to enable the design, discovery, and development of new materials and chemical systems; and

(ii) focus on overcoming challenges and maximizing the benefits of exascale and other high performance computing underpinned by accelerated node technologies.

(B) Selection

The Director shall select centers under subparagraph (A) on a competitive, merit-reviewed basis. The Director shall consider applications from the National Laboratories, institutions of higher education, multi-institutional collaborations, and other appropriate entities.

(C) Duration

(i) New centers

A center selected under subparagraph (A) shall receive support for a period of not more than 5 years beginning on the date of establishment of that center, subject to the availability of appropriations.

(ii) Existing centers

A center already in existence on August 9, 2022, may continue to receive support for a period of not more than 5 years beginning on the date of establishment of that center.

(D) Renewal

Upon the expiration of any period of support of a center under this subsection, the Director may renew support for the center, on a merit-reviewed basis, for a period of not more than 5 years.

(i) Materials research database

(1) In general

The Director shall support the development of a web-based platform to develop and provide access to a database of computed information on known and predicted materials properties and computational tools to accelerate breakthroughs in materials discovery and design.

(2) Program

In carrying out this subsection, the Director shall—

(A) conduct cooperative research among National Laboratories, industry, academia, and other research institutions to advance understanding, prediction, and manipulation of materials and facilitate the design of novel materials;

(B) develop and maintain data infrastructure at user facilities that generate data to collect, analyze, label, and otherwise prepare the data for inclusion in the database;

(C) leverage existing high performance computing systems to conduct high throughput calculations, and develop computational and data mining algorithms for the prediction of material properties;

(D) strengthen the foundation for new technologies and advanced manufacturing; and

(E) drive the development of advanced materials for applications that span the Department's missions in energy, environment, and national security.

(3) Coordination

In carrying out this subsection, the Director shall leverage programs and activities across the Department, including computational materials and chemical sciences centers established under subsection (h).

(4) Funding

Out of funds authorized to be appropriated under subsection (j), there is authorized to be appropriated to the Secretary to carry out activities under this subsection $10,000,000 for each of fiscal years 2023 through 2027.

(j) Authorization of appropriations

Out of funds authorized to be appropriated to the Office of Science in a fiscal year, there are authorized to be appropriated to the Secretary to carry out the activities described in this section—

(1) $2,685,414,000 for fiscal year 2023;
(2) $2,866,890,840 for fiscal year 2024;
(3) $2,987,727,170 for fiscal year 2025;
(4) $3,062,732,781 for fiscal year 2026; and
(5) $3,080,067,167 for fiscal year 2027.

(Pub. L. 115–246, title III, § 303, Sept. 28, 2018, 132 Stat. 3140; Pub. L. 117–167, div. B, title I, § 10102(a), Aug. 9, 2022, 136 Stat. 1409.)

Editorial Notes

CODIFICATION

Section is comprised of section 303 of Pub. L. 115–246. Subsecs. (f) and (g) of section 303 of Pub. L. 115–246 generally amended sections 16313 and 16315 of this title, respectively, and amended the table of contents for the Energy Policy Act of 2005. Originally, only subsecs. (a) to (c) of section 303 of Pub. L. 115–246 were classified to this section, but the amendments made by Pub. L. 117–167 prompted the reclassification of all of section 303 to this section, with the omission of subsecs. (f) and (g). See 2022 Amendment notes below.

AMENDMENTS

2022—Subsecs. (a) to (d). Pub. L. 117–167, § 10102(a)(1), (2), added subsecs. (a) and (b) and redesignated former subsecs. (a) and (b) as (c) and (d), respectively. Former subsec. (d) redesignated (f).

Subsec. (d)(3)(D), (E). Pub. L. 117–167, § 10102(a)(3)(A), added subpar. (D) and redesignated former subpar. (D) as (E).

Subsec. (d)(4) to (11). Pub. L. 117–167, § 10102(a)(3)(B), added pars. (4) to (11).

Subsecs. (e) to (g). Pub. L. 117–167, § 10102(a)(1), redesignated subsec. (c) and omitted subsecs. (d) and (e) as (e) to (g), respectively.

Subsecs. (h) to (j). Pub. L. 117–167, § 10102(a)(4), added subsecs. (h) to (j).

§ 18642. Advanced scientific computing research

(a) In general

As part of the activities authorized under section 7139 of this title, the Director shall carry out, in coordination with academia and relevant public and private sector entities, a research, development, and demonstration program—

(1) to steward applied mathematics, computational science, and computer science research relevant to the missions of the Department and the competitiveness of the United States;

(2) to develop modeling, simulation, and other computational tools relevant to other

scientific disciplines and to the development of new energy technologies and other technologies;

(3) to advance computing and networking capabilities for data-driven discovery; and

(4) to develop advanced scientific computing hardware and software tools for science and engineering.

(b) Omitted

(c) High-performance computing and networking research

(1) Director

The Director shall support research in high-performance computing and networking relevant to energy applications, including modeling, simulation, and advanced data analytics for basic and applied energy research programs carried out by the Secretary.

(2) Coordination

The Under Secretary for Science shall ensure the coordination of the activities of the Department, including activities under this section, to determine and meet the computational and networking research and facility needs of the Office of Science and all other relevant energy technology and energy efficiency programs within the Department and with other Federal agencies as appropriate.

(d) Applied mathematics and software development for high-end computing systems and computer sciences research

(1) In general

The Director shall carry out activities to develop, test, and support—

(A) mathematics, statistics, and algorithms for modeling complex systems relevant to the missions of the Department, including on advanced computing architectures; and

(B) tools, languages, programming environments, and operations for high-end computing systems (as defined in section 5541 of title 15).

(2) Portfolio balance

(A) In general

The Director shall maintain a balanced portfolio within the advanced scientific computing research and development program established under section 976 of the Energy Policy Act of 2005 (42 U.S.C. 16316)[1] that supports robust investment in—

(i) applied mathematical, computational, and computer sciences research needs relevant to the mission of the Department, including foundational areas that are critical to the advancement of energy sciences and technologies and new and emerging computing technologies; and

(ii) associated high-performance computing hardware and facilities.

(B) Exascale ecosystem sustainment

(i) Sense of Congress

It is the sense of Congress that the Exascale Computing Project has successfully created a broad ecosystem that provides shared software packages, novel evaluation systems, and applications relevant to the science and engineering requirements of the Department, and that such products must be maintained and improved in order that the full potential of the deployed systems can be continuously realized.

(ii) Sustainment

The Secretary shall seek to sustain and evolve the ecosystem described in clause (i) to ensure that the exascale software stack and other research software will continue to be maintained, hardened, and otherwise optimized for long-term use on exascale systems and beyond and reliable availability to the user community.

(e) Advanced computing program

(1) In general

The Secretary shall establish a program to develop and implement a strategy for achieving computing systems with capabilities beyond exascale computing systems. In establishing this program, the Secretary shall—

(A) maintain foundational research programs in mathematical, computational, and computer sciences focused on new and emerging computing needs within the mission of the Department, including post-Moore's law computing architectures, novel approaches to modeling and simulation, artificial intelligence and scientific machine learning, quantum computing, edge computing, extreme heterogeneity, including potential quantum accelerators, and distributed high-performance computing;

(B) retain best practices and maintain support for essential hardware, applications, and software elements of the Exascale Computing Program that are necessary for sustaining the vitality of a long-term capable software ecosystem for exascale and beyond; and

(C) develop a Department-wide strategy for balancing on-premises and cloud-based computing and scientific data management.

(2) Report

Not later than 1 year after August 9, 2022, the Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on the development and implementation of the strategy described in paragraph (1).

(f) Guidance on mitigation of bias in high-performance computing capabilities

In leveraging high-performance computing systems for research purposes, including through the use of machine learning algorithms for data analysis and artificial intelligence, the Secretary shall issue, and ensure adherence to, guidance for the Department, the National Laboratories, and users as to how those capabilities should be employed in a manner that mitigates and, to the maximum extent practicable, avoids harmful algorithmic bias.

[1] See References in Text note below.

(g) Architectural research in heterogeneous computing systems

(1) In general

The Secretary shall carry out a program of research and development in heterogeneous and reconfigurable computing systems to expand understanding of the potential for heterogeneous and reconfigurable computing systems to deliver high performance, high efficiency computing for Department mission challenges. The program shall include research and development that explores the convergence of big data analytics, simulations, and artificial intelligence to drive the design of heterogeneous computing system architectures.

(2) Coordination

In carrying out the program described in paragraph (1), the Secretary shall ensure coordination between research activities undertaken by the Advanced Scientific Computing Research program and materials research supported by the Basic Energy Sciences program within the Office of Science.

(h) Energy efficient computing program

(1) In general

The Secretary shall support a program of fundamental research, development, and demonstration of energy efficient computing and data center technologies relevant to advanced computing applications, including high-performance computing, artificial intelligence, and scientific machine learning.

(2) Execution

(A) Program

In carrying out the program under paragraph (1), the Secretary shall—

(i) establish a partnership for National Laboratories, industry partners, and institutions of higher education for codesign of energy efficient hardware, technology, software, and applications across all applicable program offices of the Department, and provide access to energy efficient computing resources to such partners;

(ii) develop hardware and software technologies that decrease the energy needs of advanced computing practices, including through data center codesign;

(iii) consider multiple heterogeneous computing architectures in collaboration with the program established under subsection (g), including neuromorphic computing, persistent computing, and ultrafast networking; and

(iv) provide, as appropriate, on a competitive, merit-reviewed basis, access for researchers from institutions of higher education, National Laboratories, industry, and other Federal agencies to the energy efficient computing technologies developed pursuant to clause (i).

(B) Selection of partners

In selecting participants for the partnership established under subparagraph (A)(i), the Secretary shall select participants through a competitive, merit review process.

(C) Report

Not later than 1 year after August 9, 2022, the Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on—

(i) the activities conducted under subparagraph (A); and

(ii) the coordination and management of the program under subparagraph (A) to ensure an integrated research program across the Department.

(i) Energy Sciences Network

(1) In general

The Secretary shall provide for upgrades to the Energy Sciences Network user facility in order to meet the research needs of the Department for highly reliable data transport capabilities optimized for the requirements of large-scale science.

(2) Capabilities

In carrying out paragraph (1), the Secretary shall ensure the following capabilities:

(A) To provide high bandwidth scientific networking across the continental United States and the Atlantic Ocean.

(B) To ensure network reliability.

(C) To protect the network infrastructure from cyberattacks.

(D) To manage transport of exponentially increasing levels of data from the Department's National Laboratories and sites, user facilities, experiments, and sensors.

(E) To contribute to the integration of heterogeneous computing frameworks and systems.

(j) Computational Science Graduate Fellowship

(1) In general

The Secretary shall support the Computational Science Graduate Fellowship program in order to facilitate collaboration between graduate students and researchers at the National Laboratories, and contribute to the development of a diverse and inclusive computational workforce to help advance research in all areas of computational science relevant to the mission of the Department, including quantum computing.

(2) Funding

Of the funds authorized to be appropriated for the Advanced Scientific Computing Research Program, there are authorized to be appropriated to the Secretary for carrying out activities under this subsection—

(A) $15,750,000 for fiscal year 2023;

(B) $16,537,500 for fiscal year 2024;

(C) $17,364,375 for fiscal year 2025;

(D) $18,232,594 for fiscal year 2026; and

(E) $19,144,223 for fiscal year 2027.

(k) Authorization of appropriations

Out of funds authorized to be appropriated for the Office of Science in a fiscal year, there are authorized to be appropriated to the Secretary to carry out the activities described in this section—

(1) $1,126,950,000 for fiscal year 2023;

(2) $1,194,109,500 for fiscal year 2024;
(3) $1,265,275,695 for fiscal year 2025;
(4) $1,340,687,843 for fiscal year 2026; and
(5) $1,420,599,500 for fiscal year 2027.

(Pub. L. 115–246, title III, § 304, Sept. 28, 2018, 132 Stat. 3145; Pub. L. 117–167, div. B, title I, § 10104(a), Aug. 9, 2022, 136 Stat. 1433.)

Editorial Notes

REFERENCES IN TEXT

Section 976 of the Energy Policy Act of 2005, referred to in subsec. (d)(2)(A), enacted section 16316 of this title and amended section 5523 of Title 15, Commerce and Trade.

CODIFICATION

Section is comprised of section 304 of Pub. L. 115–246. Subsec. (b) of section 304 of Pub. L. 115–246 amended sections 16316 of this title, sections 5541 and 5542 of Title 15, Commerce and Trade, and provisions set out as a note under section 5501 of Title 15.

AMENDMENTS

2022—Subsecs. (a), (b). Pub. L. 117–167, § 10104(a)(1), (2), added subsec. (a) and redesignated former subsec. (a) as (b). Former subsec. (b) redesignated (c).

Subsec. (c). Pub. L. 117–167, § 10104(a)(1), (3), redesignated subsec. (b) as (c), designated existing provisions par. (1) and inserted heading, and added par. (2). Former subsec. (c) redesignated (d).

Subsec. (d). Pub. L. 117–167, § 10104(a)(1), (4), redesignated subsec. (c) as (d) and amended it generally. Prior to amendment, text read as follows: ''The Director shall carry out activities to develop, test, and support—

''(1) mathematics, models, and algorithms for complex systems and programming environments; and

''(2) tools, languages, and operating systems for high-end computing systems (as defined in section 5541 of title 15).''

Subsecs. (e) to (k). Pub. L. 117–167, § 10104(a)(5), added subsecs. (e) to (k).

§ 18643. High-energy physics

(a) Sense of Congress

It is the sense of Congress that—

(1) the Director should incorporate the findings and recommendations of the report of the Particle Physics Project Prioritization Panel entitled ''Building for Discovery: Strategic Plan for U.S. Particle Physics in the Global Context'' into the planning process of the Department; and

(2) the nations that lead in particle physics by hosting international teams dedicated to a common scientific goal attract the world's best talent and inspire future generations of physicists and technologists.

(b) Program

As part of the activities authorized under section 7139 of this title, the Director shall carry out a research program in elementary particle physics and advanced technology research and development to improve the understanding of the fundamental properties of the universe, including constituents of matter and energy and the nature of space and time.

(c) High energy frontier research

As part of the program described in subsection (b), the Director shall carry out research using high energy accelerators and advanced detectors, including accelerators and detectors that will function as national user facilities, to create and study interactions of elementary particles and investigate fundamental forces.

(d) International collaboration

The Director shall—

(1) as practicable and in coordination with other appropriate Federal agencies as necessary, ensure the access of United States researchers to the most advanced accelerator facilities and research capabilities in the world, including the Large Hadron Collider;

(2) to the maximum extent practicable, continue to leverage United States participation in the Large Hadron Collider, and prioritize expanding international partnerships and investments in the Long-Baseline Neutrino Facility and Deep Underground Neutrino Experiment; and

(3) to the maximum extent practicable, prioritize engagement in collaborative efforts in support of future international facilities that would provide access to the most advanced accelerator facilities in the world to United States researchers.

(e) Neutrino research

The Director shall carry out research activities on rare decay processes and the nature of the neutrino, which may include collaborations with the National Science Foundation or international collaborations.

(f) Cosmic frontier research

The Director shall carry out research activities on the nature of the primary contents of the universe, including the nature of dark energy and dark matter. These activities shall, to the maximum extent practicable, be consistent with the research priorities identified by the High Energy Physics Advisory Panel or the National Academy of Sciences, and may include—

(1) collaborations with the National Aeronautics and Space Administration, the National Science Foundation, or international partners on relevant projects; and

(2) the development of space-based, land-based, water-based, and underground facilities and experiments.

(g) Facility construction and major items of equipment

(1) Projects

Consistent with the Office of Science's project management practices, the Director shall, to the maximum extent practicable, by incorporating the findings and recommendations of the 2014 Particle Physics Project Prioritization Panel (P5) report entitled ''Building for Discovery'', support construction or fabrication of—

(A) an international Long-Baseline Neutrino Facility based in the United States;

(B) the Proton Improvement Plan II;

(C) Second Generation Dark Matter experiments;

(D) the Legacy Survey of Space and Time camera;

(E) upgrades to detectors and other components of the Large Hadron Collider; and

(F) the Cosmic Microwave Background Stage 4 project; and