

URANIUM ENRICHMENT DECONTAMINATION AND DECOMMISSIONING FUND

The agreement provides \$841,000,000 for activities funded from the Uranium Enrichment Decontamination and Decommissioning Fund. Within available funds, the agreement provides \$134,701,000 for East Tennessee Technology Park to continue cleanup and demolition of all remaining facilities, including the K-1200 complex and the K-1600 complex, and to conduct remedial actions and site closure activities. Within funds available for Pensions and Community and Regulatory Support, the agreement provides an additional \$10,000,000 above the budget request to ensure contractor pensions are adequately funded and up to an additional \$2,219,000 for community support at Portsmouth.

SCIENCE

The agreement provides \$7,026,000,000 for the Office of Science.

Additional direction related to Department-wide crosscutting initiatives is provided under the heading Crosscutting Initiatives in the front matter of Department of Energy.

The Department is directed to provide to the Committees on Appropriations of both Houses of Congress a briefing that details all programs, projects, and activities to be funded in the Office of Science that are not directed by this recommendation or explicitly included in the fiscal year 2021 budget request. The plan shall be provided not later than 90 days after enactment of this Act.

Artificial Intelligence and Machine Learning.—The agreement provides not less than \$100,000,000 for Artificial Intelligence and Machine Learning capabilities across the Office of Science Programs. The Department is directed to apply those capabilities to the Office of Science's mission with a focus on accelerating scientific discovery in its Scientific User Facilities and large experiments.

Biomedical Sciences.—The Department is encouraged to expand its relationships with the National Institutes of Health (NIH) in order to work together more strategically to leverage the Department's research capabilities, including instrumentation, materials, modeling and simulation, and data science. The agreement supports the budget request proposal of \$1,000,000 for collaboration with NIH within the Department's data and computational mission space.

Exascale Computing Initiative.—The agreement provides not less than \$474,945,000 for exascale activities.

Quantum Information Science.—The agreement provides not less than \$245,000,000 for the Office of Science's coordinated and focused research program in quantum information science. Within these available funds, the agreement provides not less than \$120,000,000 for research and \$125,000,000 for five National Quantum Information Science Research Centers. To the greatest extent practical, this effort shall be undertaken in coordination with the National Science Foundation and the National Institute of Standards and Technology. Further, the Department is directed to collaborate with private sector stakeholders, the user community and interagency partners, to develop a roadmap to provide researchers

access to quantum systems so as to enhance the U.S. quantum research enterprise, stimulate the fledgling U.S. quantum computing industry, educate the future quantum computing workforce, and accelerate advancement of quantum computer capabilities. The Department is directed to brief the Committees on Appropriations of both Houses of Congress not later than 90 days after enactment of this Act on such a roadmap.

Strategic Partnership Projects.—The Department is directed to provide to the Committees on Appropriations of both Houses of Congress not later than 30 days after enactment of this Act a briefing inventorying all Strategic Partnership Projects that have not received payment sufficient to cover completed work and how the Department plans to recoup any insufficient payments. This is the only direction related to Strategic Partnership Projects.

Distinguished Scientist Program.—The agreement provides \$4,000,000 to support the Department's Distinguished Scientist Program.

Negative Emissions Technology.—The agreement provides not less than \$22,500,000 in Basic Energy Sciences and Biological and Environmental Research for research and development of negative emissions technologies, including not less than \$7,500,000 for direct air capture. The Office of Science is directed to continue to collaborate with the Office of Fossil Energy and the Office of Energy Efficiency and Renewable Energy to support research, development, and demonstration projects to advance the development and commercialization of carbon removal technologies on a significant scale.

ADVANCED SCIENTIFIC COMPUTING RESEARCH

The agreement supports ASCR's leadership in emerging areas relevant to the Department's mission, including artificial intelligence and quantum information science. The agreement supports ASCR's pursuit of machine learning tools for scientific applications and its support for the development of algorithms for future deployable quantum computers. The agreement recognizes that a robust research program in applied and computational mathematics and computer science will be critical to continued progress in these areas and is supportive of the Department's efforts to prioritize these programs.

High Performance Computing and Network Facilities.—The agreement provides not less than \$150,000,000 for the Argonne Leadership Computing Facility, not less than \$225,000,000 for the Oak Ridge Leadership Computing Facility, not less than \$110,000,000 for the National Energy Research Scientific Computing Center, and \$90,000,000 for ESnet.

Mathematical, Computational, and Computer Sciences Research.—The agreement provides not less than \$250,000,000 for Mathematical, Computational, and Computer Sciences Research, including not less than \$10,000,000 for the Computational Science Graduate Fellowship program. The agreement provides up to \$40,000,000 for the development of AI-optimized emerging memory technology for AI-specialized hardware to drive national competitiveness.

BASIC ENERGY SCIENCES

The agreement provides \$24,088,000 for the Batteries and Energy Storage Innovation Hub, \$20,000,000 for the Fuels from Sunlight Energy Innovation Hub, and \$115,000,000 for the Energy Frontier Research Centers. The agreement supports the EPSCoR program and its goals of broadening participation in sustainable and competitive basic energy research in eligible jurisdictions. The Department is directed to continue annual or at minimum, biennial implementation grant solicitations for the EPSCoR program.

The agreement provides not less than \$525,000,000 for facilities operations of the nation's light sources, not less than \$292,000,000 for facilities operations of the high flux neutron sources, and not less than \$139,000,000 for facilities operations of the Nanoscale Science Research Centers (NSRCs).

The agreement provides not less than \$19,000,000 for other project costs, including \$3,000,000 for Proton Power Upgrade, \$2,000,000 for Linac Coherent Light Source-II HE, \$13,000,000 for Second Target Station, and \$1,000,000 for Cryomodule Repair & Maintenance Facility. The agreement provides not less than \$5,000,000 for NSRC Recapitalization and not less than \$5,500,000 for NSLS-II Experimental Tools-II.

The agreement provides \$26,000,000 for exascale systems.

The Department is directed to continue supporting the construction of additional beamlines in future budget requests so the nation's scientists can more fully leverage the investment that has been made in the NSLS II while it is the most powerful X-Ray light source in the nation.

The Department is encouraged to explore opportunities to develop an autonomous chemistry and materials synthesis platform. The capabilities will leverage advances in artificial intelligence to enable greater efficiencies and scientific throughput, leading to significant reduction of the total time and cost in novel materials discovery and innovation.

The Department is encouraged to continue funding to support research and development needs of graduate and postgraduate science programs at Historically Black Colleges and Universities.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

The agreement provides not less than \$390,000,000 for Biological Systems Science and not less than \$350,000,000 for Earth and Environmental Systems Sciences.

The Department is directed to maintain Genomic Science as a top priority, and the agreement provides not less than \$100,000,000 for Foundational Genomics Research and not less than \$100,000,000 for the Bioenergy Research Centers. The agreement provides not less than \$42,000,000 for Biomolecular Characterization and Imaging Science and not less than \$80,000,000 for the Joint Genome Institute. Within available funds for Biomolecular Characterization and Imaging Science, the agreement provides \$15,000,000 to continue the development of a multi-scale genes-to ecosystems approach that supports a predictive understanding of gene functions and how they scale with complex biological and environmental

systems. The agreement supports the Department's establishment of a national microbiome database collaborative.

The agreement provides not less than \$5,000,000 for low-dose radiation research. The Department is directed to work through the multi-agency sub-working group to develop the proper role and direction for the Department in future low-dose radiation research.

The agreement provides not less than \$78,000,000 for Environmental System Science, of which not less than \$10,000,000 is for Next Generation Ecosystem Experiments Arctic; \$8,300,000 is for the Spruce and Peatland Responses Under Changing Environments field site; \$5,000,000 is to initiate planning and pilot studies for new Terrestrial Ecosystem Science manipulation experiments; \$7,000,000 is for Next Generation Ecosystem Experiments Tropics; \$5,100,000 is for AmeriFLUX Long-Term Earth System Observations; not less than \$3,500,000 is to support ongoing research and discovery related to mercury biogeochemical transformations in the environment; and \$6,800,000 is for Watershed Function Science Focus Area.

The agreement provides \$15,000,000 for cloud-aerosol research and computing.

The recommendation includes \$30,000,000 for ongoing efforts to develop observational assets and associated research to study the nation's major land-water interfaces, including the Great Lakes and the Puget Sound, that leverages national laboratories' assets as well as local infrastructure and expertise at universities and other research institutions.

The Department is encouraged to continue to support the River Corridor Science Focus Area. The Department is encouraged to develop an integrated mountainous hydrology focus, which extends observations and models and leverages collaborations supported by other Federal agencies.

The Department is directed to submit to the Committees on Appropriations of both Houses of Congress not later than 90 days after enactment of this Act a report that outlines the activities previously conducted under the Energy-Water Nexus across the Department, which activities have continued, which activities ended, and an explanation for the termination of each activity that ended. The Department is directed to coordinate all energy-water nexus activities across the Offices of Energy Efficiency and Renewable Energy, Electricity, Fossil Energy, Nuclear Energy, Science, and any other relevant program offices.

The agreement provides up to \$6,000,000 to advance biological and environmental capabilities through the development and prototyping of fabricated ecosystems and sensors that enable interrogation of biological-environmental interactions across molecular to ecosystem-relevant scales under controlled laboratory conditions.

The agreement provides \$15,000,000 to support the exascale computing initiative. The Department is directed to enhance investments in machine learning to advance the use of diverse and increasingly autonomous datasets to understand environmental and climate dynamics; rapidly incorporate datasets into predictive watershed, ecosystem, and climate models; and project the onset of and track extreme events, such as atmospheric rivers and hurricanes.

The Department is encouraged to increase its funding for academia to perform independent evaluations of climate models using existing data sets and peer-reviewed publications of climate-scale processes to determine various models' ability to reproduce the actual climate. The Department is encouraged to establish an Earth System Grid Federation node for Arctic climate data. Given the clear synergies and overlap of missions, the Department is encouraged to increase collaboration with the National Oceanic and Atmospheric Administration (NOAA) in its climate research and modeling efforts.

FUSION ENERGY SCIENCES

The agreement provides not less than \$20,000,000 for the High-Energy-Density Laboratory Plasmas program to support initiatives in quantum information science, advance cutting-edge research in extreme states of matter, expand the capabilities of the LaserNetUS facilities, and provide initial investments in new intense, ultrafast laser technologies needed to retain U.S. leadership in these fields. To maintain U.S. leadership in intense, ultrafast lasers, the Department is directed to submit to the Committees on Appropriations of both Houses of Congress not later than 180 days after enactment of this Act a report describing the Department's plans to respond to the recommendations of the Brightest Light Initiative Workshop Report, including facility investments and improvements needed to advance laser science technology and applications.

The agreement provides \$65,000,000 for NSTX-U operations and not less than \$21,000,000 for the Materials Plasma Exposure eXperiment. The Department is encouraged to support optimal facility operations levels for DIII-D.

The agreement provides \$4,000,000 for the Innovation Network for Fusion Energy (INFUSE) research and development program. The Fusion Energy Sciences Advisory Committee was previously directed to give full consideration to the establishment of a cost-share program for reactor technologies as part of the ongoing long-range strategic planning activity. The Department is encouraged to take into account the long-range strategic plan when developing future budget requests.

The agreement provides \$242,000,000 for the U.S. contribution to the ITER project, of which \$60,000,000 is for in-cash contributions. The Department is directed to provide to the Committees on Appropriations of both Houses of Congress not later than 180 days after enactment of this Act the performance baseline for the entire project, including an updated baseline for Subproject 1 and a baseline for Subproject 2.

HIGH ENERGY PHYSICS

The agreement provides not less than \$30,000,000 for the Sanford Underground Research Facility; \$16,000,000 for the Facility for Advanced Accelerator Experimental Tests-II; not less than \$6,000,000 for Cosmic Microwave Background-Stage 4; \$12,000,000 for the Dark Energy Spectroscope Instrument; \$6,000,000 for Lux Zeplin; and not less than \$18,500,000 for Vera C. Rubin Observatory operations. The agreement provides no direction for the HL-LHC Upgrade projects. The agreement supports activities toward the completion of the Large Synoptic Survey Telescope and Super Cryogenic Dark Matter Search projects.

The agreement notes the longstanding planning and contributions of resources by partner organizations with respect to data management on the Vera C. Rubin Observatory. The Department is directed to employ the computational expertise and existing capabilities in data management of the Vera C. Rubin Observatory, potentially in partnership with the national laboratories, to ensure the successful operation of this project and access for the broad research community. The Department is directed to brief the Committees on Appropriations of both Houses of Congress not later than 30 days after enactment of this Act on the status of the project, including plans for management of the data facility.

The Department is strongly urged to maintain a balanced portfolio of small-, medium-, and large-scale experiments and to ensure adequate funding for research performed at universities and the national laboratories. The Department is encouraged to fund facility operations at levels for optimal operations.

NUCLEAR PHYSICS

The Department is directed to give priority to optimizing operations for all Nuclear Physics user facilities.

The agreement provides not less than \$6,600,000 for the Gamma-Ray Energy Tracking Array, \$5,530,000 for sPHENIX, not less than \$5,000,000 for MOLLER, not less than \$1,400,000 for Ton-Scale Neutrino-less Double Beta Decay, not less than \$17,000,000 for the Electron Ion Collider, not less than \$3,000,000 for the High Rigidity Spectrometer, and \$3,000,000 for the U.S. Stable Isotope Production and Research Center. The agreement supports activities toward the completion of the Muon to Electron Conversion Experiment.

The agreement provides not less than \$1,000,000 to establish a traineeship program for students to develop the future workforce of radioisotope production. Further, the Department is directed to provide a plan to the Committees on Appropriations of both Houses of Congress not later than 180 days after enactment of this Act to develop a consortium of research universities to apply advanced manufacturing techniques to radioisotope production, including automation, digitalization, artificial intelligence, fabrication, and state-of-the-art characterization instrumentation. This is the only direction related to a consortium of research universities to apply advanced manufacturing techniques to radioisotope production.

WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS

The agreement provides \$29,000,000 for Workforce Development for Teachers and Scientists. Within available funds, the agreement provides \$13,800,000 for Science Undergraduate Laboratory Internships, \$1,900,000 for Community College Internships, \$4,600,000 for the Graduate Student Research Program, \$1,800,000 for the Visiting Faculty Program, \$1,200,000 for the Albert Einstein Distinguished Educator Fellowship, \$2,900,000 for the National Science Bowl, \$700,000 for Technology Development and Online Application, \$600,000 for Evaluation Studies, and \$1,500,000 for Outreach.

The Department is directed to widely publicize its opportunities and diversify the applicant pool, with an emphasis on targeted recruitment of individuals traditionally underrepresented in STEM.

Further, the Department was previously directed in the fiscal year 2020 Act to provide to the Committees on Appropriations of both Houses of Congress a report on the how the Office of Science plans to comply with Executive Order 13853 to develop a pipeline to meet future needs in trade craft requirements and workforce development in coordination with the national laboratories. The Department is encouraged to submit the report expeditiously.

Within available funds for Outreach, the Department is directed to establish a working group comprised of the Office of Science and national laboratories and a consortium of universities to assist universities in the development of a curriculum to promote the next generation of scientists utilizing artificial intelligence, quantum information science, and machine learning. The Department is directed to provide to the Committees on Appropriations of both Houses of Congress not later than 180 days after enactment of this Act a report and briefing on a plan to meet universities' educational curriculum needs to support this future scientific workforce.

SCIENCE LABORATORIES INFRASTRUCTURE

In future budget requests, the Office of Science is directed to work with the Office of Nuclear Energy to demonstrate a commitment to operations and maintenance of nuclear facilities at Oak Ridge National Laboratory that supports multiple critical missions. The Department is directed to provide to the Committees on Appropriations of both Houses of Congress not later than 180 days after enactment of this Act a briefing on the funding levels required for operations and maintenance of Oak Ridge National Laboratory nuclear facilities.

Within available funds for General Plant Projects, the Department is directed to prioritize projects related to power resilience.

DEPARTMENT OF ENERGY

(Amounts in thousands)

	FY 2020 Enacted	FY 2021 Request	Final Bill	Final Bill vs Enacted	Final Bill vs Request
20-U-401 On-site Waste Disposal Facility (Cell Line 2&3).....	10,000	16,500	16,500	+6,500	---
Subtotal, Portsmouth.....	418,295	414,993	430,332	+12,037	+15,339
Pension and Community and Regulatory Support.....	21,762	18,748	30,967	+9,205	+12,219
Title X Uranium/Thorium Reimbursement Program.....	5,250	21,284	5,000	-250	-16,284
TOTAL, UED&D FUND.....	881,000	806,244	841,000	-40,000	+34,756

SCIENCE

Advanced Scientific Computing Research:					
Research.....	791,265	819,106	846,055	+54,790	+26,949
Construction:					
17-SC-20 Office of Science Exascale Computing Project (SC-ECP).....	188,735	168,945	168,945	-19,790	---
Subtotal, Advanced Scientific Computing Research.....	980,000	988,051	1,015,000	+35,000	+26,949
Basic Energy Sciences:					
Research.....	1,853,000	1,751,673	1,856,000	+3,000	+104,327
Construction:					
13-SC-10 LINAC coherent light source II (LCLS-II), SLAC.....	---	---	33,000	+33,000	+33,000

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(Amounts in thousands)

	FY 2020 Enacted	FY 2021 Request	Final Bill	Final Bill vs Enacted	Final Bill vs Request
18-SC-10 Advanced Photon Source Upgrade (APS-U), ANL.....	170,000	150,000	160,000	-10,000	+10,000
18-SC-11 Spallation Neutron Source Proton Power Upgrade (PPU), ORNL.....	60,000	5,000	52,000	-8,000	+47,000
18-SC-12 Advanced Light Source Upgrade (ALS-U), LBNL.....	60,000	13,000	62,000	+2,000	+49,000
18-SC-13 Linac Coherent Light Source-II-High Energy (LCLS-II-HE), SLAC.....	50,000	14,000	52,000	+2,000	+38,000
19-SC-14 Second Target Station (STS), ORNL.....	20,000	1,000	29,000	+9,000	+28,000
21-SC-10 Cryomodule Repair and Maintenance Facility.....	---	1,000	1,000	+1,000	---
Subtotal, Construction.....	360,000	184,000	389,000	+29,000	+205,000
Subtotal, Basic Energy Sciences.....	2,213,000	1,935,673	2,245,000	+32,000	+309,327
Biological and Environmental Research.....	750,000	516,934	753,000	+3,000	+236,066
Fusion Energy Sciences Research.....	414,000	313,151	415,000	+1,000	+101,849
Construction:					
14-SC-60 U.S. Contributions to ITER (U.S. ITER). 20-SC-61 Matter in Extreme Conditions (MEC) Petawatt Upgrade, SLAC.....	242,000	107,000	242,000	---	+135,000
	15,000	5,000	15,000	---	+10,000
Subtotal, Construction.....	257,000	112,000	257,000	---	+145,000
Subtotal, Fusion Energy Sciences.....	671,000	425,151	672,000	+1,000	+246,849

DEPARTMENT OF ENERGY

(Amounts in thousands)

	FY 2020 Enacted	FY 2021 Request	Final Bill	Final Bill vs Enacted	Final Bill vs Request
High Energy Physics					
Research.....	814,000	697,631	794,000	-20,000	+96,369
Construction:					
11-SC-40 Long Baseline Neutrino Facility / Deep Underground Neutrino Experiment (LBNF/DUNE), FNAL.....	171,000	100,500	171,000	---	+70,500
11-SC-41 Muon to electron conversion experiment, FNAL.....	---	---	2,000	+2,000	+2,000
18-SC-42 Proton Improvement Plan II (PIP-II), FNAL.....	60,000	20,000	79,000	+19,000	+59,000
Subtotal, Construction.....	231,000	120,500	252,000	+21,000	+131,500
Subtotal, High Energy Physics.....	1,045,000	818,131	1,046,000	+1,000	+227,869
Nuclear Physics:					
Research.....	660,000	635,027	690,700	+30,700	+55,673
Construction:					
14-SC-50 Facility for Rare Isotope Beams, MSU...	40,000	5,300	5,300	-34,700	---
20-SC-51 U.S. Stable Isotope Production and Research Center, ORNL.....	12,000	12,000	12,000	---	---
20-SC-52 Electron Ion Collider, BNL.....	1,000	1,000	5,000	+4,000	+4,000
Subtotal, Construction.....	53,000	18,300	22,300	-30,700	+4,000
Subtotal, Nuclear Physics.....	713,000	653,327	713,000	---	+59,673

DEPARTMENT OF ENERGY

(Amounts in thousands)

	FY 2020 Enacted	FY 2021 Request	Final Bill	Final Bill vs Enacted	Final Bill vs Request
Workforce Development for Teachers and Scientists.....	28,000	20,500	29,000	+1,000	+8,500
Science Laboratories Infrastructure:					
Infrastructure Support:					
Payment in Lieu of Taxes.....	4,540	4,650	4,650	+110	---
Oak Ridge Landlord.....	5,610	5,860	5,860	+250	---
Facilities and Infrastructure.....	56,850	6,200	29,790	-27,060	+23,590
Oak Ridge Nuclear Operations.....	26,000	6,000	26,000	---	+20,000
Subtotal, Infrastructure Support.....	93,000	22,710	66,300	-26,700	+43,590
Construction:					
17-SC-71 Integrated Engineering Research Center, FNAL.....	22,000	12,000	10,250	-11,750	-1,750
18-SC-71 Energy Sciences Capability, PNNL.....	23,000	23,000	23,000	---	---
19-SC-71 Science User Support Center, BNL.....	20,000	7,000	20,000	---	+13,000
19-SC-72 Electrical Capacity and Distribution Capability, ANL.....	30,000	---	---	-30,000	---
19-SC-73 Translational Research Capability, ORNL..	25,000	10,000	22,000	-3,000	+12,000
19-SC-74 BioEPIC, LBNL.....	15,000	6,000	20,000	+5,000	+14,000
20-SC-71 Critical Utilities Rehabilitation Project, BNL.....	20,000	15,000	20,000	---	+5,000
20-SC-72 Seismic and Safety Modernization, LBNL..	10,000	10,000	5,000	-5,000	-5,000
20-SC-73 CEBAF Renovation and Expansion, TJNAF ..	2,000	2,000	2,000	---	---
20-SC-74 Craft Resources Support Facility, ORNL ..	15,000	25,000	25,000	+10,000	---
20-SC-75 Large Scale Collaboration Center, SLAC ..	11,000	8,000	11,000	---	+3,000

DEPARTMENT OF ENERGY

(Amounts in thousands)

	FY 2020 Enacted	FY 2021 Request	Final Bill	Final Bill vs Enacted	Final Bill vs Request
20-SC-76 Tritium System Demolition and Disposal, PPPL.....	13,000	19,400	13,000	---	-6,400
20-SC-77 Argonne Utilities Upgrade, ANL	500	2,000	500	---	-1,500
20-SC-78 Linear Assets Modernization Project, LBNL	500	2,000	500	---	-1,500
20-SC-79 Critical Utilities Infrastructure Revitalization, SLAC	500	2,000	500	---	-1,500
20-SC-80 Utilities Infrastructure Project, FNAL ..	500	2,000	500	---	-1,500
21-SC-71 Princeton Plasma Innovation Center, PPPL	---	2,000	150	+150	-1,850
21-SC-72 Critical Infrastructure Recovery & Renewal, PPPL.....	---	2,000	150	+150	-1,850
21-SC-73 Ames Infrastructure Modernization.....	---	2,000	150	+150	-1,850
Subtotal, Construction:.....	208,000	151,400	173,700	-34,300	+22,300
Subtotal, Science Laboratories Infrastructure.	301,000	174,110	240,000	-61,000	+65,890
Safeguards and Security.....	112,700	115,623	121,000	+8,300	+5,377
Program Direction.....	186,300	190,306	192,000	+5,700	+1,694
TOTAL, SCIENCE.....	7,000,000	5,837,806	7,026,000	+26,000	+1,188,194
NUCLEAR WASTE DISPOSAL.....	---	27,500	27,500	+27,500	---
ADVANCED RESEARCH PROJECTS AGENCY-ENERGY					
ARPA-E Projects.....	390,000	---	392,000	+2,000	+392,000
Program Direction.....	35,000	21,256	35,000	---	+13,744