

115TH CONGRESS
2D SESSION

S. 2503

To establish Department of Energy policy for science and energy research and development programs, and reform National Laboratory management and technology transfer programs, and for other purposes.

IN THE SENATE OF THE UNITED STATES

MARCH 6, 2018

Ms. MURKOWSKI (for herself and Ms. CANTWELL) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

A BILL

To establish Department of Energy policy for science and energy research and development programs, and reform National Laboratory management and technology transfer programs, and for other purposes.

1 *Be it enacted by the Senate and House of Representa-
2 tives of the United States of America in Congress assembled,*

3 **SECTION 1. SHORT TITLE; TABLE OF CONTENTS.**

4 (a) SHORT TITLE.—This Act may be cited as the
5 “Department of Energy Research and Innovation Act”.

6 (b) TABLE OF CONTENTS.—The table of contents of
7 this Act is as follows:

Sec. 1. Short title; table of contents.

See. 2. Definitions.

TITLE I—LABORATORY MODERNIZATION AND TECHNOLOGY TRANSFER

- Sec. 101. Short title.
- Sec. 102. Inclusion of early stage technology demonstration in authorized technology transfer activities.
- Sec. 103. Sense of Congress on accelerating energy innovation.
- Sec. 104. Restoration of laboratory directed research and development program.
- Sec. 105. Research grants database.
- Sec. 106. Technology transfer and transitions assessment.
- Sec. 107. Agreements for commercializing technology pilot program.
- Sec. 108. Short-term cost-share pilot program.

TITLE II—DEPARTMENT OF ENERGY RESEARCH COORDINATION

- Sec. 201. Short title.
- Sec. 202. Protection of information.
- Sec. 203. Crosscutting research and development.
- Sec. 204. Strategic research portfolio analysis and coordination plan.
- Sec. 205. Strategy for facilities and infrastructure.
- Sec. 206. Energy Innovation Hubs.

TITLE III—DEPARTMENT OF ENERGY OFFICE OF SCIENCE POLICY

- Sec. 301. Short title.
- Sec. 302. Mission.
- Sec. 303. Basic energy sciences.
- Sec. 304. Advanced scientific computing research.
- Sec. 305. High-energy physics.
- Sec. 306. Biological and environmental research.
- Sec. 307. Fusion energy.
- Sec. 308. Nuclear physics.
- Sec. 309. Science laboratories infrastructure program.

TITLE IV—NUCLEAR ENERGY INNOVATION CAPABILITIES

- Sec. 401. Short title.
- Sec. 402. Nuclear energy innovation capabilities.

1 SEC. 2. DEFINITIONS.

2 In this Act:

- 3 (1) DEPARTMENT.**—The term “Department”
- 4** means the Department of Energy.
- 5 (2) DIRECTOR.**—The term “Director” means
- 6** the Director of the Office of Science of the Depart-
- 7** ment, except as otherwise indicated.

5 (4) SECRETARY.—The term “Secretary” means
6 the Secretary of Energy.

7 TITLE I—LABORATORY MODER- 8 NIZATION AND TECHNOLOGY 9 TRANSFER

10 SEC. 101. SHORT TITLE.

11 This title may be cited as the "Laboratory Mod-
12 ernization and Technology Transfer Act".

13 SEC. 102. INCLUSION OF EARLY STAGE TECHNOLOGY DEM-
14 ONSTRATION IN AUTHORIZED TECHNOLOGY
15 TRANSFER ACTIVITIES.

16 Section 1001 of the Energy Policy Act of 2005 (42
17 U.S.C. 16391) is amended—

18 (1) by redesignating subsection (g) as sub-
19 section (h); and

20 (2) by inserting after subsection (f) the fol-
21 lowing:

22 "(g) EARLY STAGE TECHNOLOGY DEMONSTRA-
23 TION.—The Secretary shall permit the directors of the Na-
24 tional Laboratories to use funds authorized to support
25 technology transfer within the Department to carry out

1 early stage and precommercial technology demonstration
2 activities to remove technology barriers that limit private
3 sector interest and demonstrate potential commercial ap-
4 plications of any research and technologies arising from
5 National Laboratory activities.”.

6 **SEC. 103. SENSE OF CONGRESS ON ACCELERATING ENERGY**

7 **INNOVATION.**

8 It is the sense of Congress that—

9 (1) although important progress has been made
10 in cost reduction and deployment of clean energy
11 technologies, accelerating clean energy innovation
12 will help meet critical competitiveness, energy secu-
13 rity, and environmental goals;

14 (2) accelerating the pace of clean energy inno-
15 vation in the United States calls for—

16 (A) supporting existing research and devel-
17 opment programs at the Department and the
18 world-class National Laboratories;

19 (B) exploring and developing new path-
20 ways for innovators, investors, and decision-
21 makers to leverage the resources of the Depart-
22 ment for addressing the challenges and com-
23 parative strengths of geographic regions; and

24 (C) recognizing the financial constraints of
25 the Department, regularly reviewing clean en-

1 ergy programs to ensure that taxpayer invest-
2 ments are maximized;

3 (3) the energy supply, demand, policies, mar-
4 kets, and resource options of the United States vary
5 by geographic region;

6 (4) a regional approach to innovation can
7 bridge the gaps between local talent, institutions,
8 and industries to identify opportunities and convert
9 United States investment into domestic companies;
10 and

16 (A) provide clean, affordable, and reliable
17 energy for everyone;

18 (B) promote economic growth;

(C) are critical for energy security; and

20 (D) are sustainable without government
21 support.

22 SEC. 104. RESTORATION OF LABORATORY DIRECTED RE-
23 SEARCH AND DEVELOPMENT PROGRAM

24 (a) IN GENERAL.—Except as provided in subsection
25 (b) the Secretary shall ensure that laboratory operating

1 contractors do not allocate costs of general and adminis-
2 trative overhead to laboratory directed research and devel-
3 opment.

4 (b) EXCEPTION FOR NATIONAL SECURITY LABORA-
5 TORIES.—This section shall not apply to the national secu-
6 rity laboratories with respect to which section 3119 of the
7 National Defense Authorization Act for Fiscal Year 2017
8 (Public Law 114–328) applies.

9 **SEC. 105. RESEARCH GRANTS DATABASE.**

10 (a) IN GENERAL.—The Secretary shall establish and
11 maintain a public database, accessible on the website of
12 the Department, that contains a searchable listing of each
13 unclassified research and development project contract,
14 grant, cooperative agreement, task order for a federally
15 funded research and development center, or other trans-
16 action administered by the Department.

17 (b) REQUIREMENTS.—Each listing described in sub-
18 section (a) shall include, at a minimum, for each listed
19 project, the Department office carrying out the project,
20 the project name, an abstract or summary of the project,
21 funding levels, project duration, contractor or grantee
22 name (including the names of any subcontractors), and
23 expected objectives and milestones.

24 (c) RELEVANT LITERATURE AND PATENTS.—The
25 Secretary shall provide information through the public

1 database established under subsection (a) on relevant lit-
2 erature and patents that are associated with each research
3 and development project contract, grant, or cooperative
4 agreement, or other transaction, of the Department.

5 **SEC. 106. TECHNOLOGY TRANSFER AND TRANSITIONS AS-**
6 **SESSMENT.**

7 Not later than 1 year after the date of enactment
8 of this Act, and as often as the Secretary determines to
9 be necessary thereafter, the Secretary shall transmit to the
10 appropriate committees of Congress a report that includes
11 recommended changes to the policy of the Department and
12 legislative changes to section 1001 of the Energy Policy
13 Act of 2005 (42 U.S.C. 16391) to improve the ability of
14 the Department to successfully transfer new energy tech-
15 nologies to the private sector.

16 **SEC. 107. AGREEMENTS FOR COMMERCIALIZING TECH-**
17 **NOLOGY PILOT PROGRAM.**

18 (a) IN GENERAL.—The Secretary shall carry out the
19 Agreements for Commercializing Technology pilot pro-
20 gram of the Department, as announced by the Secretary
21 on December 8, 2011, in accordance with this section.

22 (b) TERMS.—Each agreement entered into pursuant
23 to the pilot program referred to in subsection (a) shall
24 provide to the contractor of the applicable National Lab-
25 oratory, to the maximum extent determined to be appro-

1 priate by the Secretary, increased authority to negotiate
2 contract terms, such as intellectual property rights, pay-
3 ment structures, performance guarantees, and multiparty
4 collaborations.

5 (c) ELIGIBILITY.—

6 (1) IN GENERAL.—Any director of a National
7 Laboratory may enter into an agreement pursuant
8 to the pilot program referred to in subsection (a).

9 (2) AGREEMENTS WITH NON-FEDERAL ENTI-
10 TIES.—To carry out paragraph (1) and subject to
11 paragraph (3), the Secretary shall permit the direc-
12 tors of the National Laboratories to execute agree-
13 ments with a non-Federal entity, including a non-
14 Federal entity already receiving Federal funding
15 that will be used to support activities under agree-
16 ments executed pursuant to paragraph (1), provided
17 that such funding is solely used to carry out the
18 purposes of the Federal award.

19 (3) RESTRICTION.—The requirements of chap-
20 ter 18 of title 35, United States Code (commonly
21 known as the “Bayh-Dole Act”) shall apply if—

22 (A) the agreement is a funding agreement
23 (as that term is defined in section 201 of that
24 title); and

1 (B) at least one of the parties to the fund-
2 ing agreement is eligible to receive rights under
3 that chapter.

4 (d) SUBMISSION TO SECRETARY.—Each affected di-
5 rector of a National Laboratory shall submit to the Sec-
6 retary, with respect to each agreement entered into under
7 this section—

8 (1) a summary of information relating to the
9 relevant project;

10 (2) the total estimated costs of the project;

11 (3) estimated commencement and completion
12 dates of the project; and

15 (e) CERTIFICATION.—The Secretary shall require the
16 contractor of the affected National Laboratory to certify
17 that each activity carried out under a project for which
18 an agreement is entered into under this section—

19 (1) is not in direct competition with the private
20 sector; and

21 (2) does not present, or minimizes, any appar-
22 ent conflict of interest, and avoids or neutralizes any
23 actual conflict of interest, as a result of the agree-
24 ment under this section.

1 (f) EXTENSION.—The pilot program referred to in
2 subsection (a) shall be extended until September 30, 2019.

3 (g) REPORTS.—

4 (1) OVERALL ASSESSMENT.—Not later than 60
5 days after the date described in subsection (f), the
6 Secretary, in coordination with directors of the Na-
7 tional Laboratories, shall submit to the appropriate
8 committees of Congress a report that—

9 (A) assesses the overall effectiveness of the
10 pilot program referred to in subsection (a);

11 (B) identifies opportunities to improve the
12 effectiveness of the pilot program;

13 (C) assesses the potential for program ac-
14 tivities to interfere with the responsibilities of
15 the National Laboratories to the Department;
16 and

17 (D) provides a recommendation regarding
18 the future of the pilot program.

19 (2) TRANSPARENCY.—The Secretary, in coordi-
20 nation with directors of the National Laboratories,
21 shall submit to the appropriate committees of Con-
22 gress an annual report that accounts for all
23 incidences of, and provides a justification for, non-
24 Federal entities using funds derived from a Federal

1 contract or award to carry out agreements pursuant
2 to this section.

3 **SEC. 108. SHORT-TERM COST-SHARE PILOT PROGRAM.**

4 (a) IN GENERAL.—Section 988(b) of the Energy Pol-
5 icy Act of 2005 (42 U.S.C. 16352(b)) is amended—

6 (1) in paragraph (1), by striking “Except as
7 provided in paragraphs (2) and (3)” and inserting
8 “Except as provided in paragraphs (2), (3), and
9 (4)”; and

10 (2) by adding at the end the following:

11 “(4) EXEMPTION FOR INSTITUTIONS OF HIGH-
12 ER EDUCATION AND OTHER NONPROFIT INSTITU-
13 TIONS.—

14 (A) IN GENERAL.—Paragraph (1) shall
15 not apply to a research or development activity
16 performed by an institution of higher education
17 or nonprofit institution (as defined in section 4
18 of the Stevenson-Wydler Technology Innovation
19 Act of 1980 (15 U.S.C. 3703)).

20 (B) TERMINATION DATE.—The exemp-
21 tion under subparagraph (A) shall apply during
22 the 2-year period beginning on the date of en-
23 actment of this paragraph.”.

24 (b) REPORTS.—

17 **TITLE II—DEPARTMENT OF EN-**
18 **ERGY RESEARCH COORDINA-**
19 **TION**

20 SEC. 201. SHORT TITLE.

21 This title may be cited as the “Department of Energy
22 Research Coordination Act”.

23 SEC. 202. PROTECTION OF INFORMATION.

24 Section 5012 of the America Competes Act (42
25 U.S.C. 16538) is amended—

5 (3) by inserting after subsection (m) the fol-
6 lowing:

7 “(n) PROTECTION OF INFORMATION.—The following
8 types of information collected by ARPA-E from recipients
9 of financial assistance awards shall be considered commer-
10 cial and financial information obtained from a person and
11 privileged or confidential and not subject to disclosure
12 under section 552(b)(4) of title 5, United States Code:

13 “(1) Plans for commercialization of technologies
14 developed under the award, including business plans,
15 technology-to-market plans, market studies, and cost
16 and performance models.

17 “(2) Investments provided to an awardee from
18 third parties (such as venture capital firms, hedge
19 funds, and private equity firms), including amounts
20 and the percentage of ownership of the awardee pro-
21 vided in return for the investments.

22 “(3) Additional financial support that the
23 awardee—

1 “(B) is seeking from third parties.

2 “(4) Revenue from the licensing or sale of new
3 products or services resulting from research con-
4 ducted under the award.”.

5 **SEC. 203. CROSCUTTING RESEARCH AND DEVELOPMENT.**

6 (a) IN GENERAL.—The Secretary shall use the capa-
7 bilities of the Department to identify strategic opportuni-
8 ties for collaborative research, development, demonstra-
9 tion, and commercial application of innovative science and
10 technologies.

11 (b) EXISTING PROGRAMS; COORDINATION OF ACTIVI-
12 TIES.—To the maximum extent practicable, the Secretary
13 shall seek—

14 (1) to leverage existing programs of the Depart-
15 ment; and

16 (2) to consolidate and coordinate activities
17 throughout the Department to promote collaboration
18 and crosscutting approaches within programs of the
19 Department.

20 (c) ADDITIONAL ACTIONS.—The Secretary shall—

21 (1) prioritize activities that use all affordable
22 domestic resources;

23 (2) develop a planning, evaluation, and tech-
24 nical assessment framework for setting objective

1 long-term strategic goals and evaluating progress
2 that—

3 (A) ensures integrity and independence;

4 and

5 (B) provides the flexibility to adapt to
6 market dynamics;

7 (3) ensure that activities shall be undertaken in
8 a manner that does not duplicate other activities
9 within the Department or other Federal Government
10 activities; and

11 (4) identify programs that may be more effec-
12 tively left to the States, industry, nongovernmental
13 organizations, institutions of higher education, or
14 other stakeholders.

15 **SEC. 204. STRATEGIC RESEARCH PORTFOLIO ANALYSIS**

16 **AND COORDINATION PLAN.**

17 The Energy Policy Act of 2005 is amended by strik-
18 ing section 994 (42 U.S.C. 16358) and inserting the fol-
19 lowing:

20 **“SEC. 994. STRATEGIC RESEARCH PORTFOLIO ANALYSIS**

21 **AND COORDINATION PLAN.**

22 “(a) IN GENERAL.—The Secretary shall periodically
23 review all of the science and technology activities of the
24 Department in a strategic framework that takes into ac-
25 count—

1 “(1) the frontiers of science to which the De-
2 partment can contribute;

3 “(2) the national needs relevant to the statu-
4 tory missions of the Department; and

5 “(3) global energy dynamics.

6 “(b) COORDINATION ANALYSIS AND PLAN.—

7 “(1) IN GENERAL.—As part of the review under
8 subsection (a), the Secretary shall develop a plan to
9 improve coordination and collaboration in research,
10 development, demonstration, and commercial appli-
11 cation activities across organizational boundaries of
12 the Department.

13 “(2) PLAN CONTENTS.—The plan developed
14 under paragraph (1) shall describe—

15 “(A) crosscutting scientific and technical
16 issues and research questions that span more
17 than one program or major office of the De-
18 partment;

19 “(B) ways in which the applied technology
20 programs of the Department are coordinating
21 activities and addressing the questions referred
22 to in subparagraph (A);

23 “(C) ways in which the technical inter-
24 change within the Department, particularly be-
25 tween the Office of Science and the applied

1 technology programs, could be enhanced, in-
2 cluding ways in which the research agendas of
3 the Office of Science and the applied programs
4 could better interact and assist each other;

5 “(D) ways in which the Secretary would
6 ensure that the overall research agenda of the
7 Department includes, in addition to funda-
8 mental, curiosity-driven research, fundamental
9 research related to topics of concern to the ap-
10 plied programs, and applications in Depart-
11 mental technology programs of research results
12 generated by fundamental, curiosity-driven re-
13 search;

14 “(E) critical assessments of any ongoing
15 programs that have experienced subpar per-
16 formance or cost overruns of 10 percent or
17 more over one or more years;

18 “(F) any activities that may be more effec-
19 tively left to the States, industry, nongovern-
20 mental organizations, institutions of higher edu-
21 cation, or other stakeholders; and

22 “(G) detailed evaluations and proposals for
23 innovation hubs, institutes, and research cen-
24 ters of the Department, including—

1 “(i) an affirmation that the hubs, in-
2 stitutes, and research centers will—
3 “(I) advance the mission of the
4 Department; and
5 “(II) prioritize research, develop-
6 ment, and demonstration; and
7 “(ii) an affirmation that any hubs, in-
8 stitutes, or research centers that are estab-
9 lished or renewed within the Office of
10 Science are consistent with the mission of
11 the Office of Science described in sub-
12 section (c) of section 209 of the Depart-
13 ment of Energy Organization Act (42
14 U.S.C. 7139).

15 “(c) SUBMISSION TO CONGRESS.—Every 4 years, the
16 Secretary shall submit to Congress—
17 “(1) the results of the review under subsection
18 (a); and
19 “(2) the coordination plan under subsection
20 (b).”.

21 **SEC. 205. STRATEGY FOR FACILITIES AND INFRASTRUC-**
22 **TURE.**

23 (a) AMENDMENTS.—Section 993 of the Energy Pol-
24 icy Act of 2005 (42 U.S.C. 16357) is amended—

4 (2) in subsection (b)(1), by striking “2008”
5 and inserting “2018”.

6 (b) CLERICAL AMENDMENT.—The table of contents
7 in section 1(b) of the Energy Policy Act of 2005 is amend-
8 ed by striking the item relating to section 993 and insert-
9 ing the following:

“Sec. 993. Strategy for facilities and infrastructure.”.

10 SEC. 206. ENERGY INNOVATION HUBS.

11 (a) DEFINITIONS.—In this section:

12 (1) ADVANCED ENERGY TECHNOLOGY.—The
13 term “advanced energy technology” means—

14 (A) an innovative technology—

15 (i) that produces energy from solar,
16 wind, geothermal, biomass, tidal, wave,
17 ocean, or other renewable energy resources;

18 (ii) that produces nuclear energy;

19 (iii) for carbon capture and sequestra-
20 tion;

21 (iv) that enables advanced vehicles,
22 vehicle components, and related tech-
23 nologies that result in significant energy
24 savings;

1 (v) that generates, transmits, distrib-
2 utes, uses, or stores energy more efficiently
3 than conventional technologies, including
4 through Smart Grid technologies; or

5 (vi) that enhances the energy inde-
6 pendence and security of the United States
7 by enabling improved or expanded supply
8 and production of domestic energy re-
9 sources, including coal, oil, and natural
10 gas;

(B) a research, development, demonstration, or commercial application activity necessary to ensure the long-term, secure, and sustainable supply of an energy-critical element; or

15 (C) any other innovative energy technology
16 area identified by the Secretary.

17 (2) HUB.—

18 (A) IN GENERAL.—The term “Hub”
19 means an Energy Innovation Hub established
20 under this section.

21 (B) INCLUSION.—The term “Hub” in-
22 cludes any Energy Innovation Hub in existence
23 on the date of enactment of this Act.

- 1 (A) an institution of higher education;
- 2 (B) an appropriate State or Federal entity,
3 including a federally funded research and devel-
4 opment center of the Department;
- 5 (C) a nongovernmental organization with
6 expertise in advanced energy technology re-
7 search, development, demonstration, or com-
8 mercial application; or
- 9 (D) any other relevant entity the Secretary
10 determines appropriate.

(b) AUTHORIZATION OF PROGRAM.—

22 (2) TECHNOLOGY DEVELOPMENT FOCUS.—The
23 Secretary shall designate for each Hub a unique ad-
24 vanced energy technology or basic research focus.

5 (A) other research entities of the Department
6 including the National Laboratories, the
7 Advanced Research Projects Agency—Energy,
8 and Energy Frontier Research Centers; and

9 (B) industry.

14 (A) be composed of not fewer than two
15 qualifying entities;

16 (B) operate subject to a binding agree-
17 ment, entered into by each member of the con-
18 sortium, that documents—

19 (i) the proposed partnership agree-
20 ment, including the governance and man-
21 agement structure of the Hub;

22 (ii) measures the consortium will un-
23 dertake to enable cost-effective implemen-
24 tation of activities under the program de-
25 scribed in subsection (b)(1); and

1 (iii) a proposed budget, including fi-
2 nancial contributions from non-Federal
3 sources; and

4 (C) operate as a nonprofit organization.

5 (2) APPLICATION.—

6 (A) IN GENERAL.—A consortium seeking
7 to establish and operate a Hub under sub-
8 section (b)(1) shall submit to the Secretary an
9 application at such time, in such manner, and
0 containing such information as the Secretary
1 may require, including a detailed description of
2 each element of the consortium agreement re-
3 quired under paragraph (1)(B).

14 (B) REQUIREMENT.—If the consortium
15 members will not be located at one centralized
16 location, the application under subparagraph
17 (A) shall include a communications plan that
18 ensures close coordination and integration of
19 Hub activities.

20 (3) SELECTION.—

1 (B) CONSIDERATIONS.—In selecting con-
2 sortia under subparagraph (A), the Secretary
3 shall consider—

4 (i) the information disclosed by the
5 consortium under this subsection; and
6 (ii) any existing facilities a consortium
7 will provide for Hub activities.

8 (d) TERM.—

14 (2) EXISTING HUBS.—A Hub already in exist-
15 ence on, or undergoing a renewal process on, the
16 date of enactment of this Act—

17 (A) may continue to receive support during
18 the 5-year period beginning on the date of es-
19 tablishment of that Hub; and

20 (B) shall be eligible for renewal of that
21 support at the end of that 5-year period.

22 (e) HUB OPERATIONS.—

23 (1) IN GENERAL.—Each Hub shall conduct or
24 provide for multidisciplinary, collaborative research,
25 development, demonstration, and commercial appli-

1 cation of advanced energy technologies within the
2 technology development focus designated under sub-
3 section (b)(2).

4 (2) ACTIVITIES.—Each Hub shall—

5 (A) encourage collaboration and commu-
6 nication among the member qualifying entities
7 of the consortium and awardees;

8 (B) develop and publish proposed plans
9 and programs on a publicly accessible website;

10 (C) submit an annual report to the De-
11 partment summarizing the activities of the
12 Hub, including—

13 (i) detailing organizational expendi-
14 tures; and

15 (ii) describing each project under-
16 taken by the Hub; and

17 (D) monitor project implementation and
18 coordination.

19 (3) CONFLICTS OF INTEREST.—Each Hub shall
20 maintain conflict of interest procedures, consistent
21 with the conflict of interest procedures of the De-
22 partment.

23 (4) PROHIBITION ON CONSTRUCTION.—

24 (A) IN GENERAL.—Except as provided in
25 subparagraph (B)—

1 (i) no funds provided under this sec-
2 tion may be used for construction of new
3 buildings or facilities for Hubs; and

4 (ii) construction of new buildings or
5 facilities shall not be considered as part of
6 the non-Federal share of a Hub cost-shar-
7 ing agreement.

8 (B) TEST BED AND RENOVATION EXCEP-
9 TION.—Nothing in this paragraph prohibits the
10 use of funds provided under this section or non-
11 Federal cost share funds for the construction of
12 a test bed or renovations to existing buildings
13 or facilities for the purposes of research if the
14 Secretary determines that the test bed or ren-
15 ovations are limited to a scope and scale nec-
16 essary for the research to be conducted.

17 **TITLE III—DEPARTMENT OF EN-**
18 **ERGY OFFICE OF SCIENCE**
19 **POLICY**

20 SEC. 301. SHORT TITLE.

21 This title may be cited as the “Department of Energy
22 Office of Science Policy Act”.

1 **SEC. 302. MISSION.**

2 Section 209 of the Department of Energy Organiza-
3 tion Act (42 U.S.C. 7139) is amended by adding at the
4 end the following:

5 “(c) MISSION.—The mission of the Office of Science
6 shall be the delivery of scientific discoveries, capabilities,
7 and major scientific tools to transform the understanding
8 of nature and to advance the energy, economic, and na-
9 tional security of the United States.”.

10 **SEC. 303. BASIC ENERGY SCIENCES.**

11 (a) ENERGY FRONTIER RESEARCH CENTERS.—

12 (1) IN GENERAL.—The Director shall carry out
13 a program to provide awards, on a competitive,
14 merit-reviewed basis, to multi-institutional collabora-
15 tions or other appropriate entities to conduct funda-
16 mental and use-inspired energy research to accel-
17 erate scientific breakthroughs.

18 (2) COLLABORATIONS.—A collaboration receiv-
19 ing an award under this subsection may include mul-
20 tiple types of institutions and private sector entities.

21 (3) SELECTION AND DURATION.—

22 (A) IN GENERAL.—A collaboration under
23 this subsection shall be selected for a period of
24 4 years.

25 (B) EXISTING CENTERS.—An Energy
26 Frontier Research Center in existence and sup-

1 ported by the Director on the date of enactment
2 of this Act may continue to receive support for
3 a period of 4 years beginning on the date of es-
4 tablishment of that center.

5 (C) REAPPLICATION.—After the end of the
6 period described in subparagraph (A) or (B), as
7 applicable, a recipient of an award may reapply
8 for selection on a competitive, merit-reviewed
9 basis.

10 (D) TERMINATION.—Consistent with the
11 existing authorities of the Department, the Di-
12 rector may terminate an underperforming cen-
13 ter for cause during the performance period.

14 (4) NO FUNDING FOR CONSTRUCTION.—No
15 funding provided pursuant to this subsection may be
16 used for the construction of new buildings or facil-
17 ties.

18 (b) BASIC ENERGY SCIENCES USER FACILITIES.—

19 (1) IN GENERAL.—The Director shall carry out

20 a program for the development, construction, oper-

21 ation, and maintenance of national user facilities.

22 (2) REQUIREMENTS.—To the maximum extent
23 practicable, the national user facilities developed,
24 constructed, operated, or maintained under para-
25 graph (1) shall serve the needs of the Department,

1 industry, the academic community, and other relevant
2 entities to create and examine materials and chemical
3 processes for the purpose of improving the competitiveness
4 of the United States.

5 (3) INCLUDED FACILITIES.—The national user facilities developed, constructed, operated, or maintained under paragraph (1) shall include—

8 (A) x-ray light sources;
9 (B) neutron sources;
10 (C) nanoscale science research centers; and
11 (D) such other facilities as the Director considers appropriate, consistent with section 209 of the Department of Energy Organization Act (42 U.S.C. 7139).

15 (c) ACCELERATOR RESEARCH AND DEVELOPMENT.—The Director shall carry out research and development on advanced accelerator and storage ring technologies relevant to the development of basic energy sciences user facilities, in consultation with the High Energy Physics and Nuclear Physics programs of the Office of Science.

22 (d) SOLAR FUELS RESEARCH INITIATIVE.—

23 (1) IN GENERAL.—Section 973 of the Energy Policy Act of 2005 (42 U.S.C. 16313) is amended to read as follows:

1 **“SEC. 973. SOLAR FUELS RESEARCH INITIATIVE.**

2 “(a) INITIATIVE.—

3 “(1) IN GENERAL.—The Secretary shall carry
4 out a research initiative, to be known as the ‘Solar
5 Fuels Research Initiative’ (referred to in this section
6 as the ‘Initiative’) to expand theoretical and funda-
7 mental knowledge of photochemistry, electro-
8 chemistry, biochemistry, and materials science useful
9 for the practical development of experimental sys-
10 tems to convert solar energy to chemical energy.

11 “(2) LEVERAGING.—In carrying out programs
12 and activities under the Initiative, the Secretary
13 shall leverage expertise and resources from—

14 “(A) the Basic Energy Sciences Program
15 and the Biological and Environmental Research
16 Program of the Office of Science; and

17 “(B) the Office of Energy Efficiency and
18 Renewable Energy.

19 “(3) TEAMS.—

20 “(A) IN GENERAL.—In carrying out the
21 Initiative, the Secretary shall organize activities
22 among multidisciplinary teams to leverage, to
23 the maximum extent practicable, expertise from
24 the National Laboratories, institutions of higher
25 education, and the private sector.

1 “(B) GOALS.—The multidisciplinary teams
2 described in subparagraph (A) shall pursue ag-
3 gressive, milestone-driven, basic research goals.

4 “(C) RESOURCES.—The Secretary shall
5 provide sufficient resources to the multidisci-
6 plinary teams described in subparagraph (A) to
7 achieve the goals described in subparagraph (B)
8 over a period of time to be determined by the
9 Secretary.

10 “(4) ADDITIONAL ACTIVITIES.—The Secretary
11 may organize additional activities under this sub-
12 section through Energy Frontier Research Centers,
13 Energy Innovation Hubs, or other organizational
14 structures.

15 “(b) ARTIFICIAL PHOTOSYNTHESIS.—

16 “(1) IN GENERAL.—The Secretary shall carry
17 out under the Initiative a program to support re-
18 search needed to bridge scientific barriers to, and
19 discover knowledge relevant to, artificial photosyn-
20 thetic systems.

21 “(2) ACTIVITIES.—As part of the program de-
22 scribed in paragraph (1)—

23 “(A) the Director of the Office of Basic
24 Energy Sciences shall support basic research to

1 pursue distinct lines of scientific inquiry, in-
2 cluding—

3 “(i) photoinduced production of hy-
4 drogen and oxygen from water; and

5 “(ii) the sustainable photoinduced re-
6 duction of carbon dioxide to fuel products
7 including hydrocarbons, alcohols, carbon
8 monoxide, and natural gas; and

9 “(B) the Assistant Secretary for Energy
10 Efficiency and Renewable Energy shall support
11 translational research, development, and valida-
12 tion of physical concepts developed under the
13 program.

14 “(3) STANDARD OF REVIEW.—The Secretary
15 shall review activities carried out under the program
16 described in paragraph (1) to determine the achieve-
17 ment of technical milestones.

18 “(4) PROHIBITION.—No funds allocated to the
19 program described in paragraph (1) may be obli-
20 gated or expended for commercial application of en-
21 ergy technology.

22 “(c) BIOCHEMISTRY, REPLICATION OF NATURAL
23 PHOTOSYNTHESIS, AND RELATED PROCESSES.—

24 “(1) IN GENERAL.—The Secretary shall carry
25 out under the Initiative a program to support re-

1 search needed to replicate natural photosynthetic
2 processes by use of artificial photosynthetic compo-
3 nents and materials.

4 “(2) ACTIVITIES.—As part of the program de-
5 scribed in paragraph (1)—

6 “(A) the Director of the Office of Basic
7 Energy Sciences shall support basic research to
8 expand fundamental knowledge to replicate nat-
9 ural synthesis processes, including—

10 “(i) the photoinduced reduction of
11 dinitrogen to ammonia;

12 “(ii) the absorption of carbon dioxide
13 from ambient air;

14 “(iii) molecular-based charge separa-
15 tion and storage;

16 “(iv) photoinitiated electron transfer;
17 and

18 “(v) catalysis in biological or bio-
19 mimetic systems;

20 “(B) the Associate Director of Biological
21 and Environmental Research shall support sys-
22 tems biology and genomics approaches to un-
23 derstand genetic and physiological pathways
24 connected to photosynthetic mechanisms; and

1 “(C) the Assistant Secretary for Energy
2 Efficiency and Renewable Energy shall support
3 translational research, development, and valida-
4 tion of physical concepts developed under the
5 program.

6 “(3) STANDARD OF REVIEW.—The Secretary
7 shall review activities carried out under the program
8 described in paragraph (1) to determine the achieve-
9 ment of technical milestones.

10 “(4) PROHIBITION.—No funds allocated to the
11 program described in paragraph (1) may be obli-
12 gated or expended for commercial application of en-
13 ergy technology.”.

14 (2) CONFORMING AMENDMENT.—The table of
15 contents for the Energy Policy Act of 2005 is
16 amended by striking the item relating to section 973
17 and inserting the following:

“Sec. 973. Solar fuels research initiative.”.

18 (e) ELECTRICITY STORAGE RESEARCH INITIATIVE.—
19 (1) IN GENERAL.—Section 975 of the Energy
20 Policy Act of 2005 (42 U.S.C. 16315) is amended
21 to read as follows:

22 **“SEC. 975. ELECTRICITY STORAGE RESEARCH INITIATIVE.**

23 “(a) INITIATIVE.—

24 “(1) IN GENERAL.—The Secretary shall carry
25 out a research initiative, to be known as the ‘Elec-

1 tricity Storage Research Initiative' (referred to in
2 this section as the 'Initiative')—

3 “(A) to expand theoretical and funda-
4 mental knowledge to control, store, and con-
5 vert—

6 “(i) electrical energy to chemical en-
7 ergy; and

8 “(ii) chemical energy to electrical en-
9 ergy; and

10 “(B) to support scientific inquiry into the
11 practical understanding of chemical and phys-
12 ical processes that occur within systems involv-
13 ing crystalline and amorphous solids, polymers,
14 and organic and aqueous liquids.

15 “(2) LEVERAGING.—In carrying out programs
16 and activities under the Initiative, the Secretary
17 shall leverage expertise and resources from—

18 “(A) the Basic Energy Sciences Program,
19 the Advanced Scientific Computing Research
20 Program, and the Biological and Environmental
21 Research Program of the Office of Science; and

22 “(B) the Office of Energy Efficiency and
23 Renewable Energy.

24 “(3) TEAMS.—

1 “(A) IN GENERAL.—In carrying out the
2 Initiative, the Secretary shall organize activities
3 among multidisciplinary teams to leverage, to
4 the maximum extent practicable, expertise from
5 the National Laboratories, institutions of higher
6 education, and the private sector.

7 “(B) GOALS.—The multidisciplinary teams
8 described in subparagraph (A) shall pursue ag-
9 gressive, milestone-driven, basic research goals.

10 “(C) RESOURCES.—The Secretary shall
11 provide sufficient resources to the multidisci-
12 plinary teams described in subparagraph (A) to
13 achieve the goals described in subparagraph (B)
14 over a period of time to be determined by the
15 Secretary.

16 “(4) ADDITIONAL ACTIVITIES.—The Secretary
17 may organize additional activities under this sub-
18 section through Energy Frontier Research Centers,
19 Energy Innovation Hubs, or other organizational
20 structures.

21 “(b) MULTIVALENT SYSTEMS.—

22 “(1) IN GENERAL.—The Secretary shall carry
23 out under the Initiative a program to support re-
24 search needed to bridge scientific barriers to, and

1 discover knowledge relevant to, multivalent ion mate-
2 rials in electric energy storage systems.

3 “(2) ACTIVITIES.—As part of the program de-
4 scribed in paragraph (1)—

5 “(A) the Director of the Office of Basic
6 Energy Sciences shall investigate electro-
7 chemical properties and the dynamics of mate-
8 rials, including charge transfer phenomena and
9 mass transport in materials; and

10 “(B) the Assistant Secretary for Energy
11 Efficiency and Renewable Energy shall support
12 translational research, development, and valida-
13 tion of physical concepts developed under the
14 program.

15 “(3) STANDARD OF REVIEW.—The Secretary
16 shall review activities carried out under the program
17 described in paragraph (1) to determine the achieve-
18 ment of technical milestones.

19 “(4) PROHIBITION.—No funds allocated to the
20 program described in paragraph (1) may be obli-
21 gated or expended for commercial application of en-
22 ergy technology.

23 “(c) ELECTROCHEMISTRY MODELING AND SIMULA-
24 TION.—

1 “(1) IN GENERAL.—The Secretary shall carry
2 out under the Initiative a program to support re-
3 search to model and simulate organic electrolytes,
4 including the static and dynamic electrochemical be-
5 havior and phenomena of organic electrolytes at the
6 molecular and atomic level in monovalent and multi-
7 valent systems.

8 “(2) ACTIVITIES.—As part of the program de-
9 scribed in paragraph (1)—

10 “(A) the Director of the Office of Basic
11 Energy Sciences, in coordination with the Asso-
12 ciate Director of Advanced Scientific Com-
13 puting Research, shall support the development
14 of high performance computational tools
15 through a joint development process to maxi-
16 mize the effectiveness of current and projected
17 high performance computing systems; and

18 “(B) the Assistant Secretary for Energy
19 Efficiency and Renewable Energy shall support
20 translational research, development, and valida-
21 tion of physical concepts developed under the
22 program.

23 “(3) STANDARD OF REVIEW.—The Secretary
24 shall review activities carried out under the program

1 described in paragraph (1) to determine the achieve-
2 ment of technical milestones.

3 “(4) PROHIBITION.—No funds allocated to the
4 program described in paragraph (1) may be obli-
5 gated or expended for commercial application of en-
6 ergy technology.

7 “(d) MESOSCALE ELECTROCHEMISTRY.—

8 “(1) IN GENERAL.—The Secretary shall carry
9 out under the Initiative a program to support re-
10 search needed to reveal electrochemistry in confined
11 mesoscale spaces, including scientific discoveries rel-
12 evant to—

13 “(A) bio-electrochemistry and electro-
14 chemical energy conversion and storage in con-
15 fined spaces; and

16 “(B) the dynamics of the phenomena de-
17 scribed in subparagraph (A).

18 “(2) ACTIVITIES.—As part of the program de-
19 scribed in paragraph (1)—

20 “(A) the Director of the Office of Basic
21 Energy Sciences and the Associate Director of
22 Biological and Environmental Research shall in-
23 vestigate phenomena of mesoscale electro-
24 chemical confinement for the purpose of repli-

1 cating and controlling new electrochemical be-
2 havior; and

3 “(B) the Assistant Secretary for Energy
4 Efficiency and Renewable Energy shall support
5 translational research, development, and valida-
6 tion of physical concepts developed under the
7 program.

8 “(3) STANDARD OF REVIEW.—The Secretary
9 shall review activities carried out under the program
10 described in paragraph (1) to determine the achieve-
11 ment of technical milestones.

12 “(4) PROHIBITION.—No funds allocated to the
13 program described in paragraph (1) may be obli-
14 gated or expended for commercial application of en-
15 ergy technology.”.

16 (2) CONFORMING AMENDMENT.—The table of
17 contents for the Energy Policy Act of 2005 is
18 amended by striking the item relating to section 975
19 and inserting the following:

“Sec. 975. Electricity storage research initiative.”.

20 **SEC. 304. ADVANCED SCIENTIFIC COMPUTING RESEARCH.**

21 (a) AMERICAN SUPER COMPUTING LEADERSHIP.—

22 (1) RENAMING OF ACT.—

23 (A) IN GENERAL.—Section 1 of the De-
24 partment of Energy High-End Computing Revi-
25 talization Act of 2004 (15 U.S.C. 5501 note;

1 Public Law 108–423) is amended by striking
2 “Department of Energy High-End Computing
3 Revitalization Act of 2004” and inserting
4 “American Super Computing Leadership Act of
5 2017”.

6 (B) CONFORMING AMENDMENT.—Section
7 976(a)(1) of the Energy Policy Act of 2005 (42
8 U.S.C. 16316(1)) is amended by striking “De-
9 partment of Energy High-End Computing Revi-
10 talization Act of 2004” and inserting “Amer-
11 ican Super Computing Leadership Act of
12 2017”.

13 (2) DEFINITIONS.—Section 2 of the American
14 Super Computing Leadership Act of 2017 (15
15 U.S.C. 5541) is amended—

16 (A) by redesignating paragraphs (2)
17 through (5) as paragraphs (3) through (6), re-
18 spectively;

19 (B) by striking paragraph (1) and insert-
20 ing the following:

21 “(1) DEPARTMENT.—The term ‘Department’
22 means the Department of Energy.

23 “(2) EXASCALE COMPUTING.—The term
24 ‘exascale computing’ means computing through the
25 use of a computing machine that performs near or

1 above 10 to the 18th power operations per second.”;
2 and

3 (C) in paragraph (6) (as redesignated by
4 subparagraph (A)), by striking “, acting
5 through the Director of the Office of Science of
6 the Department of Energy”.

7 (3) DEPARTMENT OF ENERGY HIGH-END COM-
8 PUTING RESEARCH AND DEVELOPMENT PROGRAM.—
9 Section 3 of the American Super Computing Leader-
10 ship Act of 2017 (15 U.S.C. 5542) is amended—

11 (A) in subsection (a)(1), by striking “pro-
12 gram” and inserting “coordinated program
13 across the Department”;

14 (B) in subsection (b)(2), by striking “,
15 which may” and all that follows through “archi-
16 tectures”; and

17 (C) by striking subsection (d) and insert-
18 ing the following:

19 “(d) EXASCALE COMPUTING PROGRAM.—

20 “(1) IN GENERAL.—The Secretary shall con-
21 duct a research program (referred to in this sub-
22 section as the ‘Program’) for exascale computing, in-
23 cluding the development of two or more exascale
24 computing machine architectures, to promote the
25 missions of the Department.

1 “(2) EXECUTION.—

2 “(A) IN GENERAL.—In carrying out the
3 Program, the Secretary shall—

4 “(i) establish two or more National
5 Laboratory partnerships with industry
6 partners and institutions of higher education
7 for the research and development of
8 two or more exascale computing architectures
9 across all applicable organizations of
10 the Department;

11 “(ii) conduct mission-related codesign
12 activities in developing the exascale computing
13 architectures under clause (i);

14 “(iii) develop such advancements in
15 hardware and software technology as are
16 required to fully realize the potential of an
17 exascale production system in addressing
18 Department target applications and solving
19 scientific problems involving predictive
20 modeling and simulation and large scale
21 data analytics and management;

22 “(iv) explore the use of exascale computing
23 technologies to advance a broad
24 range of science and engineering; and

1 “(v) provide, as appropriate, on a
2 competitive, merit-reviewed basis, access
3 for researchers in industries in the United
4 States, institutions of higher education,
5 National Laboratories, and other Federal
6 agencies to the exascale computing systems
7 developed pursuant to clause (i).

8 “(B) SELECTION OF PARTNERS.—The Sec-
9 retary shall select the partnerships with the
10 computing facilities of the Department under
11 subparagraph (A) through a competitive, peer-
12 review process.

13 “(3) CODESIGN AND APPLICATION DEVELOP-
14 MENT.—

15 “(A) IN GENERAL.—The Secretary shall—
16 “(i) carry out the Program through
17 an integration of applications, computer
18 science, applied mathematics, and com-
19 puter hardware architecture using the
20 partnerships established pursuant to para-
21 graph (2) to ensure that, to the maximum
22 extent practicable, two or more exascale
23 computing machine architectures are capa-
24 ble of solving Department target applica-
25 tions and broader scientific problems, in-

25 “(4) PROJECT REVIEW.—

1 “(A) IN GENERAL.—The exascale archite-
2 tures developed pursuant to partnerships estab-
3 lished pursuant to paragraph (2) shall be re-
4 viewed through a project review process.

5 “(B) REPORT.—Not later than 90 days
6 after the date of enactment of this subsection,
7 the Secretary shall submit to Congress a report
8 on—

9 “(i) the results of the review con-
10 ducted under subparagraph (A); and
11 “(ii) the coordination and manage-
12 ment of the Program to ensure an inte-
13 grated research program across the De-
14 partment.

15 “(5) ANNUAL REPORTS.—At the time of the
16 budget submission of the Department for each fiscal
17 year, the Secretary, in consultation with the mem-
18 bers of the partnerships established pursuant to
19 paragraph (2), shall submit to Congress a report
20 that describes funding for the Program as a whole
21 by functional element of the Department and critical
22 milestones.”.

23 (b) HIGH-PERFORMANCE COMPUTING AND NET-
24 WORKING RESEARCH.—The Director shall support re-
25 search in high-performance computing and networking rel-

1 event to energy applications, including modeling, simula-
2 tion, and advanced data analytics for basic and applied
3 energy research programs carried out by the Secretary.

4 (c) APPLIED MATHEMATICS AND SOFTWARE DEVEL-
5 OPMENT FOR HIGH-END COMPUTING SYSTEMS.—The Di-
6 rector shall carry out activities to develop, test, and sup-
7 port—

8 (1) mathematics, models, and algorithms for
9 complex systems and programming environments;
10 and
11 (2) tools, languages, and operating systems for
12 high-end computing systems (as defined in section 2
13 of the American Super Computing Leadership Act of
14 2017 (15 U.S.C. 5541)).

15 **SEC. 305. HIGH-ENERGY PHYSICS.**

16 (a) SENSE OF CONGRESS.—It is the sense of Con-
17 gress that—

18 (1) the Director should incorporate the findings
19 and recommendations of the report of the Particle
20 Physics Project Prioritization Panel entitled “Build-
21 ing for Discovery: Strategic Plan for U.S. Particle
22 Physics in the Global Context” into the planning
23 process of the Department; and

24 (2) the nations that lead in particle physics by
25 hosting international teams dedicated to a common

1 scientific goal attract the world's best talent and in-
2 spire future generations of physicists and tech-
3 nologists.

4 (b) INTERNATIONAL COLLABORATION.—The Direc-
5 tor, as practicable and in coordination with other appro-
6 priate Federal agencies as necessary, shall ensure the ac-
7 cess of United States researchers to the most advanced
8 accelerator facilities and research capabilities in the world,
9 including the Large Hadron Collider.

10 (c) NEUTRINO RESEARCH.—The Director shall carry
11 out research activities on rare decay processes and the na-
12 ture of the neutrino, which may include collaborations
13 with the National Science Foundation or international col-
14 laborations.

15 (d) DARK ENERGY AND DARK MATTER RE-
16 SEARCH.—The Director shall carry out research activities
17 on the nature of dark energy and dark matter, which may
18 include collaborations with the National Aeronautics and
19 Space Administration or the National Science Foundation;
20 or international collaborations.

21 **SEC. 306. BIOLOGICAL AND ENVIRONMENTAL RESEARCH.**

22 (a) BIOLOGICAL SYSTEMS.—The Director shall carry
23 out research and development activities in fundamental,
24 structural, computational, and systems biology to increase

1 systems-level understanding of the complex biological sys-
2 tems, which may include activities—

3 (1) to accelerate breakthroughs and new knowl-
4 edge that would enable the cost-effective, sustainable
5 production of—

6 (A) biomass-based liquid transportation
7 fuels;

8 (B) bioenergy; and

9 (C) biobased materials;

10 (2) to improve understanding of the global car-
11 bon cycle, including processes for removing carbon
12 dioxide from the atmosphere, through photosynthesis
13 and other biological processes, for sequestration and
14 storage; and

15 (3) to understand the biological mechanisms
16 used to transform, immobilize, or remove contami-
17 nants from subsurface environments.

18 (b) LIMITATION FOR RESEARCH FUNDS.—The Di-
19 rector shall not approve new climate science-related initia-
20 tives without making a determination that such work is
21 well-coordinated with any relevant work carried out by
22 other Federal agencies.

23 (c) LOW-DOSE RADIATION RESEARCH PROGRAM.—

24 (1) IN GENERAL.—The Director shall carry out
25 a research program on low-dose radiation.

6 SEC. 307. FUSION ENERGY.

7 (a) FUSION MATERIALS RESEARCH AND DEVELOP-
8 MENT.—As part of the activities authorized in section 978
9 of the Energy Policy Act of 2005 (42 U.S.C. 16318)—

18 (A) the need for one or more facilities that
19 can examine and test potential fusion and next
20 generation fission materials and other enabling
21 technologies relevant to the development of fu-
22 sion power; and

23 (B) whether a single new facility that sub-
24 stantly addresses magnetic fusion and next
25 generation fission materials research needs is

1 feasible, in conjunction with the expected capa-
2 bilities of facilities operational as of the date of
3 enactment of this Act.

4 (b) TOKAMAK RESEARCH AND DEVELOPMENT.—The
5 Director shall support research and development activities
6 and facility operations to optimize the tokamak approach
7 to fusion energy.

8 (c) INERTIAL FUSION ENERGY RESEARCH AND DE-
9 VELOPMENT.—The Director shall support research and
10 development activities for inertial fusion for energy appli-
11 cations.

12 (d) ALTERNATIVE AND ENABLING CONCEPTS.—The
13 Director shall support research and development activities
14 and facility operations at institutions of higher education,
15 National Laboratories, and private facilities in the United
16 States for a portfolio of alternative and enabling fusion
17 energy concepts that may provide solutions to significant
18 challenges to the establishment of a commercial magnetic
19 fusion power plant, prioritized based on the ability of the
20 United States to play a leadership role in the international
21 fusion research community.

22 (e) COORDINATION WITH ARPA–E.—The Director
23 shall coordinate with the Director of the Advanced Re-
24 search Projects Agency–Energy (referred to in this sub-
25 section as “ARPA–E”) to—

1 (1) assess the potential for any fusion energy
2 project supported by ARPA-E to represent a prom-
3 ising approach to a commercially viable fusion power
4 plant;

5 (2) determine whether the results of any fusion
6 energy project supported by ARPA-E merit the sup-
7 port of follow-on research activities carried out by
8 the Office of Science; and

9 (3) avoid the unintentional duplication of activi-
10 ties.

11 (f) FAIRNESS IN COMPETITION FOR SOLICITATIONS
12 FOR INTERNATIONAL PROJECT ACTIVITIES.—Section 33
13 of the Atomic Energy Act of 1954 (42 U.S.C. 2053) is
14 amended by inserting before the first sentence the fol-
15 lowing: “In this section, with respect to international re-
16 search projects, the term ‘private facilities or laboratories’
17 means facilities or laboratories located in the United
18 States.”.

19 (g) IDENTIFICATION OF PRIORITIES.—

20 (1) REPORT.—

21 (A) IN GENERAL.—Not later than 2 years
22 after the date of enactment of this Act, the Sec-
23 retary shall submit to Congress a report on the
24 fusion energy research and development activi-
25 ties that the Department proposes to carry out

1 over the 10-year period following the date of
2 the report under not fewer than 3 realistic
3 budget scenarios, including a scenario based on
4 3-percent annual growth in the non-ITER por-
5 tion of the budget for fusion energy research
6 and development activities.

7 (B) INCLUSIONS.—The report required
8 under subparagraph (A) shall—

9 (i) identify specific areas of fusion en-
10 ergy research and enabling technology de-
11 velopment in which the United States can
12 and should establish or solidify a lead in
13 the global fusion energy development ef-
14 fort;

15 (ii) identify priorities for initiation of
16 facility construction and facility decommis-
17 sioning under each of the three budget sce-
18 narios described in subparagraph (A); and

19 (iii) assess the ability of the fusion
20 workforce of the United States to carry out
21 the activities identified under clauses (i)
22 and (ii), including the adequacy of pro-
23 grams at institutions of higher education
24 in the United States to train the leaders

1 and workers of the next generation of fu-
2 sion energy researchers.

14 SEC. 308. NUCLEAR PHYSICS.

15 (a) ISOTOPE DEVELOPMENT AND PRODUCTION FOR

16 RESEARCH APPLICATIONS.—The Director—

22 (2) shall ensure that isotope production activi-
23 ties carried out under the program under this para-
24 graph do not compete with private industry unless
25 the Director determines that critical national inter-

1 ests require the involvement of the Federal Govern-
2 ment.

3 (b) RENAMING OF THE RARE ISOTOPE ACCEL-
4 ERATOR.—Section 981 of the Energy Policy Act of 2005
5 (42 U.S.C. 16321) is amended—

6 (1) in the section heading, by striking “**RARE**
7 **ISOTOPE ACCELERATOR**” and inserting “**FACIL-**
8 **ITY FOR RARE ISOTOPE BEAMS**”; and

9 (2) by striking “Rare Isotope Accelerator” each
10 place it appears and inserting “Facility for Rare Iso-
11 tope Beams”.

12 **SEC. 309. SCIENCE LABORATORIES INFRASTRUCTURE PRO-**
13 **GRAM.**

14 (a) IN GENERAL.—The Director shall carry out a
15 program to improve the safety, efficiency, and mission
16 readiness of infrastructure at laboratories of the Office of
17 Science.

18 (b) INCLUSIONS.—The program under subsection (a)
19 shall include projects—

20 (1) to renovate or replace space that does not
21 meet research needs;

22 (2) to replace facilities that are no longer cost
23 effective to renovate or operate;

24 (3) to modernize utility systems to prevent fail-
25 ures and ensure efficiency;

1 (4) to remove excess facilities to allow safe and
2 efficient operations; and

3 (5) to construct modern facilities to conduct ad-
4 vanced research in controlled environmental condi-
5 tions.

6 **TITLE IV—NUCLEAR ENERGY 7 INNOVATION CAPABILITIES**

8 SEC. 401. SHORT TITLE.

9 This title may be cited as the “Nuclear Energy Inno-
10 vation Capabilities Act”.

11 SEC. 402. NUCLEAR ENERGY INNOVATION CAPABILITIES.

12 (a) NUCLEAR ENERGY.—Section 951 of the Energy
13 Policy Act of 2005 (42 U.S.C. 16271) is amended to read
14 as follows:

15 "SEC. 951. NUCLEAR ENERGY.

16 "(a) MISSION.—

17 “(1) IN GENERAL.—The Secretary shall carry
18 out programs of civilian nuclear research, develop-
19 ment, demonstration, and commercial application,
20 including activities under this subtitle.

21 “(2) CONSIDERATIONS.—The programs carried
22 out under paragraph (1) shall take into consider-
23 ation the following objectives:

24 “(A) Providing research infrastructure to
25 promote scientific progress and enable users

1 from academia, the National Laboratories, and
2 the private sector to make scientific discoveries
3 relevant for nuclear, chemical, and materials
4 science engineering.

5 “(B) Maintaining nuclear energy research
6 and development programs at the National
7 Laboratories and institutions of higher edu-
8 cation, including infrastructure at the National
9 Laboratories and institutions of higher edu-
10 cation.

11 “(C) Providing the technical means to re-
12 duce the likelihood of nuclear proliferation.

13 “(D) Increasing confidence margins for
14 public safety of nuclear energy systems.

15 “(E) Reducing the environmental impact
16 of activities relating to nuclear energy.

17 “(F) Supporting technology transfer from
18 the National Laboratories to the private sector.

19 “(G) Enabling the private sector to part-
20 ner with the National Laboratories to dem-
21 onstrate novel reactor concepts for the purpose
22 of resolving technical uncertainty associated
23 with the objectives described in subparagraphs
24 (A) through (F).

25 “(b) DEFINITIONS.—In this subtitle:

1 “(1) ADVANCED NUCLEAR REACTOR.—The
2 term ‘advanced nuclear reactor’ means—

3 “(A) a nuclear fission reactor with significant
4 improvements over the most recent generation
5 of nuclear fission reactors, which may include—

7 “(i) inherent safety features;
8 “(ii) lower waste yields;
9 “(iii) greater fuel utilization;
10 “(iv) superior reliability;
11 “(v) resistance to proliferation;
12 “(vi) increased thermal efficiency; and
13 “(vii) the ability to integrate into electric
14 and nonelectric applications; or
15 “(B) a nuclear fusion reactor.

16 “(2) COMMISSION.—The term ‘Commission’
17 means the Nuclear Regulatory Commission.

18 “(3) FAST NEUTRON.—The term ‘fast neutron’
19 means a neutron with kinetic energy above 100
20 kiloelectron volts.

21 “(4) NATIONAL LABORATORY.—

22 “(A) IN GENERAL.—Except as provided in
23 subparagraph (B), the term ‘National Laboratory’
24 has the meaning given the term in section
25 2.

1 “(B) LIMITATION.—With respect to the
2 Lawrence Livermore National Laboratory, the
3 Los Alamos National Laboratory, and the
4 Sandia National Laboratories, the term ‘Na-
5 tional Laboratory’ means only the civilian ac-
6 tivities of the laboratory.

7 “(5) NEUTRON FLUX.—The term ‘neutron flux’
8 means the intensity of neutron radiation measured
9 as a rate of flow of neutrons applied over an area.

10 “(6) NEUTRON SOURCE.—The term ‘neutron
11 source’ means a research machine that provides neu-
12 tron irradiation services for—

13 “(A) research on materials sciences and
14 nuclear physics; and

15 “(B) testing of advanced materials, nuclear
16 fuels, and other related components for reactor
17 systems.”.

18 (b) NUCLEAR ENERGY RESEARCH PROGRAMS.—

19 (1) IN GENERAL.—Section 952 of the Energy
20 Policy Act of 2005 (42 U.S.C. 16272) is amended—

21 (A) by striking subsection (c); and

22 (B) by redesignating subsections (d) and
23 (e) as subsections (c) and (d), respectively.

24 (2) CONFORMING AMENDMENT.—Section
25 641(b)(1) of the Energy Policy Act of 2005 (42

1 U.S.C. 16021(b)(1)) is amended by striking “section
2 942(d)” and inserting “section 952(c)”.

3 (c) ADVANCED FUEL CYCLE INITIATIVE.—Section
4 953(a) of the Energy Policy Act of 2005 (42 U.S.C.
5 16273(a)) is amended by striking “, acting through the
6 Director of the Office of Nuclear Energy, Science and
7 Technology.”.

8 (d) UNIVERSITY NUCLEAR SCIENCE AND ENGINEER-
9 ING SUPPORT.—Section 954(d)(4) of the Energy Policy
10 Act of 2005 (42 U.S.C. 16274(d)(4)) is amended by strik-
11 ing “as part of a taking into consideration effort that em-
12 phasizes” and inserting “that emphasize”.

13 (e) DEPARTMENT OF ENERGY CIVILIAN NUCLEAR
14 INFRASTRUCTURE AND FACILITIES.—Section 955 of the
15 Energy Policy Act of 2005 (42 U.S.C. 16275) is amend-
16 ed—

17 (1) by striking subsections (c) and (d); and
18 (2) by adding at the end the following:

19 “(c) VERSATILE NEUTRON SOURCE.—

20 “(1) MISSION NEED.—

21 “(A) IN GENERAL.—Not later than De-
22 cember 31, 2017, the Secretary shall determine
23 the mission need for a versatile reactor-based
24 fast neutron source, which shall operate as a
25 national user facility.

1 “(B) CONSULTATIONS REQUIRED.—In car-
2 rying out subparagraph (A), the Secretary shall
3 consult with the private sector, institutions of
4 higher education, the National Laboratories,
5 and relevant Federal agencies to ensure that
6 the user facility described in subparagraph (A)
7 will meet the research needs of the largest prac-
8 ticable majority of prospective users.

9 “(2) ESTABLISHMENT.—As soon as practicable
10 after determining the mission need under paragraph
11 (1)(A), the Secretary shall submit to the appropriate
12 committees of Congress a detailed plan for the es-
13 tablishment of the user facility.

14 “(3) FACILITY REQUIREMENTS.—

15 “(A) CAPABILITIES.—The Secretary shall
16 ensure that the user facility will provide, at a
17 minimum, the following capabilities:

18 “(i) Fast neutron spectrum irradia-
19 tion capability.

20 “(ii) Capacity for upgrades to accom-
21 modate new or expanded research needs.

22 “(B) CONSIDERATIONS.—In carrying out
23 the plan submitted under paragraph (2), the
24 Secretary shall consider the following:

1 “(i) Capabilities that support experimental high-temperature testing.

2 “(ii) Providing a source of fast neutrons at a neutron flux, higher than that at which current research facilities operate, sufficient to enable research for an optimal base of prospective users.

3 “(iii) Maximizing irradiation flexibility and irradiation volume to accommodate as many concurrent users as possible.

4 “(iv) Capabilities for irradiation with neutrons of a lower energy spectrum.

5 “(v) Multiple loops for fuels and materials testing in different coolants.

6 “(vi) Additional pre-irradiation and post-irradiation examination capabilities.

7 “(vii) Lifetime operating costs and lifecycle costs.

8 “(4) DEADLINE FOR ESTABLISHMENT.—The Secretary shall, to the maximum extent practicable, complete construction of, and approve the start of operations for, the user facility by not later than December 31, 2025.

9 “(5) REPORTING.—The Secretary shall include in the annual budget request of the Department an

1 explanation for any delay in the progress of the De-
2 partment in completing the user facility by the dead-
3 line described in paragraph (4).

4 “(6) COORDINATION.—The Secretary shall le-
5 verage the best practices for management, construc-
6 tion, and operation of national user facilities from
7 the Office of Science.”.

8 (f) SECURITY OF NUCLEAR FACILITIES.—Section
9 956 of the Energy Policy Act of 2005 (42 U.S.C. 16276)
10 is amended by striking “, acting through the Director of
11 the Office of Nuclear Energy, Science and Technology,”.

12 (g) HIGH-PERFORMANCE COMPUTATION AND SUP-
13 PORTIVE RESEARCH.—Section 957 of the Energy Policy
14 Act of 2005 (42 U.S.C. 16277) is amended to read as
15 follows:

16 **“SEC. 957. HIGH-PERFORMANCE COMPUTATION AND SUP-**
17 **PORTIVE RESEARCH.**

18 “(a) MODELING AND SIMULATION.—The Secretary
19 shall carry out a program to enhance the capabilities of
20 the United States to develop new reactor technologies
21 through high-performance computation modeling and sim-
22 ulation techniques.

23 “(b) COORDINATION.—In carrying out the program
24 under subsection (a), the Secretary shall coordinate with
25 relevant Federal agencies as described by the National

1 Strategic Computing Initiative established by Executive
2 Order No. 13702 (80 Fed. Reg. 46177 (July 29, 2015)),
3 while taking into account the following objectives:

4 “(1) Using expertise from the private sector, in-
5 stitutions of higher education, and the National
6 Laboratories to develop computational software and
7 capabilities that prospective users may access to ac-
8 celerate research and development of advanced nu-
9 clear reactor systems and reactor systems for space
10 exploration.

11 “(2) Developing computational tools to simulate
12 and predict nuclear phenomena that may be vali-
13 dated through physical experimentation.

14 “(3) Increasing the utility of the research infra-
15 structure of the Department by coordinating with
16 the Advanced Scientific Computing Research pro-
17 gram within the Office of Science.

18 “(4) Leveraging experience from the Energy In-
19 novation Hub for Modeling and Simulation.

20 “(5) Ensuring that new experimental and com-
21 putational tools are accessible to relevant research
22 communities, including private sector entities en-
23 gaged in nuclear energy technology development.

24 “(c) SUPPORTIVE RESEARCH ACTIVITIES.—The Sec-
25 retary shall consider support for additional research activi-

1 ties to maximize the utility of the research facilities of the
2 Department, including physical processes—

3 “(1) to simulate degradation of materials and
4 behavior of fuel forms; and
5 “(2) for validation of computational tools.”.

6 (h) ENABLING NUCLEAR ENERGY INNOVATION.—
7 Subtitle E of title IX of the Energy Policy Act of 2005
8 (42 U.S.C. 16271 et seq.) is amended by adding at the
9 end the following:

10 **“SEC. 958. ENABLING NUCLEAR ENERGY INNOVATION.**

11 “(a) NATIONAL REACTOR INNOVATION CENTER.—

12 “(1) IN GENERAL.—There is authorized a pro-
13 gram to enable the testing and demonstration of re-
14 actor concepts to be proposed and funded by the pri-
15 vate sector.

16 “(2) PARTICIPATION.—Nothing in this section
17 shall prevent a private sector entity that has re-
18 ceived Federal grants from participating in this pro-
19 gram.

20 “(b) TECHNICAL EXPERTISE.—In carrying out the
21 program under subsection (a), the Secretary shall leverage
22 the technical expertise of relevant Federal agencies and
23 the National Laboratories in order to minimize the time
24 required to enable construction and operation of privately

1 funded experimental reactors at National Laboratories or
2 other Department-owned sites.

3 “(c) OBJECTIVES.—The reactors described in sub-
4 section (b) shall operate to meet the following objectives:

5 “(1) Enabling physical validation of advanced
6 nuclear reactor concepts.

7 “(2) Resolving technical uncertainty and in-
8 creasing practical knowledge relevant to safety, resil-
9 ience, security, and functionality of advanced nuclear
10 reactor concepts.

11 “(3) General research and development to im-
12 prove nascent technologies.

13 “(d) SHARING TECHNICAL EXPERTISE.—In carrying
14 out the program under subsection (a), the Secretary may
15 enter into a memorandum of understanding with the
16 Chairman of the Commission in order to share technical
17 expertise and knowledge through—

18 “(1) enabling the testing and demonstration of
19 advanced nuclear reactor concepts to be proposed
20 and funded by the private sector;

21 “(2) operating a database to store and share
22 data and knowledge relevant to nuclear science and
23 engineering between Federal agencies and the pri-
24 vate sector;

1 “(3) developing and testing electric and non-
2 electric integration and energy conversion systems
3 relevant to advanced nuclear reactors;

4 “(4) leveraging expertise from the Commission
5 with respect to safety analysis; and

6 “(5) enabling technical staff of the Commission
7 to actively observe and learn about technologies de-
8 veloped under the program.

9 “(e) AGENCY COORDINATION.—The Chairman of the
10 Commission and the Secretary shall enter into a memo-
11 randum of understanding regarding the following:

12 “(1) Ensuring that—

13 “(A) the Department has sufficient tech-
14 nical expertise to support the timely research,
15 development, demonstration, and commercial
16 application by the civilian nuclear industry of
17 safe and innovative advanced nuclear reactor
18 technology; and

19 “(B) the Commission has sufficient tech-
20 nical expertise to support the evaluation of ap-
21 plications for licenses, permits, and design cer-
22 tifications and other requests for regulatory ap-
23 proval for advanced nuclear reactors.

24 “(2) The use of computers and software codes
25 to calculate the behavior and performance of ad-

1 vanced nuclear reactors based on mathematical mod-
2 els of the physical behavior of advanced nuclear re-
3 actors.

4 “(3) Ensuring that—

5 “(A) the Department maintains and devel-
6 ops the facilities necessary to enable the timely
7 research, development, demonstration, and com-
8 mercial application by the civilian nuclear in-
9 dustry of safe and innovative reactor tech-
10 nology; and

11 “(B) the Commission has access to the fa-
12 cilities described in subparagraph (A), as need-
13 ed.

14 “(f) REPORTING REQUIREMENTS.—

15 “(1) IN GENERAL.—Not later than 180 days
16 after the date of enactment of the Nuclear Energy
17 Innovation Capabilities Act of 2017, the Secretary,
18 in consultation with the National Laboratories, rel-
19 evant Federal agencies, and other stakeholders, shall
20 submit to the appropriate committees of Congress a
21 report assessing the capabilities of the Department
22 to authorize, host, and oversee privately funded ex-
23 perimental advanced nuclear reactors as described in
24 subsection (b).

1 “(2) CONTENTS.—The report submitted under
2 paragraph (1) shall address—

3 “(A) the safety review and oversight capa-
4 bilities of the Department, including options to
5 leverage expertise from the Commission and the
6 National Laboratories;

7 “(B) options to regulate privately proposed
8 and funded experimental reactors hosted by the
9 Department;

10 “(C) potential sites capable of hosting pri-
11 vately funded experimental advanced nuclear re-
12 actors;

13 “(D) the efficacy of the available contrac-
14 tual mechanisms of the Department to partner
15 with the private sector and Federal agencies,
16 including cooperative research and development
17 agreements, strategic partnership projects, and
18 agreements for commercializing technology;

19 “(E) the liability of the Federal Govern-
20 ment with respect to the disposal of low-level
21 radioactive waste, spent nuclear fuel, or high-
22 level radioactive waste (as those terms are de-
23 fined in section 2 of the Nuclear Waste Policy
24 Act of 1982 (42 U.S.C. 10101));

1 “(F) the impact on the aggregate inven-
2 tory in the United States of low-level radio-
3 active waste, spent nuclear fuel, or high-level
4 radioactive waste (as those terms are defined in
5 section 2 of the Nuclear Waste Policy Act of
6 1982 (42 U.S.C. 10101));

7 “(G) potential cost structures relating to
8 physical security, decommissioning, liability,
9 and other long-term project costs; and

10 “(H) other challenges or considerations
11 identified by the Secretary.

12 “(3) UPDATES.—Once every 2 years, the Sec-
13 retary shall update relevant provisions of the report
14 submitted under paragraph (1) and submit to the
15 appropriate committees of Congress the update.

16 “(g) SAVINGS CLAUSES.—

17 “(1) LICENSING REQUIREMENT.—Nothing in
18 this section authorizes the Secretary or any person
19 to construct or operate a nuclear reactor for the pur-
20 pose of demonstrating the suitability for commercial
21 application of the nuclear reactor unless licensed by
22 the Commission in accordance with section 202 of
23 the Energy Reorganization Act of 1974 (42 U.S.C.
24 5842).

1 “(2) FINANCIAL PROTECTION.—Any activity
2 carried out under this section that involves the risk
3 of public liability shall be subject to the financial
4 protection or indemnification requirements of section
5 170 of the Atomic Energy Act of 1954 (42 U.S.C.
6 2210) (commonly known as the ‘Price-Anderson
7 Act’).”.

8 (i) BUDGET PLAN.—Subtitle E of title IX of the En-
9 ergy Policy Act of 2005 (42 U.S.C. 16271 et seq.) (as
10 amended by subsection (h)) is amended by adding at the
11 end the following:

12 **“SEC. 959. BUDGET PLAN.**

13 “(a) IN GENERAL.—Not later than 1 year after the
14 date of enactment of the Nuclear Energy Innovation Ca-
15 pabilities Act of 2017, the Secretary shall submit to the
16 Committee on Energy and Natural Resources of the Sen-
17 ate and the Committee on Science, Space, and Technology
18 of the House of Representatives 2 alternative 10-year
19 budget plans for civilian nuclear energy research and de-
20 velopment by the Secretary, as described in subsections
21 (b) through (d).

22 “(b) BUDGET PLAN ALTERNATIVE 1.—One of the
23 budget plans submitted under subsection (a) shall assume
24 constant annual funding for 10 years at the appropriated

1 level for the civilian nuclear energy research and develop-
2 ment of the Department for fiscal year 2016.

3 “(c) BUDGET PLAN ALTERNATIVE 2.—One of the
4 budget plans submitted under subsection (a) shall be an
5 unconstrained budget.

6 “(d) INCLUSIONS.—Each alternative budget plan
7 submitted under subsection (a) shall include—

8 “(1) a prioritized list of the programs, projects,
9 and activities of the Department to best support the
10 development of advanced nuclear reactor tech-
11 nologies;

12 “(2) realistic budget requirements for the De-
13 partment to implement sections 955(c), 957, and
14 958; and

15 “(3) the justification of the Department for
16 continuing or terminating existing civilian nuclear
17 energy research and development programs.”.

18 (j) CONFORMING AMENDMENTS.—The table of con-
19 tents for the Energy Policy Act of 2005 is amended by
20 striking the item relating to section 957 and inserting the
21 following:

“957. High-performance computation and supportive research.
“958. Enabling nuclear energy innovation.
“959. Budget plan.”.

