

AMENDMENT NO. \_\_\_\_\_ Calendar No. \_\_\_\_\_

Purpose: In the nature of a substitute.

**IN THE SENATE OF THE UNITED STATES—116th Cong., 1st Sess.**

**S. 2668**

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

Referred to the Committee on \_\_\_\_\_ and  
ordered to be printed

Ordered to lie on the table and to be printed

AMENDMENT IN THE NATURE OF A SUBSTITUTE intended  
to be proposed by \_\_\_\_\_

Viz:

1 Strike all after the enacting clause and insert the fol-  
2 lowing:

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 research agency associated with a  
10 territory 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”  
24 has the meaning given the term in section 4 of the

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

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

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

11 (6) NATIVE HAWAIIAN COMMUNITY-BASED OR-  
12 GANIZATION.—The term “Native Hawaiian commu-  
13 nity-based organization” has the meaning given the  
14 term in section 6207 of the Elementary and Sec-  
15 ondary 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  
19 into electricity through a solid-state, semicon-  
20 ductor process;

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

23 (C) the electronic and electrical compo-  
24 nents of a device described in subparagraph  
25 (A).

1           (8) PROGRAM.—The term “program” means  
2 the 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  
15 area” in section 1404 of the Food and Agriculture  
16 Act of 1977 (7 U.S.C. 3103).

17           (12) TRIBAL ENERGY DEVELOPMENT ORGANI-  
18 ZATION.—The term “tribal energy development or-  
19 ganization” has the meaning given the term in sec-  
20 tion 2601 of the Energy Policy Act of 1992 (25  
21 U.S.C. 3501).

22           (13) TRIBAL ORGANIZATION.—The term “tribal  
23 organization” has the meaning given the term in  
24 section 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  
7 section.

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, in-  
12 tegration, manufacturability, and recyclability  
13 of 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,  
18 hardware, and software.

19 (C) To optimize the design and adapt-  
20 ability of solar energy systems to the broadest  
21 practical range of geographic and atmospheric  
22 conditions.

23 (D) To support the integration of solar en-  
24 ergy technologies with the electric grid and  
25 complementary energy technologies.

1           (E) To create and improve the conversion  
2 of solar energy to other useful forms of energy  
3 or 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 indus-  
11 try, workforce, and supply chain.

12          (3) TARGETS.—Not later than 180 days after  
13 the date of enactment of this Act, the Secretary  
14 shall establish targets for the program to address  
15 near-term (up to 2 years), mid-term (up to 7 years),  
16 and long-term (up to 15 years) challenges to the ad-  
17 vancement 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  
2 and 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  
16 carry out research, development, testing, evaluation,  
17 demonstration, and commercialization activities in  
18 the following subject areas:

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

21 (i) new materials, components, de-  
22 signs, 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 tech-  
8 nologies 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 tech-  
16 nologies; 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,  
5           and atmospheric measurement systems, includ-  
6           ing for small-scale, large-scale, and aggregated  
7           systems.

8           (G) Hybrid solar energy systems that in-  
9           corporate diverse—

10                   (i) generation sources;

11                   (ii) loads; and

12                   (iii) storage technologies.

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

16                   (i) distributed solar technologies, in-  
17                   cluding the development of best practices,  
18                   models, and voluntary streamlined proc-  
19                   esses for local permitting of distributed  
20                   solar energy systems to reduce costs;

21                   (ii) local communities;

22                   (iii) wildlife and wildlife habitats; and

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

1 (I) Transformational technologies for har-  
2 nassing solar energy.

3 (J) Other research areas that advance the  
4 purposes of the program, as determined by the  
5 Secretary.

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

9 (A) are located in a geographically diverse  
10 range of eligible entities;

11 (B) support the development or demonstra-  
12 tion of projects—

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

18 (ii) in economically distressed areas;

19 (C) can be replicated in a variety of re-  
20 gions and climates;

21 (D) include business commercialization  
22 plans that have the potential for—

23 (i) domestic manufacturing and pro-  
24 duction of solar energy technologies; or

1 (ii) exports of solar energy tech-  
2 nologies; and

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

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

10 (5) USE OF FUNDS.—To the extent that fund-  
11 ing is not otherwise available through other Federal  
12 programs or power purchase agreements, funding  
13 awarded under this subsection may be used for addi-  
14 tional nontechnology costs, as determined to be ap-  
15 propriate by the Secretary, such as engineering or  
16 feasibility studies.

17 (c) ADVANCED SOLAR ENERGY MANUFACTURING  
18 INITIATIVE.—

19 (1) GRANTS.—In addition to the program ac-  
20 tivities described in subsection (b), in carrying out  
21 the program, the Secretary shall award multiyear  
22 grants to eligible entities for research, development,  
23 and demonstration projects to advance new solar en-  
24 ergy manufacturing technologies and techniques.

1           (2) PRIORITY.—In awarding grants under para-  
2 graph (1), to the extent practicable, the Secretary  
3 shall give priority to solar energy manufacturing  
4 projects that—

5           (A) increase efficiency and cost effective-  
6 ness in—

7           (i) the manufacturing process; and

8           (ii) the use of resources.

9           (B) support domestic supply chains for  
10 materials and components;

11           (C) identify and incorporate nonhazardous  
12 alternative materials for components and de-  
13 vices;

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

19           (E) are located in economically distressed  
20 areas.

21           (3) EVALUATION.—Not later than 3 years after  
22 the date of enactment of this Act, and every 4 years  
23 thereafter, the Secretary shall conduct, and make  
24 available to the public and the relevant committees

1 of Congress, an independent review of the progress  
2 of the grants awarded under paragraph (1).

3 (d) SOLAR ENERGY TECHNOLOGY RECYCLING RE-  
4 SEARCH, DEVELOPMENT, AND DEMONSTRATION PRO-  
5 GRAM.—

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

13 (A) by increasing the efficiency and cost  
14 effectiveness of the recovery of raw materials  
15 from solar energy technology components and  
16 systems, including enabling technologies such as  
17 inverters;

18 (B) by minimizing environmental impacts  
19 from the recovery and disposal processes;

20 (C) by addressing any barriers to the re-  
21 search, development, demonstration, and com-  
22 mercialization of technologies and processes for  
23 the disassembly and recycling of solar energy  
24 devices;

1 (D) by developing alternative materials, de-  
2 signs, manufacturing processes, and other as-  
3 pects of solar energy technologies and the dis-  
4 assembly and resource recovery process that en-  
5 able efficient, cost effective, and environ-  
6 mentally responsible disassembly of, and re-  
7 source recovery from, solar energy technologies;  
8 and

9 (E) strategies to increase consumer accept-  
10 ance of, and participation in, the recycling of  
11 photovoltaic devices.

12 (2) DISSEMINATION OF RESULTS.—The Sec-  
13 retary shall make available to the public and the rel-  
14 evant committees of Congress the results of the  
15 projects carried out through grants awarded under  
16 paragraph (1), including any educational and out-  
17 reach materials.

18 (e) SOLAR ENERGY TECHNOLOGY MATERIALS PHYS-  
19 ICAL PROPERTY DATABASE.—

20 (1) IN GENERAL.—Not later than September 1,  
21 2021, the Secretary shall establish a comprehensive  
22 physical property database of materials for use in  
23 solar energy technologies, which shall identify the  
24 type, quantity, country of origin, source, significant

1 uses, and physical properties of materials used in  
2 solar energy technologies.

3 (2) COORDINATION.—In establishing the data-  
4 base described in paragraph (1), the Secretary shall  
5 coordinate with—

6 (A) the Director of the National Institute  
7 of Standards and Technology;

8 (B) the Administrator of the Environ-  
9 mental Protection Agency;

10 (C) the Secretary of the Interior; and

11 (D) relevant industry stakeholders, as de-  
12 termined by the Secretary.

13 (f) SOLAR ENERGY TECHNOLOGY PROGRAM STRA-  
14 TEGIC VISION.—

15 (1) IN GENERAL.—Not later than September 1,  
16 2021, and every 6 years thereafter, the Secretary  
17 shall submit to Congress a report on the strategic vi-  
18 sion, progress, goals, and targets of the program, in-  
19 cluding assessments of solar energy markets and  
20 manufacturing.

21 (2) PREPARATION.—The Secretary shall coordi-  
22 nate the preparation of the report under paragraph  
23 (1) with—

24 (A) existing peer review processes;

1 (B) studies conducted by the National  
2 Laboratories; and

3 (C) the multiyear program planning re-  
4 quired under section 994 of the Energy Policy  
5 Act of 2005 (42 U.S.C. 16358).

6 (g) AUTHORIZATION OF APPROPRIATIONS.—There is  
7 authorized to be appropriated to the Secretary to carry  
8 out the program \$270,000,000 for each of fiscal years  
9 2020 through 2024.

10 **SEC. 4. CONFORMING AMENDMENTS.**

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

14 (b) Section 6(b)(3) of the Federal Nonnuclear En-  
15 ergy Research and Development Act of 1974 (42 U.S.C.  
16 5905(b)(3)) is amended—

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

18 (2) by redesignating subparagraphs (M)  
19 through (S) as subparagraphs (L) through (R), re-  
20 spectively.

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

1 (d) Section 4 of the Renewable Energy and Energy  
2 Efficiency Technology Competitiveness Act of 1989 (42  
3 U.S.C. 12003) is amended—

4 (1) in the section heading, by striking  
5 **“PHOTOVOLTAICS, AND SOLAR THERMAL”** and  
6 inserting **“ALCOHOL FROM BIOMASS, AND**  
7 **OTHER TECHNOLOGY”**;

8 (2) in subsection (a)—

9 (A) in the matter preceding paragraph (1),  
10 by striking “photovoltaics, and solar thermal  
11 energy” and inserting “alcohol from biomass,  
12 and other energy technology”;

13 (B) by striking paragraphs (2) and (3);  
14 and

15 (C) by redesignating paragraphs (4) and  
16 (5) as paragraphs (2) and (3), respectively; and  
17 (3) in subsection (c)—

18 (A) in the matter preceding paragraph (1),  
19 by striking “the Photovoltaic Energy Systems  
20 Program, the Solar Thermal Energy Systems  
21 Program,”;

22 (B) in paragraph (1)—

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

1                   (ii) by redesignating subparagraphs  
2                   (B) and (C) as subparagraphs (A) and  
3                   (B), respectively; and  
4                   (C) in paragraph (2)—  
5                   (i) by striking subparagraph (A); and  
6                   (ii) by redesignating subparagraphs  
7                   (B) and (C) as subparagraphs (A) and  
8                   (B), respectively.

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

11           (1) in subsection (a)(2)—  
12                   (A) by striking subparagraph (A); and  
13                   (B) by redesignating subparagraphs (B)  
14                   through (E) as subparagraphs (A) through (D),  
15                   respectively;  
16           (2) by striking subsection (d); and  
17           (3) by redesignating subsections (e) through (g)  
18           as subsections (d) through (f), respectively.

19           (f) Sections 606 and 607 of the Energy Independence  
20 and Security Act of 2007 (42 U.S.C. 17174, 17175) are  
21 repealed.

22 **SEC. 5. SAVINGS PROVISION.**

23           The repeal of the Solar Energy Research, Develop-  
24 ment, and Demonstration Act of 1974 (42 U.S.C. 5551  
25 et seq.) under section 4(a) shall not affect the authority

- 1 of the Secretary to conduct research and development on
- 2 solar energy.