan of the Pacific Northwest Laboratories, Battelle Memorial Institute	SC	35,000	-	45,000	65,000	52,744
Idaho National Laboratory Employee Retirement Plan	NE	50,000	-	50,000	60,000	63,000
Salaried Employee Pension Plan for KAPL Employees and Retirees	NA	30,400	-	30,400	30,400	30,400

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[d] DOE has reimbursed contributions for 32 funded DB pension plans and 13 non-qualified DB pension plans in FY 2020. Non-qualified plans have no assets and are funded on a pay-as-you-go basis.

[e] A single employer plan is a plan sponsored by only one employer; a multiple employer plan is a plan sponsored by 2 or more unrelated employers and not maintained pursuant to a collective bargaining agreement; a multiemployer plan is a plan maintained pursuant to a collective bargaining agreement between an employee organization and more than one employer.

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

Pension Plan for KAPL Employees in Participating Bargaining Units	NA	3,300	-	3,300	3,300	3,300
Triad Defined Benefit Pension Plan (TCP1)	NA	123,500	-	131,053	131,053	131,053
LLNS Defined Benefit Pension Plan	NA	35,000	-	50,000	42,500	50,000
National Renewable Energy Laboratory Retirement Plan	EE	26,000	6,645	27,000	26,042	27,000
Consolidated Nuclear Security, LLC Retirement Plan for Bargaining Unit Members of the Pantex Guards Union	NA	2,200	700	2,500	2,500	2,500
Retirement Plan for Bargaining Unit Employees of the Metal Trades Council of Consolidated Nuclear Security, LLC	NA	8,300	7,500	8,300	8,300	8,300
NTESS Retirement Income Plan	NA	109,194	-	100,220	100,220	100,220
Pension Plan for Employees at ORNL	SC	52,000	-	102,000	142,000	142,000
NNSS Staff Pension Plan	NA	1,224	326	1,152	1,342	1,276
NNSS IGAN Pension Trust Fund	NA	1,690	601	2,219	2,269	2,269
Savannah River Nuclear Solutions, LLC Multiple Employer Pension Plan	EM	205,363	215,196	239,000	239,000	239,000
Total		**713,870**	**230,967**	**822,844**	**884,626**	**883,762**

Projections of future DB pension plan contributions are highly sensitive to underlying data, methods, and especially assumptions. Changes in the population data that are different from the expected data impact the future costs of these plans; participants retiring earlier and/or living longer than expected may increase costs; compensation increases that are less than expected may decrease the costs. The most significant assumptions affecting the contribution amounts are those assumptions with respect to future market conditions. In particular, the difference between actual experience of the markets and the assumption of the expected return on investments earned by the plans each future year, as well as future corporate bond yields (because they drive the discount rate used to value plan liabilities), have the largest impact on the ultimate contributions that will be reimbursed by the DOE. For example, the actual contributions for fiscal year 2022 will not be known until January 2022 at the earliest because these contributions will be determined based on the asset value as of December 31, 2021, and the discount rate in effect at that time. Estimated contributions above the MRC submitted during this budget process do not receive final approval until the year of execution.

Therefore, it is important to emphasize that the actual amounts reimbursed for the applicable fiscal years shown will almost certainly vary from the projections provided in this section. The information provided for the funded plans (excluding the non-qualified plans) is based on plan contributions projected by the DOE's contractors in January 2021. The non-qualified plan amounts equal the expected benefit payments which were provided by the contractors for the prior year's financial statements. This information has been reviewed by NNSA, relevant DOE Program Offices, and by the Office of the Chief Financial Officer.

- Table 2 provides aggregate FY 2020 actual and FY 2021-2022 estimated pension plan contributions eligible for reimbursement for all plans. While the expectation that the impact of BBA declines over time, increased MRCs for some contractors are offset by declining contributions for others as their plans become better funded.
- Table 3 provides plan-by-plan FY 2020 actual contributions and FY 2021 and FY 2022 estimated pension contributions eligible for reimbursement by NNSA, the DOE, and reimbursable work customers.

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[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

**Table 2: NNSA and DOE Program Office Actual Contributions for FY 2020
and Projected Contributions for FY 2021 through FY 2026 ($K)**

Based on January 2021[f] data and allocated by Program Office

Program Office	FY 2020	FY 2021	FY 2022
NNSA	592,084	632,053	550,065
EM	307,789	350,559	352,993
SC	133,304	141,471	145,482
EERE	52,168	54,965	60,203
NE	28,754	20,683	21,112
Reimbursable Work	148,764	144,670	152,584
Other	31,151	28,033	35,775
Total	**1,294,014**	**1,372,433**	**1,318,213**

There may be small variances in totals due to rounding.

Table 3 provides the following information for each plan:

Plan name and Plan type: Single employer, multiemployer, multiple employer, state, or non-qualified.

Status: *Open* means that the plans are open to new employees who earn benefits under a traditional defined benefit formula. *Closed* means that the qualified plans are closed to new employees, but active employees who were employed prior to the plan being closed continue to earn benefits; this includes plans where new entrants only or new entrants and legacy employees receive benefits under reduced hybrid formulas which are much less volatile (indicated by the word hybrid after closed). For non-qualified plans, "closed" means that the universe of possible participants is limited to individuals who are currently accruing benefits in the closed qualified plan at the respective site and who may at some point qualify for the non-qualified plan under the terms of the non-qualified plan). *Partially Closed* means that the plan is closed to some subset of the employee population, but that certain represented employees covered by collective bargaining agreements are still becoming members of the plan at the time of hire. *Frozen* means that plan liabilities are frozen (*i.e.,* that there are no longer any employees accruing credit for current service under the plan).

Reimbursements & Allocations: Expected contributions are allocated by program office for fiscal year 2020-2022 with 2020 representing actual contributions and contributions for later years based on submissions as outlined in footnote 3.

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[f] Final information for FY 2020 contributions was reported in October 2020 while projected contributions for FY 2021 and FY 2022 were reported in January 2021 for all departmental elements.

[8] See footnote 7, supra.
May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)
Based on January 2021[8] data and allocated by Program Office

Plan Name	Plan status	Fiscal Year	Total	NNSA	EM	SC	EERE	NE	Reimbursable Work	Other
East Tennessee Technology Park Pension Plan for Grandfathered Employees		2020	15,298	-	15,298	-	-	-	-	-
	EM-Partially Closed	2021	29,451	-	29,451	-	-	-	-	-
	Multiemployer	2022	26,951	-	26,951	-	-	-	-	-
University of California Retirement Plan - Lawrence Berkeley National Laboratory		2020	42,350	423	161	28,921	5,395	237	5,802	1,410
	SC-Open	2021	48,085	192	91	32,890	8,141	154	5,842	774
	State	2022	49,412	198	94	33,798	8,365	158	6,004	796
Pension Plan for Eligible Bettis Employees and Retirees		2020	30,700	16,885	-	-	-	-	13,815	-
	NA-Closed	2021	30,500	16,775	-	-	-	-	13,725	-
	Single	2022	38,411	21,126	-	-	-	-	17,285	-
Pension Plan of the Pacific Northwest Laboratories, Battelle Memorial Institute		2020	52,744	11,656	105	9,388	6,435	897	14,927	9,336
	SC-Open	2021	37,300	7,535	336	6,677	4,961	671	11,600	5,520
	Single	2022	55,000	11,110	495	9,845	7,315	990	17,105	8,140
Retirement Program for Employees of Consolidated Nuclear Security, LLC at the U. S. Department of Energy Facilities at Oak Ridge, Tennessee		2020	90,300	86,688	-	-	-	-	3,612	-
	NA-Closed	2021	52,000	49,920	-	-	-	-	2,080	-
	Single	2022	52,200	50,112	-	-	-	-	2,088	-
HPMC Occupational Health Services Retirement Plan		2020	526	-	526	-	-	-	-	-
	EM-Closed	2021	522	-	522	-	-	-	-	-
	Single	2022	509	-	509	-	-	-	-	-
Hanford Multi-Employer Pension Plan		2020	85,170	-	85,170	-	-	-	-	-
	EM-Closed	2021	92,678	-	92,678	-	-	-	-	-
	Multiemployer	2022	94,989	-	94,989	-	-	-	-	-
Idaho National Laboratory Employee Retirement Plan		2020	63,000	2,532	26,500	233	1,052	19,782	12,112	788
	NE-Closed	2021	50,000	2,420	26,500	155	765	11,485	7,795	880

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

Plan Name	Plan status	Fiscal Year	Total	NNSA	EM	SC	EERE	NE	Reimbursable Work	Other
	Multiple	2022	50,000	2,420	26,500	155	765	11,485	7,795	880
Salaried Employee Pension Plan for KAPL Employees and Retirees		2020	30,400	16,720	-	-	-	-	13,680	-
	NA-Closed	2021	30,500	16,775	-	-	-	-	13,725	-
	Single	2022	22,000	12,100	-	-	-	-	9,900	-
Pension Plan for KAPL Employees in Participating Bargaining Units		2020	3,300	1,815	-	-	-	-	1,485	-
	NA-Closed	2021	3,400	1,870	-	-	-	-	1,530	-
	Single	2022	2,200	1,210	-	-	-	-	990	-
Kansas City Division Hourly Employees' Pension Plan		2020	-	-	-	-	-	-	-	-
	NA-Closed	2021	-	-	-	-	-	-	-	-
	Single	2022	-	-	-	-	-	-	-	-
Honeywell Retirement Earnings Plan for Aerospace Employees at the Kansas City Division		2020	-	-	-	-	-	-	-	-
	NA-Closed	2021	-	-	-	-	-	-	-	-
	Single	2022	-	-	-	-	-	-	-	-
Triad Defined Benefit Pension Plan (TCP1)		2020	131,053	108,250	1,573	3,669	655	786	14,023	2,097
	NA-Closed	2021	136,800	112,997	1,642	3,830	684	821	14,638	2,189
	Multiple	2022	137,300	113,410	1,648	3,844	687	824	14,691	2,197
University of California Retirement Plan - Lawrence Livermore National Laboratory Retained Segment		2020	48,554	48,554	-	-	-	-	-	-
	NA-Frozen	2021	61,986	61,986	-	-	-	-	-	-
	State	2022	1,109	1,109	-	-	-	-	-	-
LLNS Defined Benefit Pension Plan		2020	50,000	35,500	-	2,500	500	-	10,000	1,500
	NA-Closed	2021	85,000	63,750	-	3,400	1,700	-	12,750	3,400
	Single	2022	100,000	76,000	-	3,000	1,000	-	16,000	4,000

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

Plan Name	Plan status	Fiscal Year	Total	NNSA	EM	SC	EERE	NE	Reimbursable Work	Other
Fluor-BWXT Portsmouth, LLC USW Career Pension Plan for Appendix A USW-Represented Employees		2020	2,151	-	2,151	-	-	-	-	-
	EM-Closed	2021	1,850	-	1,850	-	-	-	-	-
	Single	2022	1,550	-	1,550	-	-	-	-	-
University of California Retirement Plan - Los Alamos National Laboratory Retained Segment		2020	49,413	49,413	-	-	-	-	-	-
	NA-Frozen	2021	53,971	53,971	-	-	-	-	-	-
	State	2022	18,472	18,472	-	-	-	-	-	-
National Renewable Energy Laboratory Retirement Plan		2020	27,000	-	-	810	21,330	-	4,050	810
	EE-Closed - Hybrid	2021	27,000	-	-	810	21,330	-	3,510	1,350
	Single	2022	31,000	-	-	930	24,490	-	4,030	1,550
Golden SVCS, LLC Pension Plan		2020	1,483	-	1,186	297	-	-	-	-
	SC-Closed	2021	1,645	-	1,316	329	-	-	-	-
	Single	2022	1,426	-	1,141	285	-	-	-	-
Mission Support and Test Services, LLC (MSTS) Employee Retirement Plan		2020	25,521	21,642	1,404	-	-	-	1,710	766
	NA-Closed - Hybrid	2021	20,380	17,405	1,101	-	-	-	1,386	489
	Single	2022	17,590	15,022	950	-	-	-	1,196	422
Consolidated Nuclear Security, LLC Retirement Plan for Bargaining Unit Members of the Pantex Guards Union		2020	2,500	2,500	-	-	-	-	-	-
	NA-Closed	2021	2,600	2,600	-	-	-	-	-	-
	Single	2022	2,500	2,500	-	-	-	-	-	-
Retirement Plan for Bargaining Unit Employees of the Metal Trades Council of Consolidated Nuclear Security, LLC		2020	8,300	8,300	-	-	-	-	-	-
	NA-Closed	2021	8,600	8,600	-	-	-	-	-	-
	Single	2022	8,800	8,800	-	-	-	-	-	-
Consolidated Nuclear Security Retirement Plan for Non-		2020	20,400	19,992	-	-	-	-	408	-
	NA-Closed	2021	15,300	14,994	-	-	-	-	306	-

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

Plan Name	Plan status	Fiscal Year	Total	NNSA	EM	SC	EERE	NE	Reimbursable Work	Other
Bargaining Pantex Location Employees	Single	2022	14,600	14,308	-	-	-	-	292	-
NTESS Retirement Income Plan		2020	100,220	60,332	601	1,904	2,205	902	32,371	1,904
	NA-Closed	2021	105,444	63,793	527	2,214	2,109	1,054	33,953	1,793
	Single	2022	115,485	73,449	693	2,425	2,310	1,155	33,375	2,079
Savannah River Nuclear Solutions, LLC Multiple Employer Pension Plan		2020	239,000	81,260	150,570	-	-	-	-	7,170
	EM-Closed	2021	296,000	115,529	173,604	-	-	-	-	6,867
	Multiple	2022	296,000	108,158	176,919	-	-	-	-	10,922
DUF6 Pension Plan for Grandfathered Employees		2020	1,566	-	1,566	-	-	-	-	-
	EM-Closed	2021	1,018	-	1,018	-	-	-	-	-
	Single	2022	-	-	-	-	-	-	-	-
USW Career Pension Plan for Appendix A USW-Represented Employees (Paducah)		2020	1,410	-	1,410	-	-	-	-	-
	EM-Closed	2021	1,572	-	1,572	-	-	-	-	-
	Single	2022	1,361	-	1,361	-	-	-	-	-
Pension Plan for Employees at ORNL		2020	142,000	12,070	142	85,200	14,484	6,106	18,744	5,254
	SC-Open	2021	150,000	13,050	150	90,750	15,150	6,450	19,800	4,650
	Single	2022	150,000	13,050	150	90,750	15,150	6,450	19,800	4,650
Waste Isolation Pilot Plant Pension Plan		2020	13,013	-	13,013	-	-	-	-	-
	EM-Open	2021	13,423	-	13,423	-	-	-	-	-
	Single	2022	13,888	-	13,888	-	-	-	-	-
West Valley Pension Plan		2020	5,834	-	5,834	-	-	-	-	-
	EM-Closed	2021	4,301	-	4,301	-	-	-	-	-
	Single	2022	4,691	-	4,691	-	-	-	-	-
NNSS Staff Pension Plan		2020	1,276	1,276	-	-	-	-	-	-

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)
Based on January 2021[8] data and allocated by Program Office

Plan Name	Plan status	Fiscal Year	Total	NNSA	EM	SC	EERE	NE	Reimbursable Work	Other
	NA-Closed	2021	1,164	1,164	-	-	-	-	-	-
	Single	2022	927	927	-	-	-	-	-	-
NNSS IGAN Pension Trust Fund		2020	2,269	2,269	-	-	-	-	-	-
	NA-Closed	2021	2,511	2,511	-	-	-	-	-	-
	Single	2022	2,071	2,071	-	-	-	-	-	-
Battelle Memorial Institute Excess Benefit and Supplemental Executive Pension Plans		2020	8	2	-	1	1	-	2	1
	NA-Closed	2021	8	2	-	2	1	-	3	1
	Non-Qualified	2022	8	2	-	1	1	-	3	1
Executive and Supplemental Pension Plans for Designated Bettis Employees		2020	1,728	951	-	-	-	-	778	-
	NA-Closed	2021	1,836	1,010	-	-	-	-	826	-
	Non-Qualified	2022	1,886	1,037	-	-	-	-	849	-
Excess and Supplemental Pension Plan for Designated KAPL Employees		2020	352	194	-	-	-	-	159	-
	NA-Closed	2021	335	184	-	-	-	-	151	-
	Non-Qualified	2022	333	183	-	-	-	-	150	-
Triad 401(a)(17) Restoration Plan		2020	259	214	3	7	1	2	28	4
	NA-Closed	2021	259	214	3	7	1	2	28	4
	Non-Qualified	2022	263	217	3	7	1	2	28	4
Triad Restoration Plan		2020	84	69	1	2	-	1	9	1
	NA-Closed	2021	156	129	2	4	1	1	17	2
	Non-Qualified	2022	169	140	2	5	1	1	18	3
LLNS 401(a)(17) Restoration Plan		2020	889	631	-	44	9	-	178	27
	NA-Closed	2021	942	707	-	38	19	-	141	38
	Non-Qualified	2022	1,142	868	-	34	11	-	183	46
LLNS Restoration Plan		2020	192	137	-	10	2	-	38	6
	NA-Closed	2021	272	204	-	11	5	-	41	11

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Table 3: FY 2020 Actual and FY 2021 and FY 2022 Projected Contributions by Plan, NNSA, and Program Office ($K)

Based on January 2021[8] data and allocated by Program Office

Plan Name	Plan status	Fiscal Year	Total	NNSA	EM	SC	EERE	NE	Reimbursable Work	Other
	Non-Qualified	2022	343	261	-	10	3	-	55	14
NTESS Nonqualified Pension Plan		2020	2,374	1,429	14	45	52	21	767	45
	NA-Closed	2021	2,332	1,411	12	49	47	23	751	40
	Non-Qualified	2022	2,304	1,466	14	48	46	23	666	41
Savannah River Nuclear Solutions, LLC Nonqualified Pension Plan		2020	485	165	305	-	-	-	-	15
	EM-Frozen	2021	375	146	220	-	-	-	-	9
	Non-Qualified	2022	356	130	213	-	-	-	-	13
Washington Government Services Executive Pension Plan (TRU Solutions Participants Only)		2020	71	-	71	-	-	-	-	-
	EM-Frozen	2021	68	-	68	-	-	-	-	-
	Non-Qualified	2022	66	-	66	-	-	-	-	-
Washington Government Services Executive Pension Plan (West Valley Participants Only)		2020	184	-	184	-	-	-	-	-
	EM-Frozen	2021	171	-	171	-	-	-	-	-
	Non-Qualified	2022	166	-	166	-	-	-	-	-
Consolidated Nuclear Security, LLC Equalization Retirement Income Plan and Supplemental Retirement Income Plan		2020	183	176	-	-	-	-	7	-
	NA-Closed	2021	172	166	-	-	-	-	7	-
	Non-Qualified	2022	167	160	-	-	-	-	7	-
UT-Battelle Equalization Retirement Income Plan and Supplemental Retirement Income Plan		2020	452	38	-	271	46	19	60	17
	SC-Open	2021	504	44	1	305	51	22	67	16
	Non-Qualified	2022	567	49	1	343	57	24	75	18
Total		2020	**1,294,014**	**592,084**	**307,789**	**133,304**	**52,168**	**28,754**	**148,764**	**31,151**
		2021	**1,372,433**	**632,053**	**350,559**	**141,471**	**54,965**	**20,683**	**144,670**	**28,033**
		2022	**1,318,213**	**550,065**	**352,993**	**145,482**	**60,203**	**21,112**	**152,584**	**35,775**

[8] See footnote 7, supra.

May be small variances in totals due to rounding. For the Naval Reactors contractor's plans, Reimbursable Work includes the portion of contributions covered by the contract with the Department of the Navy.

Section II - Other Postretirement Benefit Plans

For the most part, contractors do not fund other postretirement benefit plans in advance, but instead pay the claims incurred by the retired members or the premiums required to cover the plan benefits. The other postretirement benefits covered by the contractors are primarily medical, including prescription drugs, but may also include dental, vision, and life insurance benefits that are provided upon retirement from the contractor. The costs associated with these plans are expected to grow as the retired population grows and as healthcare cost trends continue to increase.

Due to the fact that the claims are not paid until incurred and processed, the actual amounts of contractors' payment of claims that DOE will reimburse for FY 2021 and FY 2022 will not be known until after budget development. The contractor costs are included in indirect costs. The budget assumes an indirect rate sufficient to meet reimbursement requirements.[9] As mentioned in the pension section, the allocation of contributions among NNSA, the Program Offices, and Reimbursable Work, is done based on each site's best estimate of the allocation of work based on current and anticipated work for the various parties that the site serves.

The contractors are making concerted efforts to reduce the costs associated with these plans as the costs have steadily increased. In recent years, contractors have made changes to their other postretirement benefit plans in an effort to reduce the costs associated with them, simplify administration, or increase the efficiency of the delivery of benefits. These changes, effective January 1, 2020 or later, include the following:

- Two DOE contractors increased deductibles for their Consumer Directed Health Plans (CDHP).
- For one DOE contractor, recent retirees that were represented under certain collective bargaining agreements are no longer eligible for group term life insurance.
- One DOE contractor is phasing retiree medical insurance to access-only (i.e., unsubsidized) for new retirees. The retiree-cost share will increase to 100 percent by 2024.
- One DOE contractor replaced Preferred Provider Organization (PPO) and Health Maintenance Organization (HMO) plan options with a High Deductible Health Plan (HDHP).
- One DOE contractor introduced a new HDHP plan as an option for retiree medical insurance.
- One DOE contractor set retiree medical contributions to ten percent higher than that of active employee contributions; premium cost sharing for both groups were set equal prior to 2020.
- One DOE contractor carved out infertility coverage from medical and prescription plans and now directs participants to a specific cost-effective provider for infertility treatments.
- One DOE contractor increased premiums for pre-65 retirees by reducing the 80 percent employer-subsidized contribution by one percent. They also began charging for retiree dental coverage for retirees with 20 years or more of service, a benefit that was previously 100 percent subsidized.
- Pre-65 non-bargaining unit retirees for one DOE contractor will only be able to elect coverage under an HDHP.
- New retirees for one DOE contractor now participant in a Health Reimbursement Account (HRA) program in lieu of an employer-provided retiree health plan.
- One DOE contractor stopped providing retiree medical and dental benefits for newly-retired non-grandfathered employees.

Projections of future postretirement benefits to be paid are highly sensitive to underlying data, methods, and assumptions, particularly assumptions related to future increases in the expected claims paid each year as well as the underlying assumptions regarding usage and coverage. Thus, the actual amounts reimbursed in a future fiscal year may be different. All of the information for FY 2021 and FY 2022 is based on expected reimbursements as reported by the DOE's respective contractors in August 2019; this information has been reviewed by the appropriate NNSA and DOE program office and the Office of the Chief Financial Officer. The information reported for FY 2020 is primarily based on information of final employer contributions as reported by the contractors for the FY 2020 agency financial statements. Table 1 provides these aggregate FY 2020-2022 projected other postretirement benefit reimbursements.

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[9] The LM plans rely on direct costs.

Table 1: FY 2020-2026 NNSA and DOE Program Office Projected Other Postretirement Benefits Payments ($K)
Based on January 2021 data[10] and allocated by Program Office

Program Office	FY 2020	FY 2021	FY 2022
NNSA	138,634	174,633	181,095
EM	62,542	70,306	71,627
SC	50,275	59,742	61,066
EERE	6,045	8,094	7,865
NE	5,861	7,992	8,220
Reimbursable Work	37,617	47,672	47,823
LM	40,290	48,240	46,611
Other	6,315	7,610	8,694
Total	**347,580**	**424,289**	**433,001**

There may be small variances in totals due to rounding.

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[10] Includes actual FY 2020 reimbursement payments as reported by the contractors for the FY 2020 agency financial statements. Reimbursable Work also includes the costs associated with the Naval Reactors contractor's plans covered by its contract with the Department of the Navy.

Summary

The information in this report responds to requirements in The Good Accounting Obligation in Government Act (PL 115-414). The Act requires disclosure of certain information regarding the status of audit recommendations in the annual budget justification submitted to Congress, as submitted with the budget of the President under section 1105 of title 31, United States Code.

Table 1 provides a summary of the GAO and OIG audit reports issued during FY 2020. As of September 30, 2020, there were **63** ongoing OIG audits and **72** ongoing GAO audits and assessments.

Table 1: Audit Reports Issued During FY 2020

AUDIT REPORTS	NUMBER OF IG REPORTS	NUMBER OF GAO REPORTS
Final Reports Issued in FY 2020	**59**	**72**
Final Reports Issued in FY 2020 Not Requiring Corrective Actions	**22**	**53**
Final Reports Issued in FY 2020 Requiring Corrective Actions	**37**	**19**
Final Reports Issued in FY 2020 That Remain Open for Further Follow-up Actions	**27**	**17**

This Budget Request includes a listing of the applicable GAO and OIG reports issued during Fiscal Year 2020 with recommendations that are considered by DOE to be open for further follow-up actions. Table 2 lists the relevant GAO reports and Table 3 lists the relevant OIG reports. Detailed information about the specific actions taken and planned in response to GAO and OIG recommendations is maintained by the Department and is available to Congress upon request.

Table 2: GAO Reports issued during FY 2020 considered by DOE to be open for further follow-up actions as of October 1, 2020

Field Name	Field Description
DOE Lead Office	Office of Environmental Management
Report Number	GAO-19-339
Report Title	Environmental Liabilities: DOE Would Benefit from Incorporating Risk-Informed Decision-Making into Its Cleanup Policy
Final Report Date	10/18/2019

Field Name	Field Description
DOE Lead Office	Office of Environmental Management
Report Number	GAO-20-63
Report Title	Nuclear Cleanup: Actions Needed to Improve Cleanup Efforts at DOE's Three Former Gaseous Diffusion Plants
Final Report Date	12/17/2019
Field Name	**Field Description**

Field Name	Field Description
DOE Lead Office	Office of Science
Report Number	GAO-20-81
Report Title	Federal Research: Additional Actions Needed to Improve Public Access to Research Results
Final Report Date	11/21/2019

Field Name	Field Description
DOE Lead Office	Office of Management
Report Number	GAO-20-101
Report Title	Federal Property: Better Monitoring, Oversight and Data Would Help Understand Effects of Providing Property to Non-Federal Recipients
Final Report Date	12/20/2019

Field Name	Field Description
DOE Lead Office	Office of the Chief Financial Officer
Report Number	GAO-20-122
Report Title	Payments in Lieu of Taxes: Revisions to DOE Order Could Provide Better Assurance that Payments Meet Goals
Final Report Date:	10/29/2019

Field Name	Field Description
DOE Lead Office	Office of the Chief Information Officer
Report Number	GAO-20-129
Report Title	INFORMATION TECHNOLOGY: Agencies Need to Fully Implement Key Workforce Planning Activities
Final Report Date	10/30/2019

Field Name	Field Description
DOE Lead Office	Office of Environmental Management
Report Number	GAO-20-161
Report Title	Hanford Cleanup: DOE Should Take Actions to Improve Inspections and Oversight of Contaminated Excess Facilities
Final Report Date	2/20/2020

Field Name	Field Description
DOE Lead Office	Office of Economic Impact and Diversity
Report Number	GAO-20-187
Report Title	SEXUAL HARASSMENT IN STEM RESEARCH: Agencies Have Taken Actions, but Need Complaint Procedures, Overall Plans, and Better Collaboration
Final Report Date	3/19/2020

Field Name	Field Description
DOE Lead Office	Office of Cybersecurity, Energy Security, and Emergency Response
Report Number	GAO-20-299
Report Title	Critical Infrastructure Protection: Additional Actions Needed to Identify Framework Adoption and Resulting Improvement
Final Report Date	2/25/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	GAO-20-357
Report Title	Nuclear Weapons: NNSA Needs to Establish Stronger Management Controls Over Its Microelectronics Activities
Final Report Date	6/9/2020

Field Name	Field Description
DOE Lead Office	Office of Environmental Management
Report Number	GAO-20-363
Report Title	Hanford Waste Treatment Plant: DOE Is Pursuing Pretreatment Alternatives, but Its Strategy is Unclear, and Costs are Unknown
Final Report Date	5/12/2020

Field Name	Field Description
DOE Lead Office	Office of Legacy Management
Report Number	GAO-20-373
Report Title	Environmental Liabilities: DOE Needs to Better Plan for Post-Cleanup Challenges Facing Sites
Final Report Date	5/13/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	GAO-20-37R
Report Title	Nuclear Weapons Sustainment: Improvements Made to Budget Estimates in Fiscal Year 2019 Joint Report, but Opportunities Remain to Enhance Completeness
Final Report Date	11/7/2019

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	GAO-20-409
Report Title	Nuclear Weapons: Action Needed to Address the W80-4 Warhead Program's Schedule Constraints
Final Report Date	7/24/2020

Field Name	Field Description
DOE Lead Office	Office of the Chief Financial Officer
Report Number	GAO-20-442
Report Title	Improper Payments: Improvements Needed to Ensure Reliability and Accuracy in DOE's Risk Assessments and Reporting
Final Report Date	6/17/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	GAO-20-451
Report Title	National Nuclear Security Administration: Analyzing Cost Savings Program Could Result in Wider Use and Additional Contractor Efficiencies
Final Report Date	6/24/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	GAO-20-703
Report Title	Nuclear Weapons: NNSA Should Further Develop Cost, Schedule, and Risk Information for the W87-1 Warhead Program
Final Report Date	9/23/2020

Table 3: OIG Reports issued during FY 2020 considered by DOE to be open for further follow-up actions as of October 1, 2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-17
Report Title	Audit Coverage of Cost Allowability for National Security Technologies, LLC During Fiscal Years 2015 through November 30, 2017 Under Department of Energy Contract No. DE-AC52-06NA25946
Final Report Date	12/19/2019

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-18
Report Title	Audit Coverage of Cost Allowability for Honeywell Federal Manufacturing & Technologies, LLC During Fiscal Years 2015 through 2017 Under Department of Energy Contract Nos. DE-NA0000622 and DE-NA0002839
Final Report Date	12/19/2019

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-20
Report Title	Audit Coverage of Cost Allowability for Los Alamos National Laboratory from October 1, 2013, to September 30, 2016 Under the Department of Energy Contract DE-AC52-06NA25396
Final Report Date	12/26/2019

Field Name	Field Description
DOE Lead Office	Office of Environment, Health, Safety and Security
Report Number	DOE-OIG-20-22
Report Title	Follow-Up on the Department of Energy's Unclassified Foreign Visits and Assignments Program
Final Report Date	12/30/2019

Field Name	Field Description
DOE Lead Office	Richland Operations Office
Report Number	DOE-OIG-20-23
Report Title	Management of Dosimetry Services at the Hanford Site
Final Report Date	1/8/2020

Field Name	Field Description
DOE Lead Office	Office of Intelligence and Counterintelligence
Report Number	DOE-OIG-20-24
Report Title	Review of the Office of Intelligence and Counterintelligence's Closing of Category A Security Incidents
Final Report Date	1/8/2020

Field Name	Field Description
DOE Lead Office	Office of the Chief Financial Officer
Report Number	DOE-OIG-20-26
Report Title	Management Letter on the Audit of the Department of Energy's Consolidated Financial Statements for Fiscal Year 2019
Final Report Date	2/5/2020

Field Name	Field Description
DOE Lead Office	Western Area Power Administration
Report Number	DOE-OIG-20-29
Report Title	Management Letter on the Western Federal Power System's Fiscal Year 2019 Financial Statement Audit
Final Report Date	2/24/2020

Field Name	Field Description
DOE Lead Office	Office of the Chief Information Officer
Report Number	DOE-OIG-20-30
Report Title	Management Letter on the Department of Energy's Unclassified Cybersecurity Program for Fiscal Year 2019
Final Report Date	3/3/2020

Field Name	Field Description
DOE Lead Office	Office of Management
Report Number	DOE-OIG-20-31
Report Title	Evacuation Procedures for Employees Needing Assistance
Final Report Date	3/4/2020

Field Name	Field Description
DOE Lead Office	Oak Ridge National Laboratory Site Office
Report Number	DOE-OIG-20-32
Report Title	The Department of Energy's Wildland Fire Prevention Efforts at the Oak Ridge Reservation
Final Report Date	3/4/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-33
Report Title	Nuclear Material Control and Accountability at the Sandia National Laboratories
Final Report Date	3/4/2020

Field Name	Field Description
DOE Lead Office	Office of Science Consolidated Service Center
Report Number	DOE-OIG-20-36
Report Title	Audit Coverage of Cost Allowability for University of California During Fiscal Years 2015-2017 Under Department of Energy Contract DE-AC02- 5CH11231
Final Report Date	3/16/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-37
Report Title	The Department of Energy's Wildland Fire Prevention Efforts at the Nevada National Security Site
Final Report Date	3/23/2020

Field Name	Field Description
DOE Lead Office	Office of Fossil Energy
Report Number	DOE-OIG-20-43
Report Title	The Strategic Petroleum Reserve's Modernization Program
Final Report Date	6/1/2020

Field Name	Field Description
DOE Lead Office	Portsmouth/Paducah Project Office
Report Number	DOE-OIG-20-44
Report Title	The Department of Energy's Management of Cleanup at the C-400 Complex
Final Report Date	6/8/2020

Field Name	Field Description
DOE Lead Office	Office of the Chief Financial Officer
Report Number	DOE-OIG-20-45
Report Title	The Office of Science's Audit Resolution and Follow-up Process
Final Report Date	7/6/2020

Field Name	Field Description
DOE Lead Office	Office of the Chief Hunan Capital Officer
Report Number	DOE-OIG-20-46
Report Title	The Department of Energy's Federal Substance Abuse Testing Program
Final Report Date	7/6/2020

Field Name	Field Description
DOE Lead Office	Office of Science
Report Number	DOE-OIG-20-47
Report Title	Security over Information Technology Peripheral Devices at Office of Science Locations
Final Report Date	7/6/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-48
Report Title	Audit Coverage of Cost Allowability for Sandia Corporation, Under the Department of Energy Contract DE-AC04-94AL85000, for Fiscal Years 2016 through April 30, 2017
Final Report Date	7/13/2020

Field Name	Field Description
DOE Lead Office	Carlsbad Field Office
Report Number	DOE-OIG-20-49
Report Title	Audit Coverage of Cost Allowability for Nuclear Waste Partnership, LLC from October 1, 2014, to September 30, 2017, Under the Department of Energy Contract No. DE-EM0001971
Final Report Date	7/13/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-50
Report Title	The Department of Energy's Storage and Disposition of Explosives Material at Selected Sites
Final Report Date	7/20/2020

Field Name	Field Description
DOE Lead Office	Richland Operations Office
Report Number	DOE-OIG-20-51
Report Title	Small Business Subcontracting Requirements for Prime Contractors at the Hanford Site
Final Report Date	7/20/2020

Field Name	Field Description
DOE Lead Office	Richland Operations Office
Report Number	DOE-OIG-20-55
Report Title	Respiratory Equipment Maintenance at the Hanford Site
Final Report Date	9/16/2020

Field Name	Field Description
DOE Lead Office	Office of Management
Report Number	DOE-OIG-20-56
Report Title	Follow-up on Conference Management at Selected Department Sites
Final Report Date	9/30/20

Field Name	Field Description
DOE Lead Office	Office of River Protection
Report Number	DOE-OIG-20-57
Report Title	Tank Waste Management at the Hanford Site
Final Report Date	9/30/2020

Field Name	Field Description
DOE Lead Office	National Nuclear Security Administration
Report Number	DOE-OIG-20-59
Report Title	Audit Coverage of Cost Allowability for Bechtel Marine Propulsion Corporation from October 1, 2013, to September 30, 2018, Under Department of Energy Contract Number DE-NR0000031
Final Report Date	9/30/2020

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 ar-rangements (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 a contract covered by the Federal Acquisition Regulation;
 (C) issue a letter of intent to make an allocation, award, or Agreement in excess of the limits in subparagraph (A) or (B); or
 (D) announce publicly the intention to make an allocation, award, or Agree-ment 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 ex-planatory statement described in section 4 (in the matter preceding division A of this consolidated Act).
(e) The amounts made available by this title may be reprogrammed for any program, project, or activity, and the Department shall notify[, and obtain the prior approval of,] 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 substan-tial 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 practic-able, but not later than 3 days after the date of the activity to which a require-ment or restriction would otherwise have applied. Such notice shall include an explanation of the substantial risk under paragraph (1) that permitted such waiver.

(h) 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. 302. 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 [2021] 2022 until the enactment of the Intelligence Authorization Act for fiscal year [2021] 2022.

SEC. 303. 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 require-ments.

SEC. 304. 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. 305. Notwithstanding section 161 of the Energy Policy and Conservation Act (42 U.S.C. 6241), upon a determination by the President in this fiscal year that a regional supply shortage of refined petroleum product of significant scope and duration exists, that a severe increase in the price of refined petroleum product will likely result from such shortage, and that a draw down and sale of refined petroleum product would assist directly and significantly in reducing the adverse impact of such shortage, the Secretary of Energy may draw down and sell refined petroleum product from the Strategic Petroleum Reserve. Proceeds from a sale under this section shall be deposited into the SPR Petroleum Account established in section 167 of the Energy Policy and Conservation Act (42 U.S.C. 6247), and such amounts shall be available for obligation, without fiscal year limitation, consistent with that section.

[SEC. 306. (a) Of the offsetting collections, including unobligated balances of such collections, in the "Department of Energy-Power Marketing Administra-tion-Colorado River Basins Power Marketing Fund, Western Area Power Admin-istration", $21,400,000 shall be transferred to the "Department of the Interior-Bur-eau of Reclamation-Upper Colorado River Basin Fund" for the Bureau of Reclam-ation to carry out environmental stewardship and endangered species recovery efforts.

(b) No funds shall be transferred directly from "Department of Energy-Power Marketing Administration-Colorado River Basins Power Marketing Fund, Western Area Power Administration" to the general fund of the Treasury in the current fiscal year.]

TITLE V-GENERAL PROVISIONS
(INCLUDING TRANSFER OF FUNDS)

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 appro-priation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. 1913.

[SEC. 502. (a) None of the funds made available in title III of this Act may be transferred to any department, agency, or instrumentality of the United States Government, except pursuant to a transfer made by or transfer authority provided in this Act or any other appropriations Act for any fiscal year, transfer authority referenced in the explanatory statement described in section 4 (in the matter preceding division A of this consolidated Act), or any authority whereby a depart-ment, agency, or instrumentality of the United States Government may provide goods or services to another department, agency, or instrumentality.

    (b) None of the funds made available for any department, agency, or instrumentality of the United States Government may be transferred to accounts funded in title III of this Act, except pursuant to a transfer made by or transfer authority provided in this Act or any other appropriations Act for any fiscal year, transfer authority referenced in the explanatory statement described in section 4 (in the matter preceding division A of this consolidated Act), or any authority whereby a department, agency, or instrumentality of the United States Government may provide goods or services to another department, agency, or instrumentality.

    (c) The head of any relevant department or agency funded in this Act utilizing any transfer authority shall submit to the Committees on Appropriations of both Houses of Congress a semiannual report detailing the transfer authorities, except for any authority whereby a department, agency, or instrumentality of the United States Government may provide goods or services to another department, agency, or instrumentality, used in the previous 6 months and in the year-to-date. This report shall include the amounts transferred and the purposes for which they were transferred, and shall not replace or modify existing notification require-ments for each authority.]

SEC. [503]*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).

SEC. [504]*503*. (a) None of the funds made available in this Act may be used to maintain or establish a computer network unless such network blocks the viewing, downloading, and exchanging of pornography.

    (b) Nothing in subsection (a) shall limit the use of funds necessary for any Federal, State, Tribal, or local law enforcement agency or any other entity carrying out criminal investigations, prosecution, or adjudication activities.

[SEC. 505. (a) Requirements relating to non-Federal cost-share grants and co-operative agreements for the Delta Regional Authority under section 382D of the Agricultural Act of 1961 and Consolidated Farm and Rural Development Act (7 U.S.C. 2009aa-3) are waived for grants awarded in fiscal year 2020 and in sub-sequent years in response to economic distress directly related to the impacts of the Coronavirus Disease (COVID-19).

    (b) Requirements relating to non-Federal cost-share grants and cooperative
agreements for the Northern Border Regional Commission under section 15501(d) of title 40, United States Code, are waived for grants awarded in fiscal year 2020 and in subsequent years in response to economic distress directly related to the impacts of the Coronavirus Disease (COVID-19).

    (c) Requirements relating to non-Federal cost-share grants and cooperative agreements for the Denali Commission are waived for grants awarded in fiscal year 2020 and in subsequent years in response to economic distress directly re-lated to the impacts of the Coronavirus Disease (COVID-19).]

SEC. [506]*504*. Of the unavailable collections currently in the United States Enrichment Corporation Fund, [$291,000,000] $415,670,000 shall be transferred to and merged with the Uranium Enrichment Decontamination and Decommis-sioning Fund and shall be available only to the extent provided in advance in ap-propriations Acts.