

Union Calendar No. 400

116TH CONGRESS
2^D SESSION

H. R. 3597

[Report No. 116–499]

To guide and authorize basic research programs in the United States for research, development, and demonstration of solar energy technologies, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

JUNE 28, 2019

Mr. MCADAMS (for himself and Mr. FORTENBERRY) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

SEPTEMBER 11, 2020

Additional sponsors: Mr. CRIST, Ms. ESCOBAR, and Mrs. AXNE

SEPTEMBER 11, 2020

Reported with amendments, committed to the Committee of the Whole House on the State of the Union, and ordered to be printed

[Strike out all after the enacting clause and insert the part printed in *italie*]

[For text of introduced bill, see copy of bill as introduced on June 28, 2019]

A BILL

To guide and authorize basic research programs in the United States for research, development, and demonstration of solar energy technologies, 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.**

4 *This Act may be cited as the “Solar Energy Research*
5 *and Development Act of 2019”.*

6 **SEC. 2. SOLAR ENERGY TECHNOLOGY PROGRAM.**

7 *(a) IN GENERAL.—The Secretary shall carry out a*
8 *solar energy program to conduct research, development, test-*
9 *ing, and evaluation of solar energy technologies. In car-*
10 *rying out such program, the Secretary shall, in accordance*
11 *with subsection (b), award grants and enter into contracts*
12 *and cooperative agreements under this section, and sections*
13 *3, 4, and 5 for each of the following purposes:*

14 *(1) To improve the energy efficiency, reliability,*
15 *resilience, security, and capacity of solar energy gen-*
16 *eration.*

17 *(2) To optimize the design and adaptability of*
18 *solar energy systems to the broadest practical range*
19 *of geographic and atmospheric conditions.*

20 *(3) To reduce the cost of manufacturing, instal-*
21 *lation, operation, and maintenance of solar energy*
22 *systems.*

23 *(4) To create and improve conversion of solar en-*
24 *ergy to useful forms.*

1 (b) *GRANTS, CONTRACTS, AND COOPERATIVE AGREE-*
2 *MENTS.—*

3 (1) *GRANTS.—In carrying out the program es-*
4 *tablished under subsection (a), the Secretary shall*
5 *award grants on a competitive, merit-reviewed basis*
6 *to eligible entities for projects that the Secretary de-*
7 *termines would best achieve the goals of the program.*

8 (2) *CONTRACTS AND COOPERATIVE AGREE-*
9 *MENTS.—In carrying out the program established*
10 *under subsection (a), the Secretary may enter into*
11 *contracts and cooperative agreements with eligible en-*
12 *tities and Federal agencies for projects that the Sec-*
13 *retary determines would further the purposes of the*
14 *program.*

15 (3) *APPLICATION.—An entity seeking a grant or*
16 *a contract or agreement under this Act shall submit*
17 *to the Secretary an application at such time, in such*
18 *manner, and containing such information as the Sec-*
19 *retary may require.*

20 (c) *SOLAR ENERGY RESEARCH SUBJECT AREAS.—The*
21 *program established under subsection (a) shall focus on the*
22 *research, development, testing, and evaluation of each of the*
23 *following subject areas:*

24 (1) *Photovoltaic devices and related electronic*
25 *components, including converters, sensors, energy*

1 *monitors, communication and control equipment, and*
2 *protocols.*

3 (2) *Concentrated solar power, including solar*
4 *thermal and concentrating solar photovoltaic tech-*
5 *nologies.*

6 (3) *Low cost, high-quality solar energy systems.*

7 (4) *Low cost, thin-film solar technologies, includ-*
8 *ing the use of perovskite materials in solar cells.*

9 (5) *Solar heating and cooling systems, including*
10 *distributed solar-powered air conditioning.*

11 (6) *Solar technology products that can be easily*
12 *integrated into new buildings, existing buildings, ag-*
13 *ricultural and aquatic environments, and other infra-*
14 *structure.*

15 (7) *Solar technology that is resilient to extreme*
16 *weather events.*

17 (8) *Solar technology products integrated into*
18 *transportation applications in coordination with ve-*
19 *hicle technologies research and development activities*
20 *supported by the Department of Energy.*

21 (9) *Storage technologies to address the transience*
22 *and intermittency of solar energy resources, including*
23 *batteries, supercapacitors, and thermal storage.*

24 (10) *Microgrids using solar technology.*

1 (11) *Solar technologies enabling safe grid oper-*
2 *ating conditions, such as fast-disconnect during an*
3 *emergency.*

4 (12) *Distributed solar energy technologies, such*
5 *as rooftop solar panels.*

6 (13) *Technologies and designs that enable a*
7 *broad range of scales for solar power production.*

8 (14) *Advanced solar manufacturing technologies*
9 *and best practices, including—*

10 (A) *materials and processes;*

11 (B) *development of industry standards;*

12 (C) *design and integration practices; and*

13 (D) *optimized packaging methods and new*
14 *device designs.*

15 (15) *Advanced analytic and computing capabili-*
16 *ties for better modeling and simulations of solar en-*
17 *ergy systems.*

18 (16) *Electrical grid integration, including—*

19 (A) *integration of solar technologies into*
20 *smart grid, transmission, and distribution;*

21 (B) *coordination of solar with other distrib-*
22 *uted and large-scale energy resources;*

23 (C) *electrical power smoothing;*

24 (D) *microgrid integration;*

25 (E) *community solar;*

1 (F) solar resource forecasting;

2 (G) regional and national electric system
3 balancing and long distance transmission op-
4 tions, including direct current and super-
5 conducting transmission and long-term storage
6 options;

7 (H) ways to address system operations over
8 minutes, hours, days, weeks, and seasons with re-
9 spect to the full range of project scales; and

10 (I) electric grid security, including cyber
11 and physical security.

12 (17) Non-hardware and information-based ad-
13 vances in solar energy system design, installation,
14 and operation.

15 (18) Solar energy technology as a part of strate-
16 gies commonly referred to as “behind-the-meter strate-
17 gies”, including with respect to electricity generation,
18 load, energy efficiency, controls, storage, and electric
19 vehicles.

20 (19) Methods to reduce the total volume of water
21 used in the manufacture, construction, operation, and
22 maintenance of solar energy technologies.

23 (20) Next generation demonstration facilities.

24 (21) Other subject areas determined by the Sec-
25 retary.

1 (d) *TECHNICAL ASSISTANCE AND WORKFORCE DEVEL-*
2 *OPMENT.*—*In carrying out the program established under*
3 *subsection (a), the Secretary may also conduct, for purposes*
4 *of supporting technical, non-hardware, and information-*
5 *based advances in solar energy systems development and op-*
6 *erations, including activities expanding access to solar en-*
7 *ergy for low-income individuals and communities—*

8 (1) *technical assistance and analysis activities*
9 *with eligible entities; and*

10 (2) *workforce development and training activi-*
11 *ties, including activities that support the dissemina-*
12 *tion of standards and best practices for enabling solar*
13 *power production.*

14 (e) *PROGRAM TARGETS.*—*The program established*
15 *under subsection (a) shall address near-term (up to 2*
16 *years), mid-term (up to 7 years), and long-term (up to 15*
17 *years) challenges to the advancement of solar energy sys-*
18 *tems.*

19 (f) *SUSTAINABLE CHEMISTRY.*—*Each entity receiving*
20 *a grant, contract, or cooperative agreement under this sec-*
21 *tion shall endeavor, in carrying out activities under such*
22 *grant, contract, or cooperative agreement, to incorporate,*
23 *where appropriate, sustainable and green chemistry and en-*
24 *gineering principles, practices, and methodologies.*

1 (g) *WILDLIFE IMPACT MITIGATION.*—*In carrying out*
2 *the activities described in subsection (c), the program estab-*
3 *lished under subsection (a) shall support wildlife impact*
4 *mitigation technologies and strategies, including the use of*
5 *distributed solar technologies, to reduce the potential nega-*
6 *tive impacts of solar energy systems on wildlife, including*
7 *bird species and local flora and fauna.*

8 (h) *STEWARDSHIP OF NATIONAL LABORATORY RE-*
9 *SOURCES.*—*In awarding grants and entering into contracts*
10 *and cooperative agreements under this Act, the Secretary*
11 *shall steward relevant capabilities and programs of the Na-*
12 *tional Laboratories.*

13 (i) *CONFORMING REPEALS.*—*The following provisions*
14 *of law are hereby repealed:*

15 (1) *The Solar Energy Research, Development,*
16 *and Demonstration Act of 1974 (42 U.S.C. 5551 et*
17 *seq.), except for section 10.*

18 (2) *The Solar Photovoltaic Energy Research, De-*
19 *velopment, and Demonstration Act of 1978 (42 U.S.C.*
20 *5581 et seq.).*

21 (3) *Paragraphs (2) and (3) of section 4(a) of the*
22 *Renewable Energy and Energy Efficiency Technology*
23 *Competitiveness Act of 1989 (42 U.S.C. 12003(a)).*

24 (4) *Subparagraph (A) of section 931(a)(2) of the*
25 *Energy Policy Act of 2005 (42 U.S.C. 16231(a)(2)).*

1 (5) *Sections 606 and 607 of the Energy Inde-*
2 *pendence and Security Act of 2007 (42 U.S.C. 17174*
3 *and 17175).*

4 (j) *DEFINITIONS.—In this Act:*

5 (1) *The term “eligible entity” means any of the*
6 *following entities:*

7 (A) *An institution of higher education.*

8 (B) *A National Laboratory.*

9 (C) *A Federal research agency.*

10 (D) *A State research agency.*

11 (E) *A nonprofit research organization.*

12 (F) *An industrial entity or a multi-institu-*
13 *tional consortium thereof.*

14 (2) *The term “institution of higher education”*
15 *has the meaning given such term in section 101 of the*
16 *Higher Education Act of 1965 (20 U.S.C. 1001).*

17 (3) *The term “National Laboratory” has the*
18 *meaning given such term in section 2(3) of the En-*
19 *ergy Policy Act of 2005 (42 U.S.C. 15801(3)).*

20 (4) *The term “photovoltaic device” includes pho-*
21 *tovoltaic cells and the electronic and electrical compo-*
22 *nents of such devices.*

23 (5) *The term “Secretary” means the Secretary of*
24 *Energy.*

1 **SEC. 3. SOLAR ENERGY TECHNOLOGY DEMONSTRATION**
2 **PROJECTS.**

3 (a) *IN GENERAL.*—*In carrying out the program estab-*
4 *lished under section 2(a), the Secretary shall award grants*
5 *on a competitive, merit-reviewed basis to eligible entities*
6 *for demonstration projects to advance the development of*
7 *solar energy technologies and systems production.*

8 (b) *PRIORITY.*—*In awarding grants under subsection*
9 *(a), the Secretary shall give priority to projects that—*

10 (1) *are located in geographically diverse regions*
11 *of the United States;*

12 (2) *can be replicated in a variety of regions and*
13 *climates;*

14 (3) *demonstrate technologies that address*
15 *intermittency, variability, storage challenges, behind-*
16 *the-meter operations, and independent operational ca-*
17 *pability;*

18 (4) *coordinate solar technologies with other dis-*
19 *tributed and large-scale energy resources;*

20 (5) *facilitate identification of optimum ap-*
21 *proaches among competing solar energy technologies;*

22 (6) *include business commercialization plans*
23 *that have the potential for production of solar energy*
24 *equipment at high volumes;*

25 (7) *support the development of advanced manu-*
26 *facturing technologies that have the potential to im-*

1 *prove United States competitiveness in the inter-*
2 *national solar energy manufacturing sector;*

3 *(8) provide the greatest potential to reduce en-*
4 *ergy costs, as well as promote accessibility and com-*
5 *munity implementation of demonstrated technologies,*
6 *for consumers;*

7 *(9) increase disclosure and transparency of in-*
8 *formation to all market participants to help in mak-*
9 *ing optimal decisions;*

10 *(10) promote overall electric infrastructure reli-*
11 *ability and resilience should grid functions be dis-*
12 *rupted or damaged;*

13 *(11) promote solar energy in low-income commu-*
14 *nities and those disproportionately burdened by envi-*
15 *ronmental pollution; and*

16 *(12) satisfy any other criteria that the Secretary*
17 *determines appropriate.*

18 *(c) USE OF FUNDS.—Grants under this section may*
19 *be used, to the extent that funding is not otherwise available*
20 *through other Federal programs or power purchase agree-*
21 *ments, for—*

22 *(1) any necessary site engineering study;*

23 *(2) an economic assessment of site-specific condi-*
24 *tions;*

1 (3) *appropriate feasibility studies to determine*
2 *whether the demonstration can be replicated;*

3 (4) *installation of equipment, service, and sup-*
4 *port;*

5 (5) *operation for at least the minimum amount*
6 *of time required to fully assess the project’s results*
7 *and objectives, as determined by a peer-reviewed proc-*
8 *ess; and*

9 (6) *validation of technical, economic, and envi-*
10 *ronmental assumptions and documentation of lessons*
11 *learned.*

12 (d) *SOLICITATION.*—*Not later than 90 days after the*
13 *date of enactment of this Act and annually thereafter, the*
14 *Secretary shall conduct a national solicitation for applica-*
15 *tions for grants under this section.*

16 **SEC. 4. NEXT GENERATION SOLAR ENERGY MANUFAC-**
17 **TURING INITIATIVE.**

18 (a) *IN GENERAL.*—*In carrying out the program estab-*
19 *lished under section 2(a), the Secretary shall conduct re-*
20 *search, development, and demonstration projects, in accord-*
21 *ance with section 2(b), to advance new solar energy manu-*
22 *facturing technologies and techniques, including those that*
23 *manufacture solar cells, hardware, and enabling devices.*

24 (b) *STRATEGIC VISION REPORT.*—

1 (1) *IN GENERAL.*—Not later than September 1,
2 2020, the Secretary shall submit to the Committee on
3 Science, Space, and Technology of the House of Rep-
4 resentatives, the Committee on Energy and Natural
5 Resources of the Senate, and any other committees of
6 Congress deemed appropriate by the Secretary a re-
7 port on the results of a study that examines the viable
8 market opportunities available for solar energy tech-
9 nology manufacturing in the United States, including
10 solar cells, hardware, and enabling technologies.

11 (2) *REPORT REQUIREMENTS.*—The report under
12 paragraph (1) shall include—

13 (A) a description of—

14 (i) the ability to competitively manu-
15 facture solar technology in the United
16 States, including the manufacture of—

17 (I) new and advanced materials,
18 such as cells made with new, cost-effec-
19 tive, high efficiency materials;

20 (II) solar module equipment and
21 enabling technologies, including smart
22 inverters, sensors, and tracking equip-
23 ment;

24 (III) innovative solar module de-
25 signs and applications, including those

1 *that can directly integrate with new*
2 *and existing buildings and other infra-*
3 *structure; and*

4 *(IV) other research areas as deter-*
5 *mined by the Secretary; and*

6 *(ii) opportunities and barriers within*
7 *the United States and international solar*
8 *energy technology supply chains;*

9 *(B) policy recommendations for enhancing*
10 *solar energy technology manufacturing in the*
11 *United States; and*

12 *(C) an aggressive 10-year target and plan,*
13 *beginning in 2021, to enhance the competitive-*
14 *ness of solar energy technology manufacturing in*
15 *the United States.*

16 *(c) PROGRAM IMPLEMENTATION.—In carrying out the*
17 *research, development, and demonstration program under*
18 *this section, to the extent practicable, the Secretary shall*
19 *follow the recommendations included in the report under*
20 *subsection (b) and award grants and enter into contracts*
21 *and cooperative agreements for solar energy manufacturing*
22 *projects that—*

23 *(1) reduce capital expenditures or provide lower-*
24 *cost manufacturing option;*

25 *(2) eliminate manufacturing process steps;*

- 1 (3) *reduce energy, water, and material inputs;*
- 2 (4) *establish alternative supply chains for mate-*
3 *rials and components; and*
- 4 (5) *take advantage of rapid prototyping, small*
5 *batch manufacturing, and roll-to-roll processing.*

6 (d) *PROGRAM EVALUATION.*—*Beginning not later than*
7 *3 years after the completion of the report under subsection*
8 *(b), and every 4 years thereafter, the Secretary shall pro-*
9 *vide, and make available to the public and the relevant au-*
10 *thorizing and appropriations committees of Congress, an*
11 *independent review of the program authorized under this*
12 *section to evaluate its progress toward meeting the policy*
13 *recommendations and targets determined in the report.*

14 **SEC. 5. PHOTOVOLTAIC DEVICE RECYCLING RESEARCH, DE-**
15 **VELOPMENT, AND DEMONSTRATION.**

16 (a) *IN GENERAL.*—*In carrying out the program, the*
17 *Secretary shall conduct research, development, and dem-*
18 *onstration projects, in accordance with section 2(b), to cre-*
19 *ate innovative and practical approaches to increase reuse*
20 *and recycling of photovoltaic devices.*

21 (b) *PURPOSE.*—*The Secretary shall award grants and*
22 *enter into contracts and cooperative agreements under sub-*
23 *section (a) for projects that address—*

- 24 (1) *technology to increase the efficiency of photo-*
25 *voltaic device recycling and maximize the recovery of*

1 *valuable raw materials for use in new products while*
2 *minimizing the life-cycle environmental impacts such*
3 *as greenhouse gas emissions and water usage;*

4 (2) *expanded uses for materials from recycled*
5 *photovoltaic devices;*

6 (3) *development and demonstration of environ-*
7 *mentally responsible alternatives to the use of haz-*
8 *ardous materials in photovoltaic devices and the pro-*
9 *duction of such devices;*

10 (4) *development of methods to separate and re-*
11 *move hazardous materials from photovoltaic devices*
12 *and to recycle or dispose of those materials in a safe*
13 *manner;*

14 (5) *product design and construction to facilitate*
15 *disassembly and recycling of photovoltaic devices;*

16 (6) *tools and methods to aid in assessing the en-*
17 *vironmental impacts of the production of photovoltaic*
18 *devices and photovoltaic device recycling and dis-*
19 *posal;*

20 (7) *product design and construction and other*
21 *tools and techniques to extend the life cycle of photo-*
22 *voltaic devices, including methods to promote their*
23 *safe reuse;*

24 (8) *strategies to increase consumer acceptance*
25 *and practice of recycling of photovoltaic devices; and*

1 (9) processes to reduce the costs and environ-
2 mental impact of disposal of toxic materials used in
3 photovoltaic devices.

4 (c) *APPLICATIONS*.—An eligible entity seeking a grant,
5 contract, or cooperative agreement under this section shall
6 submit to the Secretary an application that includes a de-
7 scription of—

8 (1) the project that will be undertaken and the
9 contributions of each participating entity;

10 (2) the applicability of the project to increasing
11 reuse and recycling of photovoltaic devices with the
12 least environmental impacts as measured by life-cycle
13 analyses, and the potential for incorporating the re-
14 search results into industry practice; and

15 (3) how the project will promote collaboration
16 among scientists and engineers from different dis-
17 ciplines, such as electrical engineering, materials
18 science, and social science.

19 (d) *DISSEMINATION OF RESULTS*.—The Secretary
20 shall publish the results of projects supported under this sec-
21 tion through—

22 (1) development of best practices or training ma-
23 terials for use in the photovoltaics manufacturing, de-
24 sign, installation, refurbishing, or recycling indus-
25 tries;

1 (2) dissemination at industry conferences;

2 (3) coordination with information dissemination
3 programs relating to recycling of electronic devices in
4 general;

5 (4) demonstration projects; and

6 (5) educational materials for the public produced
7 in conjunction with State, Tribal, and local govern-
8 ments or nonprofit organizations on the problems and
9 solutions related to reuse and recycling of photovoltaic
10 devices.

11 (e) *PHOTOVOLTAIC MATERIALS PHYSICAL PROPERTY*
12 *DATABASE.*—

13 (1) *IN GENERAL.*—Not later than September 1,
14 2021, the Secretary shall establish a comprehensive
15 physical property database of materials for use in
16 photovoltaic devices. Such database shall include—

17 (A) identification of materials used in pho-
18 tovoltaic devices;

19 (B) a list of commercially available
20 amounts of these materials and their country of
21 origin;

22 (C) amounts of these materials projected to
23 be available through mining or recycling of pho-
24 tovoltaic and other electronic devices; and

1 (D) a list of other significant uses for each
2 of these materials.

3 (2) *PRIORITIES.*—Not later than September 1,
4 2020, the Secretary, working with private industry,
5 shall develop a plan to establish priorities and re-
6 quirements for the database under this subsection, in-
7 cluding the protection of proprietary information,
8 trade secrets, and other confidential business informa-
9 tion.

10 (3) *COORDINATION.*—The Secretary shall coordi-
11 nate with the Director of the National Institute of
12 Standards and Technology, the Administrator of the
13 Environmental Protection Agency, and the Adminis-
14 trator of the Department of Interior to facilitate the
15 incorporation of the database under this subsection
16 with any existing database for materials involved in
17 electronic manufacturing and recycling.

18 **SEC. 6. AUTHORIZATION OF APPROPRIATIONS.**

19 There are authorized to be appropriated to the Sec-
20 retary to carry out this Act—

21 (1) \$270,000,000 for fiscal year 2020;

22 (2) \$283,500,000 for fiscal year 2021;

23 (3) \$297,675,000 for fiscal year 2022;

24 (4) \$312,558,750 for fiscal year 2023; and

25 (5) \$328,186,688 for fiscal year 2024.

1 **SEC. 7. SENSE OF CONGRESS.**

2 *It is the sense of Congress that in order to reduce emis-*
3 *sions and meet 100 percent of the power demand in the*
4 *United States through clean, renewable, or zero-emission en-*
5 *ergy sources, the Secretary must prioritize research and de-*
6 *velopment for all innovative energy technologies, including*
7 *research to develop and improve the efficiency of fossil and*
8 *nuclear power technologies.*

Amend the title so as to read: “A bill to provide for a program of research, development, and demonstration of solar energy technologies, and for other purposes.”.

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[Report No. 116-499]

A BILL

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