

115TH CONGRESS  
1ST SESSION

# H. R. 589

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## AN ACT

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,*

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

- 2 (a) SHORT TITLE.—This Act may be cited as the  
 3 “Department of Energy Research and Innovation Act”.  
 4 (b) TABLE OF CONTENTS.—The table of contents of  
 5 this Act is as follows:

See. 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.

**6 SEC. 2. DEFINITIONS.**

- 7 In this Act:

10 (4) SECRETARY.—The term “Secretary” means  
11 the Secretary of Energy.

12 **TITLE I—LABORATORY MOD-**  
13 **ERNIZATION AND TECH-**  
14 **NOLOGY TRANSFER**

## 15 SEC. 101. SHORT TITLE.

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

18 SEC. 102. INCLUSION OF EARLY STAGE TECHNOLOGY DEM-  
19 ONSTRATION IN AUTHORIZED TECHNOLOGY  
20 TRANSFER ACTIVITIES.

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

23 (1) by redesignating subsection (g) as sub-  
24 section (h); and

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

3       “(g) EARLY STAGE TECHNOLOGY DEMONSTRA-  
4 TION.—The Secretary shall permit the directors of the Na-  
5 tional Laboratories to use funds authorized to support  
6 technology transfer within the Department to carry out  
7 early stage and precommercial technology demonstration  
8 activities to remove technology barriers that limit private  
9 sector interest and demonstrate potential commercial ap-  
10 plications of any research and technologies arising from  
11 National Laboratory activities.”.

12 SEC. 103. SENSE OF CONGRESS ON ACCELERATING ENERGY  
13 INNOVATION.

14 It is the sense of Congress that—

15 (1) although important progress has been made  
16 in cost reduction and deployment of clean energy  
17 technologies, accelerating clean energy innovation  
18 will help meet critical competitiveness, energy secu-  
19 rity, and environmental goals;

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

22 (A) supporting existing research and devel-  
23 opment programs at the Department and the  
24 world-class National Laboratories;

1 (B) exploring and developing new path-  
2 ways for innovators, investors, and decision-  
3 makers to leverage the resources of the Depart-  
4 ment for addressing the challenges and com-  
5 parative strengths of geographic regions; and

6 (C) recognizing the financial constraints of  
7 the Department, regularly reviewing clean en-  
8 ergy programs to ensure that taxpayer invest-  
9 ments are maximized;

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

23 (A) provide clean, affordable, and reliable  
24 energy for everyone:

25 (B) promote economic growth;

4 SEC. 104. RESTORATION OF LABORATORY DIRECTED RE-  
5 SEARCH AND DEVELOPMENT PROGRAM.

6 (a) IN GENERAL.—Except as provided in subsection  
7 (b), the Secretary shall ensure that laboratory operating  
8 contractors do not allocate costs of general and adminis-  
9 trative overhead to laboratory directed research and devel-  
10 opment.

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

## 16 SEC. 105. RESEARCH GRANTS DATABASE.

17 (a) IN GENERAL.—The Secretary shall establish and  
18 maintain a public database, accessible on the website of  
19 the Department, that contains a searchable listing of each  
20 unclassified research and development project contract,  
21 grant, cooperative agreement, task order for a federally  
22 funded research and development center, or other trans-  
23 action administered by the Department.

24 (b) REQUIREMENTS.—Each listing described in sub-  
25 section (a) shall include, at a minimum, for each listed

1 project, the Department office carrying out the project,  
2 the project name, an abstract or summary of the project,  
3 funding levels, project duration, contractor or grantee  
4 name (including the names of any subcontractors), and  
5 expected objectives and milestones.

6 (c) RELEVANT LITERATURE AND PATENTS.—The  
7 Secretary shall provide information through the public  
8 database established under subsection (a) on relevant lit-  
9 erature and patents that are associated with each research  
10 and development project contract, grant, or cooperative  
11 agreement, or other transaction, of the Department.

12 **SEC. 106. TECHNOLOGY TRANSFER AND TRANSITIONS AS-**  
13 **SESSMENT.**

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

1 **SEC. 107. AGREEMENTS FOR COMMERCIALIZING TECH-**  
2 **NOLOGY PILOT PROGRAM.**

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

7 (b) TERMS.—Each agreement entered into pursuant  
8 to the pilot program referred to in subsection (a) shall  
9 provide to the contractor of the applicable National Lab-  
10 oratory, to the maximum extent determined to be appro-  
11 priate by the Secretary, increased authority to negotiate  
12 contract terms, such as intellectual property rights, pay-  
13 ment structures, performance guarantees, and multiparty  
14 collaborations.

15 (c) ELIGIBILITY.—

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

19 (2) AGREEMENTS WITH NON-FEDERAL ENTI-  
20 TIES.—To carry out paragraph (1) and subject to  
21 paragraph (3), the Secretary shall permit the direc-  
22 tors of the National Laboratories to execute agree-  
23 ments with a non-Federal entity, including a non-  
24 Federal entity already receiving Federal funding  
25 that will be used to support activities under agree-  
26 ments executed pursuant to paragraph (1), provided

1 that such funding is solely used to carry out the  
2 purposes of the Federal award.

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

6 (A) the agreement is a funding agreement  
7 (as that term is defined in section 201 of that  
8 title); and

9 (B) at least one of the parties to the fund-  
10 ing agreement is eligible to receive rights under  
11 that chapter.

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

16 (1) a summary of information relating to the  
17 relevant project;

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

19 (3) estimated commencement and completion  
20 dates of the project; and

21 (4) other documentation determined to be ap-  
22 propriate by the Secretary.

23 (e) CERTIFICATION.—The Secretary shall require the  
24 contractor of the affected National Laboratory to certify

1 that each activity carried out under a project for which  
2 an agreement is entered into under this section—

3 (1) is not in direct competition with the private

4 sector; and

5 (2) does not present, or minimizes, any appar-  
6 ent conflict of interest, and avoids or neutralizes any  
7 actual conflict of interest, as a result of the agree-  
8 ment under this section.

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

11 (g) REPORTS.—

12 (1) OVERALL ASSESSMENT.—Not later than 60  
13 days after the date described in subsection (f), the  
14 Secretary, in coordination with directors of the Na-  
15 tional Laboratories, shall submit to the appropriate  
16 committees of Congress a report that—

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

19 (B) identifies opportunities to improve the  
20 effectiveness of the pilot program;

21 (C) assesses the potential for program ac-  
22 tivities to interfere with the responsibilities of  
23 the National Laboratories to the Department;

24 and

1 (D) provides a recommendation regarding  
2 the future of the pilot program.

## 11 SEC. 108. SHORT-TERM COST-SHARE PILOT PROGRAM.

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

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

19           “(4) EXEMPTION FOR INSTITUTIONS OF HIGH-  
20        ER EDUCATION AND OTHER NONPROFIT INSTITU-  
21        TIONS.—

22                   “(A) IN GENERAL.—Paragraph (1) shall  
23                   not apply to a research or development activity  
24                   performed by an institution of higher education  
25                   or nonprofit institution (as defined in section 4

1 of the Stevenson-Wydler Technology Innovation  
2 Act of 1980 (15 U.S.C. 3703)).

3                             “(B) TERMINATION DATE.—The exemp-  
4                             tion under subparagraph (A) shall apply during  
5                             the 2-year period beginning on the date of en-  
6                             actment of this paragraph.”.

7 (b) REPORTS.—

1   **TITLE II—DEPARTMENT OF EN-**  
2   **ERGY RESEARCH COORDINA-**  
3   **TION**

4   **SEC. 201. SHORT TITLE.**

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

7   **SEC. 202. PROTECTION OF INFORMATION.**

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

10           (1) in subsection (a)(3), by striking “subsection  
11       (n)(1)” and inserting “subsection (o)(1)”;

12           (2) by redesignating subsection (n) as sub-  
13       section (o); and

14           (3) by inserting after subsection (m) the fol-  
15       lowing:

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

22           “(1) Plans for commercialization of technologies  
23       developed under the award, including business plans,  
24       technology-to-market plans, market studies, and cost  
25       and performance models.

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

6           “(3) Additional financial support that the  
7           awardee—

8           “(A) plans to or has invested into the tech-  
9           nology developed under the award; or  
10           “(B) is seeking from third parties.

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

14 **SEC. 203. CROSSCUTTING RESEARCH AND DEVELOPMENT.**

15           (a) IN GENERAL.—The Secretary shall use the capa-  
16           bilities of the Department to identify strategic opportuni-  
17           ties for collaborative research, development, demonstra-  
18           tion, and commercial application of innovative science and  
19           technologies.

20           (b) EXISTING PROGRAMS; COORDINATION OF ACTIVI-  
21           TIES.—To the maximum extent practicable, the Secretary  
22           shall seek—

23           (1) to leverage existing programs of the Depart-  
24           ment; and

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

6 (1) prioritize activities that use all affordable  
7 domestic resources;

12 (A) ensures integrity and independence;

13 and

14 (B) provides the flexibility to adapt to  
15 market dynamics;

1 **SEC. 204. STRATEGIC RESEARCH PORTFOLIO ANALYSIS**2 **AND COORDINATION PLAN.**

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

6 **“SEC. 994. STRATEGIC RESEARCH PORTFOLIO ANALYSIS**7 **AND COORDINATION PLAN.**

8 “(a) IN GENERAL.—The Secretary shall periodically  
9 review all of the science and technology activities of the  
10 Department in a strategic framework that takes into ac-  
11 count—

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

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

16 “(3) global energy dynamics.

17 “(b) COORDINATION ANALYSIS AND PLAN.—

18 “(1) IN GENERAL.—As part of the review under  
19 subsection (a), the Secretary shall develop a plan to  
20 improve coordination and collaboration in research,  
21 development, demonstration, and commercial appli-  
22 cation activities across organizational boundaries of  
23 the Department.

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

1               “(A) crosscutting scientific and technical  
2               issues and research questions that span more  
3               than one program or major office of the De-  
4               partment;

5               “(B) ways in which the applied technology  
6               programs of the Department are coordinating  
7               activities and addressing the questions referred  
8               to in subparagraph (A);

9               “(C) ways in which the technical inter-  
10               change within the Department, particularly be-  
11               tween the Office of Science and the applied  
12               technology programs, could be enhanced, in-  
13               cluding ways in which the research agendas of  
14               the Office of Science and the applied programs  
15               could better interact and assist each other;

16               “(D) ways in which the Secretary would  
17               ensure that the overall research agenda of the  
18               Department includes, in addition to funda-  
19               mental, curiosity-driven research, fundamental  
20               research related to topics of concern to the ap-  
21               plied programs, and applications in Depart-  
22               mental technology programs of research results  
23               generated by fundamental, curiosity-driven re-  
24               search;

1                         “(E) critical assessments of any ongoing  
2                         programs that have experienced subpar per-  
3                         formance or cost overruns of 10 percent or  
4                         more over 1 or more years;

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

9                         “(G) detailed evaluations and proposals for  
10                         innovation hubs, institutes, and research cen-  
11                         ters of the Department, including—

12                         “(i) an affirmation that the hubs, in-  
13                         stitutes, and research centers will—

14                         “(I) advance the mission of the  
15                         Department; and

16                         “(II) prioritize research, develop-  
17                         ment, and demonstration; and

18                         “(ii) an affirmation that any hubs, in-  
19                         stitutes, or research centers that are estab-  
20                         lished or renewed within the Office of  
21                         Science are consistent with the mission of  
22                         the Office of Science described in sub-  
23                         section (c) of section 209 of the Depart-  
24                         ment of Energy Organization Act (42  
25                         U.S.C. 7139).

1       “(c) SUBMISSION TO CONGRESS.—Every 4 years, the  
2   Secretary shall submit to Congress—

3           “(1) the results of the review under subsection  
4   (a); and

5           “(2) the coordination plan under subsection  
6   (b).”.

7 **SEC. 205. STRATEGY FOR FACILITIES AND INFRASTRUC-**  
8 **TURE.**

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

11           (1) by striking the section heading and insert-  
12       ing the following: “**STRATEGY FOR FACILITIES**  
13       **AND INFRASTRUCTURE**”; and

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

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

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

20 **SEC. 206. ENERGY INNOVATION HUBS.**

21       (a) DEFINITIONS.—In this section:

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

24           (A) an innovative technology—



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

3 (2) HUB.—

4 (A) IN GENERAL.—The term “Hub”  
5 means an Energy Innovation Hub established  
6 under this section.

7 (B) INCLUSION.—The term “Hub” in-  
8 eludes any Energy Innovation Hub in existence  
9 on the date of enactment of this Act.

10 (3) QUALIFYING ENTITY.—The term “quali-  
11 fying entity” means—

12 (A) an institution of higher education;

13 (B) an appropriate State or Federal entity,  
14 including a federally funded research and devel-  
15 opment center of the Department:

16 (C) a nongovernmental organization with  
17 expertise in advanced energy technology re-  
18 search, development, demonstration, or com-  
19 mercial application; or

20 (D) any other relevant entity the Secretary  
21 determines appropriate.

22 (b) AUTHORIZATION OF PROGRAM.—

23 (1) IN GENERAL.—The Secretary shall carry  
24 out a program to enhance the economic, environ-  
25 mental, and energy security of the United States by

1 making awards to consortia for establishing and op-  
2 erating hubs, to be known as “Energy Innovation  
3 Hubs”, to conduct and support, at, if practicable,  
4 one centralized location, multidisciplinary, collabo-  
5 rative research, development, demonstration, and  
6 commercial application of advanced energy tech-  
7 nologies.

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

11 (3) COORDINATION.—The Secretary shall en-  
12 sure the coordination of, and avoid unnecessary du-  
13 plication of, the activities of each Hub with the ac-  
14 tivities of—

15 (A) other research entities of the Depart-  
16 ment, including the National Laboratories, the  
17 Advanced Research Projects Agency—Energy,  
18 and Energy Frontier Research Centers; and

19 (B) industry.

20 (c) APPLICATION PROCESS.—

21 (1) ELIGIBILITY.—To be eligible to receive an  
22 award for the establishment and operation of a Hub  
23 under subsection (b)(1), a consortium shall—

24 (A) be composed of not fewer than two  
25 qualifying entities;

(B) operate subject to a binding agreement, entered into by each member of the consortium, that documents—

(i) the proposed partnership agreement, including the governance and management structure of the Hub;

(ii) measures the consortium will undertake to enable cost-effective implementation of activities under the program described in subsection (b)(1); and

(iii) a proposed budget, including financial contributions from non-Federal sources; and

(C) operate as a nonprofit organization.

## (2) APPLICATION.—

(A) IN GENERAL.—A consortium seeking to establish and operate a Hub under subsection (b)(1) shall submit to the Secretary an application at such time, in such manner, and containing such information as the Secretary may require, including a detailed description of each element of the consortium agreement required under paragraph (1)(B).

(B) REQUIREMENT.—If the consortium members will not be located at one centralized

1 location, the application under subparagraph  
2 (A) shall include a communications plan that  
3 ensures close coordination and integration of  
4 Hub activities.

### 5 (3) SELECTION.—

10 (B) CONSIDERATIONS.—In selecting con-  
11 sortia under subparagraph (A), the Secretary  
12 shall consider—

13 (i) the information disclosed by the  
14 consortium under this subsection; and

15 (ii) any existing facilities a consortium  
16 will provide for Hub activities

17 (d) TERM =

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

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

## 6 (e) HUB OPERATIONS.—

13 (2) ACTIVITIES.—Each Hub shall—

14 (A) encourage collaboration and communication  
15 among the member qualifying entities  
16 of the consortium and awardees;

17 (B) develop and publish proposed plans  
18 and programs on a publicly accessible website;

19 (C) submit an annual report to the De-  
20 partment summarizing the activities of the  
21 Hub, including—

22 (i) detailing organizational expenditures; and  
23

24 (ii) describing each project under-  
25 taken by the Hub; and

1 (D) monitor project implementation and  
2 coordination.

7 (4) PROHIBITION ON CONSTRUCTION.—

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

17 (B) TEST BED AND RENOVATION EXCEP-  
18 TION.—Nothing in this paragraph prohibits the  
19 use of funds provided under this section or non-  
20 Federal cost share funds for the construction of  
21 a test bed or renovations to existing buildings  
22 or facilities for the purposes of research if the  
23 Secretary determines that the test bed or ren-  
24 ovations are limited to a scope and scale nec-  
25 essary for the research to be conducted.

1 **TITLE III—DEPARTMENT OF EN-**  
2 **ERGY OFFICE OF SCIENCE**  
3 **POLICY**

4 **SEC. 301. SHORT TITLE.**

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

7 **SEC. 302. MISSION.**

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

11 “(c) MISSION.—The mission of the Office of Science  
12 shall be the delivery of scientific discoveries, capabilities,  
13 and major scientific tools to transform the understanding  
14 of nature and to advance the energy, economic, and na-  
15 tional security of the United States.”.

16 **SEC. 303. BASIC ENERGY SCIENCES.**

17 (a) ENERGY FRONTIER RESEARCH CENTERS.—

18 (1) IN GENERAL.—The Director shall carry out  
19 a program to provide awards, on a competitive,  
20 merit-reviewed basis, to multi-institutional collabora-  
21 tions or other appropriate entities to conduct funda-  
22 mental and use-inspired energy research to accel-  
23 erate scientific breakthroughs.

### 4 (3) SELECTION AND DURATION.—

5 (A) IN GENERAL.—A collaboration under  
6 this subsection shall be selected for a period of  
7 4 years.

14 (C) REAPPLICATION.—After the end of the  
15 period described in subparagraph (A) or (B), as  
16 applicable, a recipient of an award may reapply  
17 for selection on a competitive, merit-reviewed  
18 basis.

19 (D) TERMINATION.—Consistent with the  
20 existing authorities of the Department, the Di-  
21 rector may terminate an underperforming cen-  
22 ter for cause during the performance period.

23 (4) NO FUNDING FOR CONSTRUCTION.—No  
24 funding provided pursuant to this subsection may be

1       used for the construction of new buildings or facil-  
2       ties.

3       (b) BASIC ENERGY SCIENCES USER FACILITIES.—

4           (1) IN GENERAL.—The Director shall carry out  
5       a program for the development, construction, opera-  
6       tion, and maintenance of national user facilities.

7           (2) REQUIREMENTS.—To the maximum extent  
8       practicable, the national user facilities developed,  
9       constructed, operated, or maintained under para-  
10       graph (1) shall serve the needs of the Department,  
11       industry, the academic community, and other rel-  
12       evant entities to create and examine materials and  
13       chemical processes for the purpose of improving the  
14       competitiveness of the United States.

15           (3) INCLUDED FACILITIES.—The national user  
16       facilities developed, constructed, operated, or main-  
17       tained under paragraph (1) shall include—

18               (A) x-ray light sources;

19               (B) neutron sources;

20               (C) nanoscale science research centers; and

21               (D) such other facilities as the Director  
22       considers appropriate, consistent with section  
23       209 of the Department of Energy Organization  
24       Act (42 U.S.C. 7139).

1       (c) ACCELERATOR RESEARCH AND DEVELOP-  
2 MENT.—The Director shall carry out research and devel-  
3 opment on advanced accelerator and storage ring tech-  
4 nologies relevant to the development of basic energy  
5 sciences user facilities, in consultation with the High En-  
6 ergy Physics and Nuclear Physics programs of the Office  
7 of Science.

8       (d) SOLAR FUELS RESEARCH INITIATIVE.—

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

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

13       “(a) INITIATIVE.—

14           “(1) IN GENERAL.—The Secretary shall carry  
15 out a research initiative, to be known as the ‘Solar  
16 Fuels Research Initiative’ (referred to in this section  
17 as the ‘Initiative’) to expand theoretical and funda-  
18 mental knowledge of photochemistry, electro-  
19 chemistry, biochemistry, and materials science useful  
20 for the practical development of experimental sys-  
21 tems to convert solar energy to chemical energy.

22           “(2) LEVERAGING.—In carrying out programs  
23 and activities under the Initiative, the Secretary  
24 shall leverage expertise and resources from—

1                   “(A) the Basic Energy Sciences Program  
2                   and the Biological and Environmental Research  
3                   Program of the Office of Science; and

4                   “(B) the Office of Energy Efficiency and  
5                   Renewable Energy.

6                   “(3) TEAMS.—

7                   “(A) IN GENERAL.—In carrying out the  
8                   Initiative, the Secretary shall organize activities  
9                   among multidisciplinary teams to leverage, to  
10                   the maximum extent practicable, expertise from  
11                   the National Laboratories, institutions of higher  
12                   education, and the private sector.

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

16                   “(C) RESOURCES.—The Secretary shall  
17                   provide sufficient resources to the multidisci-  
18                   plinary teams described in subparagraph (A) to  
19                   achieve the goals described in subparagraph (B)  
20                   over a period of time to be determined by the  
21                   Secretary.

22                   “(4) ADDITIONAL ACTIVITIES.—The Secretary  
23                   may organize additional activities under this sub-  
24                   section through Energy Frontier Research Centers,

1 Energy Innovation Hubs, or other organizational  
2 structures.

3 “(b) ARTIFICIAL PHOTOSYNTHESIS.—

4 “(1) IN GENERAL.—The Secretary shall carry  
5 out under the Initiative a program to support re-  
6 search needed to bridge scientific barriers to, and  
7 discover knowledge relevant to, artificial photosyn-  
8 thetic systems.

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

11 “(A) the Director of the Office of Basic  
12 Energy Sciences shall support basic research to  
13 pursue distinct lines of scientific inquiry, in-  
14 cluding—

15 “(i) photoinduced production of hy-  
16 drogen and oxygen from water; and

17 “(ii) the sustainable photoinduced re-  
18 duction of carbon dioxide to fuel products  
19 including hydrocarbons, alcohols, carbon  
20 monoxide, and natural gas; and

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

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

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

9           “(c) BIOCHEMISTRY, REPLICATION OF NATURAL  
10 PHOTOSYNTHESIS, AND RELATED PROCESSES.—

11           “(1) IN GENERAL.—The Secretary shall carry  
12 out under the Initiative a program to support re-  
13 search needed to replicate natural photosynthetic  
14 processes by use of artificial photosynthetic compo-  
15 nents and materials.

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

18           “(A) the Director of the Office of Basic  
19 Energy Sciences shall support basic research to  
20 expand fundamental knowledge to replicate nat-  
21 ural synthesis processes, including—

22           “(i) the photoinduced reduction of  
23 dinitrogen to ammonia;

24           “(ii) the absorption of carbon dioxide  
25 from ambient air;

1                         “(iii) molecular-based charge separa-  
2                         tion and storage;

3                         “(iv) photoinitiated electron transfer;  
4                         and

5                         “(v) catalysis in biological or bio-  
6                         mimetic systems;

7                         “(B) the Associate Director of Biological  
8                         and Environmental Research shall support sys-  
9                         tems biology and genomics approaches to un-  
10                         derstand genetic and physiological pathways  
11                         connected to photosynthetic mechanisms; and

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

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

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

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

5 (e) ELECTRICITY STORAGE RESEARCH INITIATIVE.—

6 (1) IN GENERAL.—Section 975 of the Energy  
7 Policy Act of 2005 (42 U.S.C. 16315) is amended  
8 to read as follows:

## 9 “SEC. 975. ELECTRICITY STORAGE RESEARCH INITIATIVE.

10           “(a) INITIATIVE.—

11               “(1) IN GENERAL.—The Secretary shall carry  
12               out a research initiative, to be known as the ‘Elec-  
13               tricity Storage Research Initiative’ (referred to in  
14               this section as the ‘Initiative’)—

15                   “(A) to expand theoretical and funda-  
16                   mental knowledge to control, store, and con-  
17                   vert—

22                             “(B) to support scientific inquiry into the  
23                             practical understanding of chemical and phys-  
24                             ical processes that occur within systems involv-

1 ing crystalline and amorphous solids, polymers,  
2 and organic and aqueous liquids.

3                   “(2) LEVERAGING.—In carrying out programs  
4        and activities under the Initiative, the Secretary  
5        shall leverage expertise and resources from—

6                         “(A) the Basic Energy Sciences Program,  
7                         the Advanced Scientific Computing Research  
8                         Program, and the Biological and Environmental  
9                         Research Program of the Office of Science; and

10                             “(B) the Office of Energy Efficiency and  
11                             Renewable Energy.

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

22                   “(C) RESOURCES.—The Secretary shall  
23                   provide sufficient resources to the multidisci-  
24                   plinary teams described in subparagraph (A) to  
25                   achieve the goals described in subparagraph (B)

1           over a period of time to be determined by the  
2           Secretary.

3           “(4) ADDITIONAL ACTIVITIES.—The Secretary  
4           may organize additional activities under this sub-  
5           section through Energy Frontier Research Centers,  
6           Energy Innovation Hubs, or other organizational  
7           structures.

8           “(b) MULTIVALENT SYSTEMS.—

9           “(1) IN GENERAL.—The Secretary shall carry  
10          out under the Initiative a program to support re-  
11          search needed to bridge scientific barriers to, and  
12          discover knowledge relevant to, multivalent ion mate-  
13          rials in electric energy storage systems.

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

16           “(A) the Director of the Office of Basic  
17          Energy Sciences shall investigate electro-  
18          chemical properties and the dynamics of mate-  
19          rials, including charge transfer phenomena and  
20          mass transport in materials; and

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

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

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

9           “(c) ELECTROCHEMISTRY MODELING AND SIMULA-  
10 TION.—

11           “(1) IN GENERAL.—The Secretary shall carry  
12 out under the Initiative a program to support re-  
13 search to model and simulate organic electrolytes,  
14 including the static and dynamic electrochemical be-  
15 havior and phenomena of organic electrolytes at the  
16 molecular and atomic level in monovalent and multi-  
17 valent systems.

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, in coordination with the Asso-  
22 ciate Director of Advanced Scientific Com-  
23 puting Research, shall support the development  
24 of high performance computational tools  
25 through a joint development process to maxi-

1 maximize the effectiveness of current and projected  
2 high performance computing systems; 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        “(d) MESOSCALE ELECTROCHEMISTRY.—

17           “(1) IN GENERAL.—The Secretary shall carry  
18           out under the Initiative a program to support re-  
19           search needed to reveal electrochemistry in confined  
20           mesoscale spaces, including scientific discoveries rel-  
21           evant to—

22 “(A) bio-electrochemistry and electro-  
23 chemical energy conversion and storage in con-  
24 fined spaces; and

1                   “(B) the dynamics of the phenomena de-  
2                   scribed in subparagraph (A).

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 and the Associate Director of  
7                   Biological and Environmental Research shall in-  
8                   vestigate phenomena of mesoscale electro-  
9                   chemical confinement for the purpose of repli-  
10                  cating and controlling new electrochemical be-  
11                  havior; and

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

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

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

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

## 5 SEC. 304. ADVANCED SCIENTIFIC COMPUTING RESEARCH.

6 (a) AMERICAN SUPER COMPUTING LEADERSHIP.—

## 7 (1) RENAMING OF ACT.—

16 (B) CONFORMING AMENDMENT.—Section  
17 976(a)(1) of the Energy Policy Act of 2005 (42  
18 U.S.C. 16316(1)) is amended by striking “De-  
19 partment of Energy High-End Computing Revi-  
20 talization Act of 2004” and inserting “Amer-  
21 ican Super Computing Leadership Act of  
22 2017”.

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

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

4 (B) by striking paragraph (1) and insert-  
5 ing the following:

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

8               “(2)    EXASCALE    COMPUTING.—The    term  
9               ‘exascale computing’ means computing through the  
10          use of a computing machine that performs near or  
11          above  $10^{18}$  operations per second.”;  
12          and

13 (C) in paragraph (6) (as redesignated by  
14 subparagraph (A)), by striking “, acting  
15 through the Director of the Office of Science of  
16 the Department of Energy”.

21 (A) in subsection (a)(1), by striking “pro-  
22 gram” and inserting “coordinated program  
23 across the Department”;

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

4 (C) by striking subsection (d) and insert-  
5 ing the following:

6        "(d) EXASCALE COMPUTING PROGRAM.—

7       “(1) IN GENERAL.—The Secretary shall con-  
8       duct a research program (referred to in this sub-  
9       section as the ‘Program’) for exascale computing, in-  
10       cluding the development of two or more exascale  
11       computing machine architectures, to promote the  
12       missions of the Department.

## 13       “(2) EXECUTION.—

1                     “(iii) develop such advancements in  
2                     hardware and software technology as are  
3                     required to fully realize the potential of an  
4                     exascale production system in addressing  
5                     Department target applications and solving  
6                     scientific problems involving predictive  
7                     modeling and simulation and large scale  
8                     data analytics and management;

9                     “(iv) explore the use of exascale com-  
10                     puting technologies to advance a broad  
11                     range of science and engineering; and

12                     “(v) provide, as appropriate, on a  
13                     competitive, merit-reviewed basis, access  
14                     for researchers in industries in the United  
15                     States, institutions of higher education,  
16                     National Laboratories, and other Federal  
17                     agencies to the exascale computing systems  
18                     developed pursuant to clause (i).

19                     “(B) SELECTION OF PARTNERS.—The Sec-  
20                     retary shall select the partnerships with the  
21                     computing facilities of the Department under  
22                     subparagraph (A) through a competitive, peer-  
23                     review process.

24                     “(3) CODESIGN AND APPLICATION DEVELOP-  
25                     MENT.—

1                     “(A) IN GENERAL.—The Secretary shall—

2                         “(i) carry out the Program through  
3                         an integration of applications, computer  
4                         science, applied mathematics, and com-  
5                         puter hardware architecture using the  
6                         partnerships established pursuant to para-  
7                         graph (2) to ensure that, to the maximum  
8                         extent practicable, two or more exascale  
9                         computing machine architectures are capa-  
10                         ble of solving Department target applica-  
11                         tions and broader scientific problems, in-  
12                         cluding predictive modeling and simulation  
13                         and large scale data analytics and manage-  
14                         ment; and

15                         “(ii) conduct outreach programs to in-  
16                         crease the readiness for the use of such  
17                         platforms by domestic industries, including  
18                         manufacturers.

19                     “(B) REPORT.—The Secretary shall sub-  
20                         mit to Congress a report describing—

21                         “(i) how the integration under sub-  
22                         paragraph (A) is furthering application  
23                         science data and computational workloads  
24                         across application interests, including na-  
25                         tional security, material science, physical

1 science, cybersecurity, biological science,  
2 the Materials Genome and BRAIN Initiatives of the President, advanced manufacturing, and the national electric grid; and  
3  
4 “(ii) the roles and responsibilities of  
5 National Laboratories and industry, including the definition of the roles and responsibilities within the Department to ensure an integrated program across the Department.

6  
7  
8  
9  
10  
11 “(4) PROJECT REVIEW.—

12 “(A) IN GENERAL.—The exascale architectures developed pursuant to partnerships established pursuant to paragraph (2) shall be reviewed through a project review process.

13  
14  
15  
16 “(B) REPORT.—Not later than 90 days after the date of enactment of this subsection, the Secretary shall submit to Congress a report  
17  
18  
19 on—

20  
21 “(i) the results of the review conducted under subparagraph (A); and

22  
23  
24  
25 “(ii) the coordination and management of the Program to ensure an integrated research program across the Department.

1                 “(5) ANNUAL REPORTS.—At the time of the  
2                 budget submission of the Department for each fiscal  
3                 year, the Secretary, in consultation with the mem-  
4                 bers of the partnerships established pursuant to  
5                 paragraph (2), shall submit to Congress a report  
6                 that describes funding for the Program as a whole  
7                 by functional element of the Department and critical  
8                 milestones.”.

9                 (b) HIGH-PERFORMANCE COMPUTING AND NET-  
10                 WORKING RESEARCH.—The Director shall support re-  
11                 search in high-performance computing and networking rel-  
12                 evant to energy applications, including modeling, simula-  
13                 tion, and advanced data analytics for basic and applied  
14                 energy research programs carried out by the Secretary.

15                 (c) APPLIED MATHEMATICS AND SOFTWARE DEVEL-  
16                 OPMENT FOR HIGH-END COMPUTING SYSTEMS.—The Di-  
17                 rector shall carry out activities to develop, test, and sup-  
18                 port—

19                         (1) mathematics, models, and algorithms for  
20                 complex systems and programming environments;  
21                 and

22                         (2) tools, languages, and operating systems for  
23                 high-end computing systems (as defined in section 2  
24                 of the American Super Computing Leadership Act of  
25                 2017 (15 U.S.C. 5541)).

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

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

4 (1) the Director should incorporate the findings  
5 and recommendations of the report of the Particle  
6 Physics Project Prioritization Panel entitled “Build-  
7 ing for Discovery: Strategic Plan for U.S. Particle  
8 Physics in the Global Context” into the planning  
9 process of the Department; and

10 (2) the nations that lead in particle physics by  
11 hosting international teams dedicated to a common  
12 scientific goal attract the world’s best talent and in-  
13 spire future generations of physicists and tech-  
14 nologists.

15 (b) INTERNATIONAL COLLABORATION.—The Direc-  
16 tor, as practicable and in coordination with other appro-  
17 priate Federal agencies as necessary, shall ensure the ac-  
18 cess of United States researchers to the most advanced  
19 accelerator facilities and research capabilities in the world,  
20 including the Large Hadron Collider.

21 (c) NEUTRINO RESEARCH.—The Director shall carry  
22 out research activities on rare decay processes and the na-  
23 ture of the neutrino, which may include collaborations  
24 with the National Science Foundation or international col-  
25 laborations.

1       (d) DARK ENERGY AND DARK MATTER RE-  
2 SEARCH.—The Director shall carry out research activities  
3 on the nature of dark energy and dark matter, which may  
4 include collaborations with the National Aeronautics and  
5 Space Administration or the National Science Foundation;  
6 or international collaborations.

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

8       (a) BIOLOGICAL SYSTEMS.—The Director shall carry  
9 out research and development activities in fundamental,  
10 structural, computational, and systems biology to increase  
11 systems-level understanding of the complex biological sys-  
12 tems, which may include activities—  
13               (1) to accelerate breakthroughs and new knowl-  
14 edge that would enable the cost-effective, sustainable  
15 production of—  
16                       (A) biomass-based liquid transportation  
17 fuels;  
18                       (B) bioenergy; and  
19                       (C) biobased materials;  
20               (2) to improve understanding of the global car-  
21 bon cycle, including processes for removing carbon  
22 dioxide from the atmosphere, through photosynthesis  
23 and other biological processes, for sequestration and  
24 storage; and

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

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

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

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

## 17 SEC. 307. FUSION ENERGY.

18 (a) FUSION MATERIALS RESEARCH AND DEVELOP-

19 MENT.—As part of the activities authorized in section 978  
20 of the Energy Policy Act of 2005 (42 U.S.C. 16318)—

1        materials that can endure the neutron, plasma, and  
2        heat fluxes expected in a fusion power system; and

3                (2) the Director shall provide an assessment  
4        of—

5                        (A) the need for one or more facilities that  
6        can examine and test potential fusion and next  
7        generation fission materials and other enabling  
8        technologies relevant to the development of fu-  
9        sion power; and

10                        (B) whether a single new facility that sub-  
11        stantially addresses magnetic fusion and next  
12        generation fission materials research needs is  
13        feasible, in conjunction with the expected capa-  
14        bilities of facilities operational as of the date of  
15        enactment of this Act.

16                (b) TOKAMAK RESEARCH AND DEVELOPMENT.—The  
17        Director shall support research and development activities  
18        and facility operations to optimize the tokamak approach  
19        to fusion energy.

20                (c) INERTIAL FUSION ENERGY RESEARCH AND DE-  
21        VELOPMENT.—The Director shall support research and  
22        development activities for inertial fusion for energy appli-  
23        cations.

24                (d) ALTERNATIVE AND ENABLING CONCEPTS.—The  
25        Director shall support research and development activities

1 and facility operations at institutions of higher education,  
2 National Laboratories, and private facilities in the United  
3 States for a portfolio of alternative and enabling fusion  
4 energy concepts that may provide solutions to significant  
5 challenges to the establishment of a commercial magnetic  
6 fusion power plant, prioritized based on the ability of the  
7 United States to play a leadership role in the international  
8 fusion research community.

9 (e) COORDINATION WITH ARPA-E.—The Director  
10 shall coordinate with the Director of the Advanced Re-  
11 search Projects Agency-Energy (referred to in this sub-  
12 section as “ARPA-E”) to—

13 (1) assess the potential for any fusion energy  
14 project supported by ARPA-E to represent a prom-  
15 ising approach to a commercially viable fusion power  
16 plant;

17 (2) determine whether the results of any fusion  
18 energy project supported by ARPA-E merit the sup-  
19 port of follow-on research activities carried out by  
20 the Office of Science; and

21 (3) avoid the unintentional duplication of activi-  
22 ties.

23 (f) FAIRNESS IN COMPETITION FOR SOLICITATIONS  
24 FOR INTERNATIONAL PROJECT ACTIVITIES.—Section 33  
25 of the Atomic Energy Act of 1954 (42 U.S.C. 2053) is

1 amended by inserting before the first sentence the fol-  
2 lowing: “In this section, with respect to international re-  
3 search projects, the term ‘private facilities or laboratories’  
4 means facilities or laboratories located in the United  
5 States.”.

6 (g) IDENTIFICATION OF PRIORITIES.—

7 (1) REPORT.—

8 (A) IN GENERAL.—Not later than 2 years  
9 after the date of enactment of this Act, the Sec-  
10 retary shall submit to Congress a report on the  
11 fusion energy research and development activi-  
12 ties that the Department proposes to carry out  
13 over the 10-year period following the date of  
14 the report under not fewer than 3 realistic  
15 budget scenarios, including a scenario based on  
16 3-percent annual growth in the non-ITER por-  
17 tion of the budget for fusion energy research  
18 and development activities.

19 (B) INCLUSIONS.—The report required  
20 under subparagraph (A) shall—

21 (i) identify specific areas of fusion en-  
22 ergy research and enabling technology de-  
23 velopment in which the United States can  
24 and should establish or solidify a lead in

1 the global fusion energy development ef-  
2 fort;

3 (ii) identify priorities for initiation of  
4 facility construction and facility decommis-  
5 sioning under each of the three budget sce-  
6 narios described in subparagraph (A); and

7 (iii) assess the ability of the fusion  
8 workforce of the United States to carry out  
9 the activities identified under clauses (i)  
10 and (ii), including the adequacy of pro-  
11 grams at institutions of higher education  
12 in the United States to train the leaders  
13 and workers of the next generation of fu-  
14 sion energy researchers.

## 1 SEC. 308. NUCLEAR PHYSICS.

2 (a) ISOTOPE DEVELOPMENT AND PRODUCTION FOR

3 RESEARCH APPLICATIONS.—The Director—

4 (1) may carry out a program for the production  
5 of isotopes, including the development of techniques  
6 to produce isotopes, that the Secretary determines  
7 are needed for research, medical, industrial, or re-  
8 lated purposes; and9 (2) shall ensure that isotope production activi-  
10 ties carried out under the program under this para-  
11 graph do not compete with private industry unless  
12 the Director determines that critical national inter-  
13 ests require the involvement of the Federal Govern-  
14 ment.15 (b) RENAMING OF THE RARE ISOTOPE ACCEL-  
16 ERATOR.—Section 981 of the Energy Policy Act of 2005  
17 (42 U.S.C. 16321) is amended—18 (1) in the section heading, by striking “**RARE**  
19 **ISOTOPE ACCELERATOR**” and inserting “**FACIL-**  
20 **ITY FOR RARE ISOTOPE BEAMS**”; and21 (2) by striking “Rare Isotope Accelerator” each  
22 place it appears and inserting “Facility for Rare Iso-  
23 tope Beams”.

1 **SEC. 309. SCIENCE LABORATORIES INFRASTRUCTURE PRO-**2 **GRAM.**

3 (a) IN GENERAL.—The Director shall carry out a  
4 program to improve the safety, efficiency, and mission  
5 readiness of infrastructure at laboratories of the Office of  
6 Science.

7 (b) INCLUSIONS.—The program under subsection (a)  
8 shall include projects—

9 (1) to renovate or replace space that does not  
10 meet research needs;

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

13 (3) to modernize utility systems to prevent fail-  
14 ures and ensure efficiency;

15 (4) to remove excess facilities to allow safe and  
16 efficient operations; and

17 (5) to construct modern facilities to conduct ad-  
18 vanced research in controlled environmental condi-  
19 tions.

20 **TITLE IV—NUCLEAR ENERGY**  
21 **INNOVATION CAPABILITIES**

22 **SEC. 401. SHORT TITLE.**

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

1 **SEC. 402. NUCLEAR ENERGY INNOVATION CAPABILITIES.**

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

5 **“SEC. 951. NUCLEAR ENERGY.**

6 “(a) MISSION.—

7 “(1) IN GENERAL.—The Secretary shall carry  
8 out programs of civilian nuclear research, develop-  
9 ment, demonstration, and commercial application,  
10 including activities under this subtitle.

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

14 “(A) Providing research infrastructure to  
15 promote scientific progress and enable users  
16 from academia, the National Laboratories, and  
17 the private sector to make scientific discoveries  
18 relevant for nuclear, chemical, and materials  
19 science engineering.

20 “(B) Maintaining nuclear energy research  
21 and development programs at the National  
22 Laboratories and institutions of higher edu-  
23 cation, including infrastructure at the National  
24 Laboratories and institutions of higher edu-  
25 cation.

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

3                   “(D) Increasing confidence margins for  
4 public safety of nuclear energy systems.

5                   “(E) Reducing the environmental impact  
6 of activities relating to nuclear energy.

7                   “(F) Supporting technology transfer from  
8 the National Laboratories to the private sector.

9                   “(G) Enabling the private sector to part-  
10 ner with the National Laboratories to dem-  
11 onstrate novel reactor concepts for the purpose  
12 of resolving technical uncertainty associated  
13 with the objectives described in subparagraphs  
14 (A) through (F).

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

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

18                   “(A) a nuclear fission reactor with signifi-  
19 cant improvements over the most recent genera-  
20 tion of nuclear fission reactors, which may in-  
21 clude—

22                   “(i) inherent safety features;

23                   “(ii) lower waste yields;

24                   “(iii) greater fuel utilization;

25                   “(iv) superior reliability;

1                         “(v) resistance to proliferation;  
2                         “(vi) increased thermal efficiency; and  
3                         “(vii) the ability to integrate into elec-  
4                         tric and nonelectric applications; or  
5                         “(B) a nuclear fusion reactor.

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

8                 “(3) FAST NEUTRON.—The term ‘fast neutron’  
9                         means a neutron with kinetic energy above 100  
10                         kiloelectron volts.

11                 “(4) NATIONAL LABORATORY.—

12                 “(A) IN GENERAL.—Except as provided in  
13                         subparagraph (B), the term ‘National Labora-  
14                         tory’ has the meaning given the term in section  
15                         2.

16                 “(B) LIMITATION.—With respect to the  
17                         Lawrence Livermore National Laboratory, the  
18                         Los Alamos National Laboratory, and the  
19                         Sandia National Laboratories, the term ‘Na-  
20                         tional Laboratory’ means only the civilian ac-  
21                         tivities of the laboratory.

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

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

4           “(A) research on materials sciences and  
5       nuclear physics; and

6           “(B) testing of advanced materials, nuclear  
7       fuels, and other related components for reactor  
8       systems.”.

9       (b) NUCLEAR ENERGY RESEARCH PROGRAMS.—

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

12           (A) by striking subsection (c); and  
13           (B) by redesignating subsections (d) and  
14       (e) as subsections (c) and (d), respectively.

15       (2) CONFORMING AMENDMENT.—Section  
16       641(b)(1) of the Energy Policy Act of 2005 (42  
17       U.S.C. 16021(b)(1)) is amended by striking “section  
18       942(d)” and inserting “section 952(c)”.

19       (c) ADVANCED FUEL CYCLE INITIATIVE.—Section  
20       953(a) of the Energy Policy Act of 2005 (42 U.S.C.  
21       16273(a)) is amended by striking “, acting through the  
22       Director of the Office of Nuclear Energy, Science and  
23       Technology,”.

24       (d) UNIVERSITY NUCLEAR SCIENCE AND ENGINEER-  
25       ING SUPPORT.—Section 954(d)(4) of the Energy Policy

1 Act of 2005 (42 U.S.C. 16274(d)(4)) is amended by strik-  
2 ing “as part of a taking into consideration effort that em-  
3 phasizes” and inserting “that emphasize”.

4 (e) DEPARTMENT OF ENERGY CIVILIAN NUCLEAR  
5 INFRASTRUCTURE AND FACILITIES.—Section 955 of the  
6 Energy Policy Act of 2005 (42 U.S.C. 16275) is amend-  
7 ed—

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

10 “(c) VERSATILE NEUTRON SOURCE.—

11 “(1) MISSION NEED.—

12 “(A) IN GENERAL.—Not later than De-  
13 cember 31, 2017, the Secretary shall determine  
14 the mission need for a versatile reactor-based  
15 fast neutron source, which shall operate as a  
16 national user facility.

17 “(B) CONSULTATIONS REQUIRED.—In car-  
18 rying out subparagraph (A), the Secretary shall  
19 consult with the private sector, institutions of  
20 higher education, the National Laboratories,  
21 and relevant Federal agencies to ensure that  
22 the user facility described in subparagraph (A)  
23 will meet the research needs of the largest prac-  
24 ticable majority of prospective users.

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

6           “(3) FACILITY REQUIREMENTS.—

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

10           “(i) Fast neutron spectrum irradia-  
11        tion capability.

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

14           “(B) CONSIDERATIONS.—In carrying out  
15        the plan submitted under paragraph (2), the  
16        Secretary shall consider the following:

17           “(i) Capabilities that support experi-  
18        mental high-temperature testing.

19           “(ii) Providing a source of fast neu-  
20        trons at a neutron flux, higher than that  
21        at which current research facilities operate,  
22        sufficient to enable research for an optimal  
23        base of prospective users.

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

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

6                     “(v) Multiple loops for fuels and ma-  
7                     terials testing in different coolants.

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

10                    “(vii) Lifetime operating costs and  
11                    lifecycle costs.

12                    “(4) DEADLINE FOR ESTABLISHMENT.—The  
13                    Secretary shall, to the maximum extent practicable,  
14                    complete construction of, and approve the start of  
15                    operations for, the user facility by not later than De-  
16                    cember 31, 2025.

17                    “(5) REPORTING.—The Secretary shall include  
18                    in the annual budget request of the Department an  
19                    explanation for any delay in the progress of the De-  
20                    partment in completing the user facility by the dead-  
21                    line described in paragraph (4).

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

1        (f) SECURITY OF NUCLEAR FACILITIES.—Section  
2 956 of the Energy Policy Act of 2005 (42 U.S.C. 16276)  
3 is amended by striking “, acting through the Director of  
4 the Office of Nuclear Energy, Science and Technology.”.

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

9        **“SEC. 957. HIGH-PERFORMANCE COMPUTATION AND SUP-**

10                    **PORITIVE RESEARCH.**

11        “(a) MODELING AND SIMULATION.—The Secretary  
12 shall carry out a program to enhance the capabilities of  
13 the United States to develop new reactor technologies  
14 through high-performance computation modeling and sim-  
15 ulation techniques.

16        “(b) COORDINATION.—In carrying out the program  
17 under subsection (a), the Secretary shall coordinate with  
18 relevant Federal agencies as described by the National  
19 Strategic Computing Initiative established by Executive  
20 Order No. 13702 (80 Fed. Reg. 46177 (July 29, 2015)),  
21 while taking into account the following objectives:

22                    “(1) Using expertise from the private sector, in-  
23 stitutions of higher education, and the National  
24 Laboratories to develop computational software and  
25 capabilities that prospective users may access to ac-

1       celerate research and development of advanced nu-  
2       clear reactor systems and reactor systems for space  
3       exploration.

4           “(2) Developing computational tools to simulate  
5       and predict nuclear phenomena that may be vali-  
6       dated through physical experimentation.

7           “(3) Increasing the utility of the research infra-  
8       structure of the Department by coordinating with  
9       the Advanced Scientific Computing Research pro-  
10       gram within the Office of Science.

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

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

17           “(c) SUPPORTIVE RESEARCH ACTIVITIES.—The Sec-  
18       retary shall consider support for additional research activi-  
19       ties to maximize the utility of the research facilities of the  
20       Department, including physical processes—

21           “(1) to simulate degradation of materials and  
22       behavior of fuel forms; and

23           “(2) for validation of computational tools.”.

24           (h) ENABLING NUCLEAR ENERGY INNOVATION.—  
25       Subtitle E of title IX of the Energy Policy Act of 2005

1 (42 U.S.C. 16271 et seq.) is amended by adding at the  
2 end the following:

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

4       **“(a) NATIONAL REACTOR INNOVATION CENTER.—**

5           **“(1) IN GENERAL.—**There is authorized a pro-  
6 gram to enable the testing and demonstration of re-  
7 actor concepts to be proposed and funded by the pri-  
8 vate sector.

9           **“(2) PARTICIPATION.—**Nothing in this section  
10 shall prevent a private sector entity that has re-  
11 ceived Federal grants from participating in this pro-  
12 gram.

13       **“(b) TECHNICAL EXPERTISE.—**In carrying out the  
14 program under subsection (a), the Secretary shall leverage  
15 the technical expertise of relevant Federal agencies and  
16 the National Laboratories in order to minimize the time  
17 required to enable construction and operation of privately  
18 funded experimental reactors at National Laboratories or  
19 other Department-owned sites.

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

22           **“(1) Enabling physical validation of advanced**  
23 **nuclear reactor concepts.**

24           **“(2) Resolving technical uncertainty and in-**  
25 **creasing practical knowledge relevant to safety, resil-**

1       ience, security, and functionality of advanced nuclear  
2       reactor concepts.

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

5           “(d) SHARING TECHNICAL EXPERTISE.—In carrying  
6       out the program under subsection (a), the Secretary may  
7       enter into a memorandum of understanding with the  
8       Chairman of the Commission in order to share technical  
9       expertise and knowledge through—

10           “(1) enabling the testing and demonstration of  
11       advanced nuclear reactor concepts to be proposed  
12       and funded by the private sector;

13           “(2) operating a database to store and share  
14       data and knowledge relevant to nuclear science and  
15       engineering between Federal agencies and the pri-  
16       vate sector;

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

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

22           “(5) enabling technical staff of the Commission  
23       to actively observe and learn about technologies de-  
24       veloped under the program.

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

4           “(1) Ensuring that—

5               “(A) the Department has sufficient tech-  
6 nical expertise to support the timely research,  
7 development, demonstration, and commercial  
8 application by the civilian nuclear industry of  
9 safe and innovative advanced nuclear reactor  
10 technology; and

11               “(B) the Commission has sufficient tech-  
12 nical expertise to support the evaluation of ap-  
13 plications for licenses, permits, and design cer-  
14 tifications and other requests for regulatory ap-  
15 proval for advanced nuclear reactors.

16           “(2) The use of computers and software codes  
17 to calculate the behavior and performance of ad-  
18 vanced nuclear reactors based on mathematical mod-  
19 els of the physical behavior of advanced nuclear re-  
20 actors.

21           “(3) Ensuring that—

22               “(A) the Department maintains and devel-  
23 ops the facilities necessary to enable the timely  
24 research, development, demonstration, and com-  
25 mercial application by the civilian nuclear in-

1 industry of safe and innovative reactor tech-  
2 nology; and

3                   “(B) the Commission has access to the fa-  
4                   cilities described in subparagraph (A), as need-  
5                   ed.

6        "(f) REPORTING REQUIREMENTS.—

7       “(1) IN GENERAL.—Not later than 180 days  
8       after the date of enactment of the Nuclear Energy  
9       Innovation Capabilities Act of 2017, the Secretary,  
10      in consultation with the National Laboratories, relevant  
11      Federal agencies, and other stakeholders, shall  
12      submit to the appropriate committees of Congress a  
13      report assessing the capabilities of the Department  
14      to authorize, host, and oversee privately funded experimental  
15      advanced nuclear reactors as described in subsection (b).  
16

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

19                   “(A) the safety review and oversight capa-  
20                   bilities of the Department, including options to  
21                   leverage expertise from the Commission and the  
22                   National Laboratories;

23                   “(B) options to regulate privately proposed  
24                   and funded experimental reactors hosted by the  
25                   Department;

1                   “(C) potential sites capable of hosting pri-  
2                   vately funded experimental advanced nuclear re-  
3                   actors;

4                   “(D) the efficacy of the available contrac-  
5                   tual mechanisms of the Department to partner  
6                   with the private sector and Federal agencies,  
7                   including cooperative research and development  
8                   agreements, strategic partnership projects, and  
9                   agreements for commercializing technology;

10                  “(E) the liability of the Federal Govern-  
11                  ment with respect to the disposal of low-level  
12                  radioactive waste, spent nuclear fuel, or high-  
13                  level radioactive waste (as those terms are de-  
14                  fined in section 2 of the Nuclear Waste Policy  
15                  Act of 1982 (42 U.S.C. 10101));

16                  “(F) the impact on the aggregate inven-  
17                  tory in the United States of low-level radio-  
18                  active waste, spent nuclear fuel, or high-level  
19                  radioactive waste (as those terms are defined in  
20                  section 2 of the Nuclear Waste Policy Act of  
21                  1982 (42 U.S.C. 10101));

22                  “(G) potential cost structures relating to  
23                  physical security, decommissioning, liability,  
24                  and other long-term project costs; and

1                 “(H) other challenges or considerations  
2                 identified by the Secretary.

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

7                 “(g) SAVINGS CLAUSES.—

8                 “(1) LICENSING REQUIREMENT.—Nothing in  
9                 this section authorizes the Secretary or any person  
10                 to construct or operate a nuclear reactor for the pur-  
11                 pose of demonstrating the suitability for commercial  
12                 application of the nuclear reactor unless licensed by  
13                 the Commission in accordance with section 202 of  
14                 the Energy Reorganization Act of 1974 (42 U.S.C.  
15                 5842).

16                 “(2) FINANCIAL PROTECTION.—Any activity  
17                 carried out under this section that involves the risk  
18                 of public liability shall be subject to the financial  
19                 protection or indemnification requirements of section  
20                 170 of the Atomic Energy Act of 1954 (42 U.S.C.  
21                 2210) (commonly known as the ‘Price-Anderson  
22                 Act’).”.

23                 (i) BUDGET PLAN.—Subtitle E of title IX of the En-  
24                 ergy Policy Act of 2005 (42 U.S.C. 16271 et seq.) (as

1 amended by subsection (h)) is amended by adding at the  
2 end the following:

3 **“SEC. 959. BUDGET PLAN.**

4       “(a) IN GENERAL.—Not later than 1 year after the  
5 date of enactment of the Nuclear Energy Innovation Ca-  
6 pabilities Act of 2017, the Secretary shall submit to the  
7 Committee on Energy and Natural Resources of the Sen-  
8 ate and the Committee on Science, Space, and Technology  
9 of the House of Representatives 2 alternative 10-year  
10 budget plans for civilian nuclear energy research and de-  
11 velopment by the Secretary, as described in subsections  
12 (b) through (d).

13       “(b) BUDGET PLAN ALTERNATIVE 1.—One of the  
14 budget plans submitted under subsection (a) shall assume  
15 constant annual funding for 10 years at the appropriated  
16 level for the civilian nuclear energy research and develop-  
17 ment of the Department for fiscal year 2016.

18       “(c) BUDGET PLAN ALTERNATIVE 2.—One of the  
19 budget plans submitted under subsection (a) shall be an  
20 unconstrained budget.

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

23           “(1) a prioritized list of the programs, projects,  
24 and activities of the Department to best support the

1 development of advanced nuclear reactor tech-  
2 nologies;

3 “(2) realistic budget requirements for the De-  
4 partment to implement sections 955(c), 957, and  
5 958; and

6 “(3) the justification of the Department for  
7 continuing or terminating existing civilian nuclear  
8 energy research and development programs.”.

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

“957. High-performance computation and supportive research.

“958. Enabling nuclear energy innovation.

“959. Budget plan.”.

Passed the House of Representatives January 24,  
2017.

Attest:

*Clerk.*

115TH CONGRESS  
1ST SESSION

# **H. R. 589**

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## **AN ACT**

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.