

116TH CONGRESS
1ST SESSION

S. 2668

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

IN THE SENATE OF THE UNITED STATES

OCTOBER 22, 2019

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

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”.

6 **SEC. 2. DEFINITIONS.**

7 In this Act:

8 (1) **ECONOMICALLY DISTRESSED AREA.**—The
9 term “economically distressed area” means an area
10 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 nonprofit research organization;

10 (F) an industrial entity; and

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

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

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

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

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

3 (A) a device that converts light directly
4 into electricity through a solid-state, semicon-
5 ductor process;

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

8 (C) the electronic and electrical compo-
9 nents of a device described in subparagraph
10 (A).

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

13 (8) SECRETARY.—The term “Secretary” means
14 the Secretary of Energy.

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

16 (a) PROGRAM.—

17 (1) IN GENERAL.—The Secretary shall establish
18 a solar energy technology program under which the
19 Secretary shall—

20 (A) award grants on a competitive, merit-
21 reviewed basis to eligible entities to conduct re-
22 search, development, testing, and evaluation of
23 solar energy technologies; and

24 (B) carry out other activities in accordance
25 with this section.

1 (2) PURPOSES.—The purposes of the program
2 are the following:

3 (A) To improve the energy efficiency, reli-
4 ability, resilience, security, and capacity of solar
5 energy generation.

6 (B) To optimize the design and adapt-
7 ability of solar energy systems to the broadest
8 practical range of geographic and atmospheric
9 conditions.

10 (C) To reduce the cost of manufacturing,
11 installation, operation, and maintenance of
12 solar energy systems.

13 (D) To create and improve conversion of
14 solar energy to useful forms.

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

20 (4) STEWARDSHIP OF NATIONAL LABORATORY
21 RESOURCES.—In awarding grants under the pro-
22 gram, the Secretary shall steward relevant capabili-
23 ties and programs of the National Laboratories.

24 (5) TECHNICAL ASSISTANCE AND WORKFORCE
25 DEVELOPMENT.—In carrying out the program, for

1 purposes of supporting technical, nonhardware, and
2 information-based advances in solar energy systems
3 development and operations, the Secretary may—

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

10 (B) carry out workforce development and
11 training activities, including to support the dis-
12 semination of standards and best practices for
13 enabling solar power production.

14 (6) WILDLIFE IMPACT MITIGATION.—In car-
15 rying out the program, the Secretary shall, to the
16 maximum extent practicable, support wildlife impact
17 mitigation technologies and strategies, including the
18 use of distributed solar technologies, to reduce the
19 potential negative impacts of solar energy systems
20 on fish or wildlife, or plants (as those terms are de-
21 fined in section 3 of the Endangered Species Act of
22 1973 (16 U.S.C. 1532)).

23 (7) SUSTAINABLE CHEMISTRY.—Each entity re-
24 ceiving a grant under the program shall endeavor, in
25 carrying out activities under the grant, to incor-

1 porate, where appropriate, sustainable and green
2 chemistry and engineering principles, practices, and
3 methodologies.

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

9 (1) Photovoltaic devices and related electronic
10 components, including converters, sensors, energy
11 monitors, communication and control equipment,
12 and protocols.

13 (2) Concentrated solar power, including solar
14 thermal and concentrating solar photovoltaic tech-
15 nologies.

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

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

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

21 (6) Solar technology products that can be easily
22 integrated into new buildings, existing buildings, ag-
23 ricultural and aquatic environments, and other infra-
24 structure.

1 (7) Solar technology that is resilient to extreme
2 weather events.

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

7 (9) Storage technologies that address the tran-
8 sience and intermittency of solar energy resources,
9 including batteries, supercapacitors, and thermal
10 storage.

11 (10) Microgrids using solar technology.

12 (11) Solar technologies enabling safe grid oper-
13 ating conditions, such as fast-disconnect during an
14 emergency.

15 (12) Distributed solar energy technologies, such
16 as rooftop solar panels.

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

19 (14) Advanced solar manufacturing technologies
20 and best practices, including—

21 (A) materials and processes;

22 (B) development of industry standards;

23 (C) design and integration practices; and

24 (D) optimized packaging methods and new
25 device designs.

1 (15) Advanced analytic and computing capabili-
 2 ties for better modeling and simulations of solar en-
 3 ergy systems.

4 (16) Electrical grid integration, including—

5 (A) integration of solar technologies into
 6 smart grid, transmission, and distribution;

7 (B) coordination of solar with other dis-
 8 tributed and large-scale energy resources;

9 (C) electrical power smoothing;

10 (D) microgrid integration;

11 (E) community solar;

12 (F) solar resource forecasting;

13 (G) regional and national electric system
 14 balancing and long-distance transmission op-
 15 tions, including direct current and super-
 16 conducting transmission and long-term storage
 17 options;

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

22 (I) electric grid security, including cyber
 23 and physical security.

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

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

8 (19) Next generation demonstration facilities.

9 (20) Any other subject area determined by the
 10 Secretary.

11 (c) SOLAR ENERGY TECHNOLOGY DEMONSTRATION
 12 GRANTS.—

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

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

21 (A) are located in geographically diverse
 22 regions of the United States;

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

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

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

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

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

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

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

23 (I) increase disclosure and transparency of
24 information to all market participants;

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

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

8 (L) satisfy any other priority that the Sec-
9 retary determines appropriate.

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

14 (A) any necessary site engineering study;

15 (B) an economic assessment of site-specific
16 conditions;

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

20 (D) installation of equipment, service, and
21 support;

22 (E) operating the demonstration project
23 for not less than the minimum period required
24 to fully assess the results and objectives of the

1 project, as determined by a peer-reviewed proc-
2 ess; and

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

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

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

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

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

photovoltaics manufacturing, design, installation, refurbishing, or recycling industries;

(B) coordination with information dissemination programs relating to general recycling of electronic devices; and

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

(f) PHOTOVOLTAIC MATERIALS PHYSICAL PROPERTY

DATABASE.—

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

(A) identification of materials used in photovoltaic devices;

(B) the quantity of each commercially available material identified under subparagraph (A) and the country of origin of that material;

(C) the quantity of materials used in photovoltaic 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.

○