

# Calendar No. 358

116TH CONGRESS  
1ST SESSION

# S. 2668

To establish a program for research, development, and demonstration of solar energy technologies, and for other purposes.

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## IN THE SENATE OF THE UNITED STATES

OCTOBER 22, 2019

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

DECEMBER 17, 2019

Reported by Ms. MURKOWSKI, with an amendment

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

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## A BILL

To establish a program 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”.

1 **SEC. 2. DEFINITIONS.**

2 In this Act:

3 (1) **ECONOMICALLY DISTRESSED AREA.**—The  
4 term “economically distressed area” means an area  
5 described in section 301(a) of the Public Works and  
6 Economic Development Act of 1965 (42 U.S.C.  
7 3161(a)).

8 (2) **ELIGIBLE ENTITY.**—The term “eligible enti-  
9 ty” means—

10 (A) an institution of higher education;

11 (B) a National Laboratory;

12 (C) a Federal research agency;

13 (D) a State research agency;

14 (E) a nonprofit research organization;

15 (F) an industrial entity; and

16 (G) a consortium of 2 or more entities de-  
17 scribed in subparagraphs (A) through (F).

18 (3) **INDIAN TRIBE.**—The term “Indian tribe”  
19 has the meaning given the term in section 4 of the  
20 Native American Housing Assistance and Self-De-  
21 termination Act of 1996 (25 U.S.C. 4103).

22 (4) **INSTITUTION OF HIGHER EDUCATION.**—The  
23 term “institution of higher education” has the  
24 meaning given the term in section 101 of the Higher  
25 Education Act of 1965 (20 U.S.C. 1001).

1           (5) NATIONAL LABORATORY.—The term “Na-  
2           tional Laboratory” has the meaning given the term  
3           in section 2 of the Energy Policy Act of 2005 (42  
4           U.S.C. 15801).

5           (6) PHOTOVOLTAIC DEVICE.—The term “photo-  
6           voltaic device” means—

7                   (A) a device that converts light directly  
8                   into electricity through a solid-state, semicon-  
9                   ductor process;

10                   (B) the photovoltaic cells of a device de-  
11                   scribed in subparagraph (A); and

12                   (C) the electronic and electrical compo-  
13                   nents of a device described in subparagraph  
14                   (A).

15           (7) PROGRAM.—The term “program” means  
16           the program established under section 3(a)(1).

17           (8) SECRETARY.—The term “Secretary” means  
18           the Secretary of Energy.

19 **SEC. 3. SOLAR ENERGY TECHNOLOGY PROGRAM.**

20           (a) PROGRAM.—

21                   (1) IN GENERAL.—The Secretary shall establish  
22                   a solar energy technology program under which the  
23                   Secretary shall—

24                           (A) award grants on a competitive, merit-  
25                           reviewed basis to eligible entities to conduct re-

1 search, development, testing, and evaluation of  
2 solar energy technologies; and

3 ~~(B) carry out other activities in accordance~~  
4 ~~with this section.~~

5 ~~(2) PURPOSES.—~~The purposes of the program  
6 are the following:

7 ~~(A) To improve the energy efficiency, reli-~~  
8 ~~ability, resilience, security, and capacity of solar~~  
9 ~~energy generation.~~

10 ~~(B) To optimize the design and adapt-~~  
11 ~~ability of solar energy systems to the broadest~~  
12 ~~practical range of geographic and atmospheric~~  
13 ~~conditions.~~

14 ~~(C) To reduce the cost of manufacturing,~~  
15 ~~installation, operation, and maintenance of~~  
16 ~~solar energy systems.~~

17 ~~(D) To create and improve conversion of~~  
18 ~~solar energy to useful forms.~~

19 ~~(3) TARGETS.—~~In carrying out the program,  
20 the Secretary shall address near-term (up to 2  
21 years), mid-term (up to 7 years), and long-term (up  
22 to 15 years) challenges to the advancement of solar  
23 energy systems.

24 ~~(4) STEWARDSHIP OF NATIONAL LABORATORY~~  
25 ~~RESOURCES.—~~In awarding grants under the pro-

1       gram, the Secretary shall steward relevant capabili-  
2       ties and programs of the National Laboratories.

3           ~~(5) TECHNICAL ASSISTANCE AND WORKFORCE~~  
4       ~~DEVELOPMENT.~~—In carrying out the program, for  
5       purposes of supporting technical, nonhardware, and  
6       information-based advances in solar energy systems  
7       development and operations, the Secretary may—

8           ~~(A)~~ provide technical assistance and carry  
9           out analysis activities with eligible entities, in-  
10          cluding activities that support expanding access  
11          to solar energy for low-income individuals and  
12          communities, including in economically dis-  
13          tressed areas; and

14          ~~(B)~~ carry out workforce development and  
15          training activities, including to support the dis-  
16          semination of standards and best practices for  
17          enabling solar power production.

18          ~~(6) WILDLIFE IMPACT MITIGATION.~~—In ear-  
19       rying out the program, the Secretary shall, to the  
20       maximum extent practicable, support wildlife impact  
21       mitigation technologies and strategies, including the  
22       use of distributed solar technologies, to reduce the  
23       potential negative impacts of solar energy systems  
24       on fish or wildlife, or plants (as those terms are de-

1        fined in section 3 of the Endangered Species Act of  
2        1973 (16 U.S.C. 1532)).

3            (7) SUSTAINABLE CHEMISTRY.—Each entity re-  
4        ceiving a grant under the program shall endeavor, in  
5        carrying out activities under the grant, to incor-  
6        porate, where appropriate, sustainable and green  
7        chemistry and engineering principles, practices, and  
8        methodologies.

9            (b) GRANT SUBJECT AREAS.—In addition to award-  
10       ing the grants described in subsections (c) through (e),  
11       the Secretary shall award grants under the program to  
12       eligible entities to carry out research, development, test-  
13       ing, and evaluation in the following subject areas:

14            (1) Photovoltaic devices and related electronic  
15        components, including converters, sensors, energy  
16        monitors, communication and control equipment,  
17        and protocols.

18            (2) Concentrated solar power, including solar  
19        thermal and concentrating solar photovoltaic tech-  
20        nologies.

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

22            (4) Solar heating and cooling systems, including  
23        distributed solar-powered air conditioning.

24            (5) Low cost, thin-film solar technologies, in-  
25        cluding the use of perovskite materials in solar cells.

1           (6) Solar technology products that can be easily  
2 integrated into new buildings, existing buildings, ag-  
3 ricultural and aquatic environments, and other infra-  
4 structure.

5           (7) Solar technology that is resilient to extreme  
6 weather events.

7           (8) Solar technology products integrated into  
8 transportation applications in coordination with vehi-  
9 cle technologies research and development activities  
10 supported by the Department of Energy.

11           (9) Storage technologies that address the tran-  
12 sience and intermittency of solar energy resources,  
13 including batteries, supercapacitors, and thermal  
14 storage.

15           (10) Microgrids using solar technology.

16           (11) Solar technologies enabling safe grid oper-  
17 ating conditions, such as fast-disconnect during an  
18 emergency.

19           (12) Distributed solar energy technologies, such  
20 as rooftop solar panels.

21           (13) Technologies and designs that enable a  
22 broad range of scales for solar power production.

23           (14) Advanced solar manufacturing technologies  
24 and best practices, including—

25                   (A) materials and processes;

1                   (B) development of industry standards;  
2                   (C) design and integration practices; and  
3                   (D) optimized packaging methods and new  
4 device designs.

5           (15) Advanced analytic and computing capabilities for better modeling and simulations of solar energy systems.

6                   (16) Electrical grid integration, including—

7                   (A) integration of solar technologies into  
8 smart grid, transmission, and distribution;

9                   (B) coordination of solar with other distributed and large-scale energy resources;

10                  (C) electrical power smoothing;

11                  (D) microgrid integration;

12                  (E) community solar;

13                  (F) solar resource forecasting;

14                  (G) regional and national electric system  
15 balancing and long-distance transmission options, including direct current and superconducting transmission and long-term storage  
16 options;

17                  (H) ways to address system operations  
18 over minutes, hours, days, weeks, and seasons  
19 with respect to the full range of project scales;  
20 and  
21  
22  
23  
24  
25



1           (I) electric grid security, including cyber  
2           and physical security.

3           (17) Nonhardware and information-based ad-  
4           vances in solar energy system design, installation,  
5           and operation.

6           (18) Solar energy technology relating to behind-  
7           the-meter strategies, including with respect to elec-  
8           tricity generation, load, energy efficiency, controls,  
9           storage, and electric vehicles.

10          (19) Next generation demonstration facilities.

11          (20) Any other subject area determined by the  
12          Secretary.

13          (e) SOLAR ENERGY TECHNOLOGY DEMONSTRATION  
14          GRANTS.—

15           (1) IN GENERAL.—In carrying out the program,  
16           the Secretary shall award multiyear grants to eligi-  
17           ble entities to carry out demonstration projects to  
18           advance the development of solar energy technologies  
19           and systems production.

20           (2) PRIORITY.—In awarding grants under para-  
21           graph (1), the Secretary shall give priority to  
22           projects that—

23           (A) are located in geographically diverse  
24           regions of the United States;

1           (B) can be replicated in a variety of re-  
2           gions and climates;

3           (C) demonstrate technologies that address  
4           intermittency, variability, storage challenges,  
5           behind-the-meter operations, and independent  
6           operational capability;

7           (D) coordinate solar technologies with  
8           other distributed and large-scale energy re-  
9           sources;

10          (E) facilitate identification of optimum ap-  
11          proaches among competing solar energy tech-  
12          nologies;

13          (F) include business commercialization  
14          plans that have the potential for production of  
15          solar energy equipment at high volumes;

16          (G) support the development of advanced  
17          manufacturing technologies that have the po-  
18          tential to improve United States competitive-  
19          ness in the international solar energy manufac-  
20          turing sector;

21          (H) provide the greatest potential to re-  
22          duce energy costs for consumers and promote  
23          accessibility and community implementation of  
24          demonstrated technologies;

1           (I) increase disclosure and transparency of  
2 information to all market participants;

3           (J) promote overall electric infrastructure  
4 reliability and resilience in the event of grid  
5 functions being disrupted or damaged;

6           (K) support the development or dem-  
7 onstration of projects in collaboration with In-  
8 dian tribes and in economically distressed areas;  
9 and

10           (L) satisfy any other priority that the Sec-  
11 retary determines appropriate.

12           (3) USE OF FUNDS.—To the extent that fund-  
13 ing is not otherwise available through other Federal  
14 programs or power purchase agreements, grants  
15 awarded under paragraph (1) may be used for—

16           (A) any necessary site engineering study;

17           (B) an economic assessment of site-specific  
18 conditions;

19           (C) appropriate feasibility studies to deter-  
20 mine whether the demonstration project may be  
21 replicated;

22           (D) installation of equipment, service, and  
23 support;

24           (E) operating the demonstration project  
25 for not less than the minimum period required

1 to fully assess the results and objectives of the  
 2 project, as determined by a peer-reviewed pro-  
 3 cess; and

4 ~~(F)~~ validation of technical, economic, and  
 5 environmental assumptions and documentation  
 6 of lessons learned.

7 ~~(4)~~ SOLICITATION.—Not later than 90 days  
 8 after the date of enactment of this Act, and annually  
 9 thereafter, the Secretary shall conduct a national so-  
 10 licitation for applications for grants described in  
 11 paragraph ~~(1)~~.

12 ~~(5)~~ ORGANIC PHOTOVOLTAIC CELL TECH-  
 13 NOLOGIES.—At least 1 grant awarded under para-  
 14 graph ~~(1)~~ during fiscal year 2020 shall be for a  
 15 project to demonstrate organic photovoltaic cell tech-  
 16 nologies.

17 ~~(d)~~ NEXT GENERATION SOLAR ENERGY MANUFAC-  
 18 TURING INITIATIVE.—

19 ~~(1)~~ GRANTS.—In carrying out the program, the  
 20 Secretary shall award multiyear grants to eligible  
 21 entities for research, development, and demonstra-  
 22 tion projects to advance new solar energy manufac-  
 23 turing technologies and techniques, including to  
 24 manufacture solar cells, hardware, and enabling de-  
 25 vices.

1           (2) PRIORITY.—In awarding grants under para-  
 2 graph (1), to the extent practicable, the Secretary  
 3 shall—

4           (A) follow the recommendations in the re-  
 5 port described in paragraph (3)(B)(ii); and

6           (B) give priority to solar energy manufac-  
 7 turing projects that—

8           (i) reduce capital expenditures or pro-  
 9 vide lower-cost manufacturing options;

10           (ii) eliminate manufacturing process  
 11 steps;

12           (iii) reduce energy, water, and mate-  
 13 rial inputs;

14           (iv) establish alternative supply chains  
 15 for materials and components;

16           (v) are located on land owned by In-  
 17 dian tribes;

18           (vi) are located on land in economi-  
 19 cally distressed areas; and

20           (vii) take advantage of rapid proto-  
 21 typing, small batch manufacturing, and  
 22 roll-to-roll processing.

23           (3) STRATEGIC VISION STUDY.—

24           (A) IN GENERAL.—The Secretary shall  
 25 conduct a study on the viable market opportuni-

1           ties available for solar energy technology manu-  
2           facturing in the United States, including solar  
3           cells, hardware, and enabling technologies.

4           (B) REPORT.—Not later than September  
5           1, 2020, the Secretary shall submit to the Com-  
6           mittee on Energy and Natural Resources of the  
7           Senate, the Committee on Science, Space, and  
8           Technology of the House of Representatives,  
9           and any other relevant Committee of Congress  
10          a report containing the results of the study  
11          under subparagraph (A), including—

12                   (i) a description of—

13                           (H) the ability of relevant busi-  
14                           nesses or other entities to competi-  
15                           tively manufacture solar technology in  
16                           the United States, including the man-  
17                           ufacture of—

18                                   (aa) new and advanced ma-  
19                                   terials, such as cells made with  
20                                   new, cost-effective, high-efficiency  
21                                   materials;

22                                   (bb) solar module equipment  
23                                   and enabling technologies, includ-  
24                                   ing smart inverters, sensors, and  
25                                   tracking equipment; and

1                   (cc) innovative solar module  
2                   designs and applications, includ-  
3                   ing designs and applications that  
4                   can directly integrate with new  
5                   and existing buildings and other  
6                   infrastructure; and

7                   (H) opportunities and barriers in  
8                   solar energy technology supply chains  
9                   in the United States and internation-  
10                  ally;

11                  (ii) policy recommendations for en-  
12                  hancing solar energy technology manufac-  
13                  turing in the United States;

14                  (iii) an aggressive 10-year target and  
15                  plan, beginning in calendar year 2021, to  
16                  enhance the competitiveness of solar en-  
17                  ergy technology manufacturing in the  
18                  United States; and

19                  (iv) needs for future research, devel-  
20                  opment, and demonstration projects in  
21                  solar manufacturing and related areas, as  
22                  determined by the Secretary.

23                  (4) EVALUATION.—Not later than 3 years after  
24                  the date on which the report under paragraph  
25                  (3)(B) is submitted, and every 4 years thereafter,

1 the Secretary shall conduct, and make available to  
2 the public and the relevant committees of Congress,  
3 an independent review of the progress of the grants  
4 awarded under paragraph (1) in meeting the rec-  
5 ommendations and targets included in the report.

6 (c) PHOTOVOLTAIC DEVICE RECYCLING RESEARCH,  
7 DEVELOPMENT, AND DEMONSTRATION GRANTS.—

8 (1) IN GENERAL.—In carrying out the program,  
9 the Secretary shall award multiyear grants to eligi-  
10 ble entities for research, development, and dem-  
11 onstration projects to create innovative and practical  
12 approaches to increase the reuse and recycling of  
13 photovoltaic devices, including by addressing—

14 (A) technology to increase the efficiency of  
15 photovoltaic device recycling and maximize the  
16 recovery of valuable raw materials for use in  
17 new products while minimizing the lifecycle en-  
18 vironmental impacts, such as greenhouse gas  
19 emissions and water usage;

20 (B) expanded uses for materials from recy-  
21 cled photovoltaic devices;

22 (C) the development and demonstration of  
23 environmentally responsible alternatives to the  
24 use of hazardous materials in photovoltaic de-  
25 vices and the production of those devices;



1           (D) the development of methods to sepa-  
2           rate and remove hazardous materials from pho-  
3           tovoltaic devices and to recycle or dispose of  
4           those materials in a safe manner;

5           (E) product design and construction to fa-  
6           cilitate disassembly and recycling of photo-  
7           voltaic devices;

8           (F) tools and methods to aid in assessing  
9           the environmental impacts of the production of  
10          photovoltaic devices and photovoltaic device re-  
11          cycling and disposal;

12          (G) product design and construction and  
13          other tools and techniques to extend the  
14          lifecycle of photovoltaic devices, including meth-  
15          ods to promote the safe reuse of those devices;

16          (H) strategies to increase consumer accept-  
17          ance and practice of recycling of photovoltaic  
18          devices;

19          (I) the development or demonstration of  
20          projects in collaboration with Indian tribes and  
21          in economically distressed areas; and

22          (J) processes to reduce the costs and envi-  
23          ronmental impact of disposal of toxic materials  
24          used in photovoltaic devices.

1           (2) APPLICATIONS.—An eligible entity seeking  
2 a grant under paragraph (1) shall submit to the  
3 Secretary an application at such time, in such man-  
4 ner, and containing such information as the Sec-  
5 retary may require, including a description of—

6           (A) the proposed project and the contribu-  
7 tions of each participating entity;

8           (B) the applicability of the project to in-  
9 creasing the reuse and recycling of photovoltaic  
10 devices with the least environmental impacts as  
11 measured by lifecycle analyses;

12           (C) the potential for incorporating the re-  
13 search results into industry practice; and

14           (D) the manner in which the project will  
15 promote collaboration among scientists and en-  
16 gineers from different disciplines, such as the  
17 electrical engineering, materials science, and so-  
18 cial science disciplines.

19           (3) DISSEMINATION OF RESULTS.—The Sec-  
20 retary shall publish the results of the projects ear-  
21 ried out through grants awarded under paragraph  
22 (1) through—

23           (A) best practices or training materials re-  
24 lating to those grants, for use in the

1 photovoltaics manufacturing, design, installa-  
 2 tion, refurbishing, or recycling industries;

3 (B) coordination with information dissemi-  
 4 nation programs relating to general recycling of  
 5 electronic devices; and

6 (C) educational materials for the public,  
 7 produced in conjunction with State and local  
 8 governments or nonprofit organizations, on the  
 9 problems and solutions relating to the reuse  
 10 and recycling of photovoltaic devices.

11 (f) 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, which shall include—

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

19 (B) the quantity of each commercially  
 20 available material identified under subpara-  
 21 graph (A) and the country of origin of that ma-  
 22 terial;

23 (C) the quantity of materials used in pho-  
 24 tovoltaic devices projected to be available

1 through mining or recycling of photovoltaic and  
2 other electronic devices; and

3 ~~(D)~~ a list of other significant uses for each  
4 material identified under subparagraph (A).

5 ~~(2)~~ PRIORITIES.—Not later than September 1,  
6 2020, the Secretary, in collaboration with private in-  
7 dustry, shall develop a plan to establish priorities  
8 and requirements for the database described in para-  
9 graph (1), including the protection of proprietary in-  
10 formation, trade secrets, and other confidential busi-  
11 ness information.

12 ~~(3)~~ COORDINATION.—The Secretary shall co-  
13 ordinate with the Director of the National Institute  
14 of Standards and Technology, the Administrator of  
15 the Environmental Protection Agency, and the Sec-  
16 retary of the Interior to facilitate the incorporation  
17 of the database under paragraph (1) with any exist-  
18 ing database for materials involved in electronic  
19 manufacturing and recycling.

20 ~~(g)~~ AUTHORIZATION OF APPROPRIATIONS.—There  
21 are authorized to be appropriated to the Secretary to carry  
22 out the program such sums as are necessary for each of  
23 fiscal years 2020 through 2024.

1 **SEC. 4. CONFORMING AMENDMENTS.**

2 (a) The Solar Energy Research, Development, and  
3 Demonstration Act of 1974 (42 U.S.C. 5551 et seq.) is  
4 repealed.

5 (b) Section 6(b)(3) of the Federal Nonnuclear En-  
6 ergy Research and Development Act of 1974 (42 U.S.C.  
7 5905(b)(3)) is amended—

8 (1) by striking subparagraph (L); and

9 (2) by redesignating subparagraphs (M)  
10 through (S) as subparagraphs (L) through (R), re-  
11 spectively.

12 (c) The Solar Photovoltaic Energy Research, Devel-  
13 opment, and Demonstration Act of 1978 (42 U.S.C. 5581  
14 et seq.) is repealed.

15 (d) Section 4(a) of the Renewable Energy and Energy  
16 Efficiency Technology Competitiveness Act of 1989 (42  
17 U.S.C. 12003(a)) is amended—

18 (1) in the matter preceding paragraph (1), by  
19 striking “photovoltaics, and solar thermal energy”  
20 and inserting “alcohol from biomass, and other tech-  
21 nologies”;

22 (2) by striking paragraphs (2) and (3); and

23 (3) by redesignating paragraphs (4) and (5) as  
24 paragraphs (2) and (3), respectively.

25 (e) Section 931 of the Energy Policy Act of 2005 (42  
26 U.S.C. 16231) is amended—

1           ~~(1) in subsection (a)(2)—~~  
 2                   ~~(A) by striking subparagraph (A); and~~  
 3                   ~~(B) by redesignating subparagraphs (B)~~  
 4           ~~through (E) as subparagraphs (A) through (D);~~  
 5           ~~respectively;~~  
 6           ~~(2) by striking subsection (d); and~~  
 7           ~~(3) by redesignating subsections (e) through (g)~~  
 8           ~~as subsections (d) through (f), respectively.~~  
 9           ~~(f) Sections 606 and 607 of the Energy Independence~~  
 10   ~~and Security Act of 2007 (42 U.S.C. 17174, 17175) are~~  
 11   ~~repealed.~~

12   **SEC. 5. SAVINGS PROVISION.**

13           The repeal of the Solar Energy Research, Develop-  
 14   ment, and Demonstration Act of 1974 (42 U.S.C. 5551  
 15   et seq.) under section 4(a) shall not affect the authority  
 16   of the Secretary to conduct research and development on  
 17   solar energy.

18   **SECTION 1. SHORT TITLE.**

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

21   **SEC. 2. DEFINITIONS.**

22           *In this Act:*

23           (1) *ECONOMICALLY DISTRESSED AREA.*—*The*  
 24           *term “economically distressed area” means an area*  
 25           *described in section 301(a) of the Public Works and*

1 *Economic Development Act of 1965 (42 U.S.C.*  
2 *3161(a)).*

3 (2) *ELIGIBLE ENTITY.*—*The term “eligible enti-*  
4 *ty” means—*

5 (A) *an institution of higher education;*

6 (B) *a National Laboratory;*

7 (C) *a Federal research agency;*

8 (D) *a State research agency;*

9 (E) *a research agency associated with a ter-*  
10 *ritory or freely associated state;*

11 (F) *a tribal energy development organiza-*  
12 *tion;*

13 (G) *an Indian tribe;*

14 (H) *a tribal organization;*

15 (I) *a Native Hawaiian community-based*  
16 *organization;*

17 (J) *a nonprofit research organization;*

18 (K) *an industrial entity;*

19 (L) *any other entity, as determined by the*  
20 *Secretary; and*

21 (M) *a consortium of 2 or more entities de-*  
22 *scribed in subparagraphs (A) through (L).*

23 (3) *INDIAN TRIBE.*—*The term “Indian tribe” has*  
24 *the meaning given the term in section 4 of the Indian*

1       *Self-Determination and Education Assistance Act (25*  
2       *U.S.C. 5304).*

3               (4) *INSTITUTION OF HIGHER EDUCATION.—The*  
4       *term “institution of higher education” has the mean-*  
5       *ing given the term in section 101 of the Higher Edu-*  
6       *cation Act of 1965 (20 U.S.C. 1001).*

7               (5) *NATIONAL LABORATORY.—The term “Na-*  
8       *tional Laboratory” has the meaning given the term in*  
9       *section 2 of the Energy Policy Act of 2005 (42 U.S.C.*  
10       *15801).*

11              (6) *NATIVE HAWAIIAN COMMUNITY-BASED ORGA-*  
12       *NIZATION.—The term “Native Hawaiian community-*  
13       *based organization” has the meaning given the term*  
14       *in section 6207 of the Elementary and Secondary*  
15       *Education Act of 1965 (20 U.S.C. 7517).*

16              (7) *PHOTOVOLTAIC DEVICE.—The term “photo-*  
17       *voltaic device” means—*

18                       (A) *a device that converts light directly into*  
19                       *electricity through a solid-state, semiconductor*  
20                       *process;*

21                       (B) *the photovoltaic cells of a device de-*  
22                       *scribed in subparagraph (A); and*

23                       (C) *the electronic and electrical components*  
24                       *of a device described in subparagraph (A).*



1           (8) *PROGRAM*.—The term “program” means the  
2           program established under section 3(a)(1).

3           (9) *SECRETARY*.—The term “Secretary” means  
4           the Secretary of Energy.

5           (10) *SOLAR ENERGY*.—The term “solar energy”  
6           means—

7                   (A) thermal or electric energy derived from  
8                   radiation from the Sun; or

9                   (B) energy resulting from a chemical reac-  
10                  tion caused by radiation recently originated in  
11                  the Sun.

12          (11) *TERRITORY OR FREELY ASSOCIATED*  
13          *STATE*.—The term “territory or freely associated  
14          state” has the meaning given the term “insular area”  
15          in section 1404 of the Food and Agriculture Act of  
16          1977 (7 U.S.C. 3103).

17          (12) *TRIBAL ENERGY DEVELOPMENT ORGANIZA-*  
18          *TION*.—The term “tribal energy development organi-  
19          zation” has the meaning given the term in section  
20          2601 of the Energy Policy Act of 1992 (25 U.S.C.  
21          3501).

22          (13) *TRIBAL ORGANIZATION*.—The term “tribal  
23          organization” has the meaning given the term in sec-  
24          tion 4 of the Indian Self-Determination and Edu-  
25          cation Assistance Act (25 U.S.C. 5304).

1 **SEC. 3. SOLAR ENERGY TECHNOLOGY PROGRAM.**

2 (a) *ESTABLISHMENT.*—

3 (1) *IN GENERAL.*—*The Secretary shall establish*  
4 *a program to conduct research, development, testing,*  
5 *evaluation, demonstration, and commercialization of*  
6 *solar energy technologies in accordance with this sec-*  
7 *tion.*

8 (2) *PURPOSES.*—*The purposes of the program*  
9 *are the following:*

10 (A) *To improve the energy efficiency, cost*  
11 *effectiveness, reliability, resilience, security, inte-*  
12 *gration, manufacturability, and recyclability of*  
13 *solar energy technologies.*

14 (B) *To optimize the performance and oper-*  
15 *ation of solar energy components, cells, and sys-*  
16 *tems, and enabling technologies, including*  
17 *through the development of new materials, hard-*  
18 *ware, and software.*

19 (C) *To optimize the design and adaptability*  
20 *of solar energy systems to the broadest practical*  
21 *range of geographic and atmospheric conditions.*

22 (D) *To support the integration of solar en-*  
23 *ergy technologies with the electric grid and com-*  
24 *plementary energy technologies.*

1           (E) To create and improve the conversion of  
2 solar energy to other useful forms of energy or  
3 other products.

4           (F) To reduce and mitigate any potential  
5 negative impacts of solar energy technologies on  
6 humans, wildlife, and wildlife habitats.

7           (G) To address barriers to the commer-  
8 cialization and export of solar energy tech-  
9 nologies.

10           (H) To support the domestic solar industry,  
11 workforce, and supply chain.

12           (3) *TARGETS.*—Not later than 180 days after the  
13 date of enactment of this Act, the Secretary shall es-  
14 tablish targets for the program to address near-term  
15 (up to 2 years), mid-term (up to 7 years), and long-  
16 term (up to 15 years) challenges to the advancement  
17 of solar energy systems.

18           (b) *ACTIVITIES.*—

19           (1) *TYPES OF ACTIVITIES.*—In carrying out the  
20 program, the Secretary shall carry out research, de-  
21 velopment, demonstration, and commercialization ac-  
22 tivities, including—

23           (A) awarding grants and awards, on a  
24 competitive, merit-reviewed basis;

1           (B) performing precompetitive research and  
2           development;

3           (C) establishing or maintaining demonstra-  
4           tion facilities and projects, including through  
5           stewardship of existing facilities;

6           (D) providing technical assistance;

7           (E) entering into contracts and cooperative  
8           agreements;

9           (F) providing small business vouchers;

10          (G) establishing prize competitions;

11          (H) conducting education and outreach ac-  
12          tivities; and

13          (I) conducting analyses, studies, and re-  
14          ports.

15          (2) *SUBJECT AREAS.*—*The Secretary shall carry*  
16          *out research, development, testing, evaluation, dem-*  
17          *onstration, and commercialization activities in the*  
18          *following subject areas:*

19                (A) *Advanced solar energy technologies, in-*  
20                *cluding—*

21                   (i) *new materials, components, designs,*  
22                   *and systems, including perovskites;*

23                   (ii) *advanced photovoltaic and thin-*  
24                   *film devices;*

25                   (iii) *concentrated solar power;*

1                   (iv) solar heating and cooling; and  
2                   (v) enabling technologies for solar en-  
3                   ergy systems, including hardware and soft-  
4                   ware.

5                   (B) Solar energy technology performance,  
6                   operations, and security.

7                   (C) Integration of solar energy technologies  
8                   with—

9                   (i) the electric grid, including trans-  
10                  mission, distribution, microgrids, and dis-  
11                  tributed energy systems;

12                  (ii) other energy technologies, includ-  
13                  ing—

14                         (I) other generation sources;

15                         (II) demand response technologies;

16                         and

17                         (III) energy storage technologies;

18                         and

19                         (iii) other nonelectric applications,  
20                         such as in the agriculture, transportation,  
21                         industrial, and fuels sectors.

22                   (D) Advanced solar energy manufacturing  
23                   technologies and practices, including materials,  
24                   processes, and design.

1           (E) *Methods to improve the lifetime, main-*  
2           *tenance, recycling, and reuse of solar energy*  
3           *components and systems.*

4           (F) *Solar energy forecasting, modeling, and*  
5           *atmospheric measurement systems, including for*  
6           *small-scale, large-scale, and aggregated systems.*

7           (G) *Hybrid solar energy systems that incor-*  
8           *porate diverse—*

9                   (i) *generation sources;*

10                   (ii) *loads; and*

11                   (iii) *storage technologies.*

12           (H) *Reducing market barriers to the adop-*  
13           *tion of solar energy technologies, including im-*  
14           *pacts on, or challenges relating to—*

15                   (i) *distributed solar technologies, in-*  
16                   *cluding the development of best practices,*  
17                   *models, and voluntary streamlined processes*  
18                   *for local permitting of distributed solar en-*  
19                   *ergy systems to reduce costs;*

20                   (ii) *local communities;*

21                   (iii) *wildlife and wildlife habitats; and*

22                   (iv) *any other appropriate matter, as*  
23                   *determined by the Secretary.*

24           (I) *Transformational technologies for har-*  
25           *nessing solar energy.*

1           *(J) Other research areas that advance the*  
2           *purposes of the program, as determined by the*  
3           *Secretary.*

4           *(3) PRIORITIZATION.—In carrying out activities*  
5           *under the program, the Secretary shall give priority*  
6           *to projects that—*

7                   *(A) are located in a geographically diverse*  
8                   *range of eligible entities;*

9                   *(B) support the development or demonstra-*  
10                  *tion of projects—*

11                           *(i) in collaboration with tribal energy*  
12                           *development organizations, Indian tribes,*  
13                           *tribal organizations, Native Hawaiian com-*  
14                           *munity-based organizations, or territories*  
15                           *or freely associated states; or*

16                           *(ii) in economically distressed areas;*

17                   *(C) can be replicated in a variety of regions*  
18                   *and climates;*

19                   *(D) include business commercialization*  
20                   *plans that have the potential for—*

21                           *(i) domestic manufacturing and pro-*  
22                           *duction of solar energy technologies; or*

23                           *(ii) exports of solar energy technologies;*

24                   *and*

1                   (E) satisfy any other priority that the Sec-  
2                   retary determines to be appropriate.

3                   (4) COORDINATION.—To the maximum extent  
4                   practicable, the Secretary shall coordinate activities  
5                   under the program with other relevant programs and  
6                   capabilities of the Department of Energy and other  
7                   Federal research programs.

8                   (5) USE OF FUNDS.—To the extent that funding  
9                   is not otherwise available through other Federal pro-  
10                  grams or power purchase agreements, funding award-  
11                  ed under this subsection may be used for additional  
12                  nontechnology costs, as determined to be appropriate  
13                  by the Secretary, such as engineering or feasibility  
14                  studies.

15                  (c) ADVANCED SOLAR ENERGY MANUFACTURING INI-  
16                  TIATIVE.—

17                  (1) GRANTS.—In addition to the program activi-  
18                  ties described in subsection (b), in carrying out the  
19                  program, the Secretary shall award multiyear grants  
20                  to eligible entities for research, development, and dem-  
21                  onstration projects to advance new solar energy man-  
22                  ufacturing technologies and techniques.

23                  (2) PRIORITY.—In awarding grants under para-  
24                  graph (1), to the extent practicable, the Secretary



1       *shall give priority to solar energy manufacturing*  
2       *projects that—*

3               *(A) increase efficiency and cost effectiveness*

4               *in—*

5                       *(i) the manufacturing process; and*

6                       *(ii) the use of resources.*

7               *(B) support domestic supply chains for ma-*  
8       *terials and components;*

9               *(C) identify and incorporate nonhazardous*  
10       *alternative materials for components and devices;*

11               *(D) operate in partnership with tribal en-*  
12       *ergy development organizations, Indian tribes,*  
13       *tribal organizations, Native Hawaiian commu-*  
14       *nity-based organizations, or territories or freely*  
15       *associated states; or*

16               *(E) are located in economically distressed*  
17       *areas.*

18               *(3) EVALUATION.—Not later than 3 years after*  
19       *the date of enactment of this Act, and every 4 years*  
20       *thereafter, the Secretary shall conduct, and make*  
21       *available to the public and the relevant committees of*  
22       *Congress, an independent review of the progress of the*  
23       *grants awarded under paragraph (1).*

1       (d) *SOLAR ENERGY TECHNOLOGY RECYCLING RE-*  
2 *SEARCH, DEVELOPMENT, AND DEMONSTRATION PRO-*  
3 *GRAM.—*

4           (1) *IN GENERAL.—In addition to the program*  
5 *activities described in subsection (b), in carrying out*  
6 *the program, the Secretary shall award multiyear*  
7 *grants to eligible entities for research, development,*  
8 *and demonstration projects to create innovative and*  
9 *practical approaches to increase the reuse and recy-*  
10 *cling of solar energy technologies, including—*

11           (A) *by increasing the efficiency and cost ef-*  
12 *fectiveness of the recovery of raw materials from*  
13 *solar energy technology components and systems,*  
14 *including enabling technologies such as inverters;*

15           (B) *by minimizing environmental impacts*  
16 *from the recovery and disposal processes;*

17           (C) *by addressing any barriers to the re-*  
18 *search, development, demonstration, and com-*  
19 *mercialization of technologies and processes for*  
20 *the disassembly and recycling of solar energy de-*  
21 *vices;*

22           (D) *by developing alternative materials, de-*  
23 *signs, manufacturing processes, and other aspects*  
24 *of solar energy technologies and the disassembly*  
25 *and resource recovery process that enable effi-*

1           *cient, cost effective, and environmentally respon-*  
2           *sible disassembly of, and resource recovery from,*  
3           *solar energy technologies; and*

4                   *(E) strategies to increase consumer accept-*  
5           *ance of, and participation in, the recycling of*  
6           *photovoltaic devices.*

7           (2) *DISSEMINATION OF RESULTS.*—*The Sec-*  
8           *retary shall make available to the public and the rel-*  
9           *evant committees of Congress the results of the*  
10          *projects carried out through grants awarded under*  
11          *paragraph (1), including any educational and out-*  
12          *reach materials.*

13          (i) *SOLAR ENERGY TECHNOLOGY MATERIALS PHYS-*  
14          *ICAL PROPERTY DATABASE.*—

15                   (1) *IN GENERAL.*—*Not later than September 1,*  
16          *2021, the Secretary shall establish a comprehensive*  
17          *physical property database of materials for use in*  
18          *solar energy technologies, which shall identify the*  
19          *type, quantity, country of origin, source, significant*  
20          *uses, and physical properties of materials used in*  
21          *solar energy technologies.*

22                   (2) *COORDINATION.*—*In establishing the data-*  
23          *base described in paragraph (1), the Secretary shall*  
24          *coordinate with—*

1                   (A) the Director of the National Institute of  
2                   Standards and Technology;

3                   (B) the Administrator of the Environmental  
4                   Protection Agency;

5                   (C) the Secretary of the Interior; and

6                   (D) relevant industry stakeholders, as deter-  
7                   mined by the Secretary.

8           (f) SOLAR ENERGY TECHNOLOGY PROGRAM STRA-  
9           TEGIC VISION.—

10                   (1) IN GENERAL.—Not later than September 1,  
11                   2021, and every 6 years thereafter, the Secretary shall  
12                   submit to Congress a report on the strategic vision,  
13                   progress, goals, and targets of the program, including  
14                   assessments of solar energy markets and manufac-  
15                   turing.

16                   (2) PREPARATION.—The Secretary shall coordi-  
17                   nate the preparation of the report under paragraph  
18                   (1) with—

19                               (A) existing peer review processes;

20                               (B) studies conducted by the National Lab-  
21                   oratories; and

22                               (C) the multiyear program planning re-  
23                   quired under section 994 of the Energy Policy  
24                   Act of 2005 (42 U.S.C. 16358).

1       (g) *AUTHORIZATION OF APPROPRIATIONS.*—*There is*  
2 *authorized to be appropriated to the Secretary to carry out*  
3 *the program \$270,000,000 for each of fiscal years 2020*  
4 *through 2024.*

5 **SEC. 4. CONFORMING AMENDMENTS.**

6       (a) *The Solar Energy Research, Development, and*  
7 *Demonstration Act of 1974 (42 U.S.C. 5551 et seq.) is re-*  
8 *pealed.*

9       (b) *Section 6(b)(3) of the Federal Nonnuclear Energy*  
10 *Research and Development Act of 1974 (42 U.S.C.*  
11 *5905(b)(3)) is amended—*

12             (1) *by striking subparagraph (L); and*

13             (2) *by redesignating subparagraphs (M) through*  
14 *(S) as subparagraphs (L) through (R), respectively.*

15       (c) *The Solar Photovoltaic Energy Research, Develop-*  
16 *ment, and Demonstration Act of 1978 (42 U.S.C. 5581 et*  
17 *seq.) is repealed.*

18       (d) *Section 4 of the Renewable Energy and Energy Ef-*  
19 *iciency Technology Competitiveness Act of 1989 (42 U.S.C.*  
20 *12003) is amended—*

21             (1) *in the section heading, by striking*  
22 *“PHOTOVOLTAICS, AND SOLAR THERMAL” and*  
23 *inserting “ALCOHOL FROM BIOMASS, AND*  
24 *OTHER TECHNOLOGY”;*

25             (2) *in subsection (a)—*

1           (A) in the matter preceding paragraph (1),  
2           by striking “photovoltaics, and solar thermal en-  
3           ergy” and inserting “alcohol from biomass, and  
4           other energy technology”;

5           (B) by striking paragraphs (2) and (3); and

6           (C) by redesignating paragraphs (4) and  
7           (5) as paragraphs (2) and (3), respectively; and  
8           (3) in subsection (c)—

9           (A) in the matter preceding paragraph (1),  
10          by striking “the Photovoltaic Energy Systems  
11          Program, the Solar Thermal Energy Systems  
12          Program,”;

13          (B) in paragraph (1)—

14               (i) by striking subparagraph (A); and

15               (ii) by redesignating subparagraphs  
16               (B) and (C) as subparagraphs (A) and (B),  
17               respectively; and

18          (C) in paragraph (2)—

19               (i) by striking subparagraph (A); and

20               (ii) by redesignating subparagraphs  
21               (B) and (C) as subparagraphs (A) and (B),  
22               respectively.

23          (e) Section 931 of the Energy Policy Act of 2005 (42  
24          U.S.C. 16231) is amended—

25               (1) in subsection (a)(2)—

1                   (A) by striking subparagraph (A); and  
2                   (B) by redesignating subparagraphs (B)  
3                   through (E) as subparagraphs (A) through (D),  
4                   respectively;  
5                   (2) by striking subsection (d); and  
6                   (3) by redesignating subsections (e) through (g)  
7                   as subsections (d) through (f), respectively.  
8                   (f) Sections 606 and 607 of the *Energy Independence*  
9                   *and Security Act of 2007* (42 U.S.C. 17174, 17175) are re-  
10                   pealed.

11   **SEC. 5. SAVINGS PROVISION.**

12                   *The repeal of the Solar Energy Research, Development,*  
13                   *and Demonstration Act of 1974* (42 U.S.C. 5551 *et seq.*)  
14                   *under section 4(a) shall not affect the authority of the Sec-*  
15                   *retary to conduct research and development on solar energy.*

Calendar No. 358

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1<sup>ST</sup> Session

**S. 2668**

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**A BILL**

To establish a program for research, development, and demonstration of solar energy technologies, and for other purposes.

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DECEMBER 17, 2019

Reported with an amendment