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(Original Signature of Member)

116TH CONGRESS
1ST SESSION

H. R. _____

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

M. _____ introduced the following bill; which was referred to the
Committee on _____

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,

1 testing, and evaluation of solar energy technologies. In
2 carrying out such program, the Secretary shall award
3 grants under this section and sections 3, 4, and 5 on a
4 competitive, merit-reviewed basis to eligible entities for
5 each of the following purposes:

6 (1) To improve the energy efficiency, reliability,
7 resilience, security, and capacity of solar energy gen-
8 eration.

9 (2) To optimize the design and adaptability of
10 solar energy systems to the broadest practical range
11 of geographic and atmospheric conditions.

12 (3) To reduce the cost of manufacturing, instal-
13 lation, operation, and maintenance of solar energy
14 systems.

15 (4) To create and improve conversion of solar
16 energy to useful forms.

17 (b) SOLAR ENERGY RESEARCH SUBJECT AREAS.—

18 The program established under subsection (a) shall focus
19 on the research, development, testing, and evaluation of
20 each of the following subject areas:

21 (1) Photovoltaic devices and related electronic
22 components including converters, sensors, energy
23 monitors, communication and control equipment,
24 and protocols.

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

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

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

7 (5) Solar technology products that can be easily
8 integrated into new buildings, existing buildings, ag-
9 ricultural and aquatic environments, and other infra-
10 structure.

11 (6) Solar technology that is resilient to extreme
12 weather events.

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

17 (8) Storage technologies to address the tran-
18 sience and intermittency of solar energy resources,
19 including batteries, supercapacitors, and thermal
20 storage.

21 (9) Micro-grids using solar technology.

22 (10) Solar technologies enabling safe grid oper-
23 ating conditions, such as fast-disconnect during an
24 emergency.

1 (11) Distributed solar energy technologies, such
2 as rooftop solar panels.

3 (12) Technologies and designs that enable a
4 broad range of scales for solar power production.

5 (13) Advanced solar manufacturing technologies
6 and best practices, including—

7 (A) materials and processes;

8 (B) development of industry standards;

9 (C) design and integration practices; and

10 (D) optimized packaging methods and new
11 device designs.

12 (14) Advanced analytic and computing capabili-
13 ties for better modeling and simulations of solar en-
14 ergy systems.

15 (15) Electrical grid integration, including—

16 (A) integration of solar technologies into
17 smart grid, transmission, and distribution;

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

20 (C) electrical power smoothing;

21 (D) microgrid integration;

22 (E) community solar;

23 (F) solar resource forecasting;

24 (G) regional and national electric system
25 balancing and long distance transmission op-

1 tions, including direct current and super-
2 conducting transmission and long-term storage
3 options;

4 (H) ways to address system operations
5 over minutes, hours, days, weeks, and seasons
6 with respect to the full range of project scales;
7 and

8 (I) electric grid security, including cyber
9 and physical security.

10 (16) Non-hardware and information-based ad-
11 vances in solar energy system design, installation,
12 and operation.

13 (17) Solar energy technology as a part of strat-
14 egies commonly referred to as “behind-the-meter
15 strategies”, including with respect to electricity gen-
16 eration, load, energy efficiency, controls, storage,
17 and electric vehicles.

18 (18) Next generation demonstration facilities.

19 (19) Other subject areas determined by the Sec-
20 retary.

21 (c) TECHNICAL ASSISTANCE AND WORKFORCE DE-
22 VELOPMENT.—In carrying out the program established
23 under subsection (a), the Secretary may also conduct, for
24 purposes of supporting technical, non-hardware, and infor-

1 mation-based advances in solar energy systems develop-
2 ment and operations—

3 (1) technical assistance and analysis activities
4 with eligible entities, including activities that sup-
5 port expanding access to solar energy for low-income
6 individuals and communities; and

7 (2) workforce development and training activi-
8 ties, including to support the dissemination of stand-
9 ards and best practices for enabling solar power pro-
10 duction.

11 (d) PROGRAM TARGETS.—The program established
12 under subsection (a) shall address near-term (up to 2
13 years), mid-term (up to 7 years), and long-term (up to
14 15 years) challenges to the advancement of solar energy
15 systems.

16 (e) WILDLIFE IMPACT MITIGATION.—In carrying out
17 the activities described in subsection (b), the program es-
18 tablished under subsection (a) shall support wildlife im-
19 pact mitigation technologies and strategies, including the
20 use of distributed solar technologies, to reduce the poten-
21 tial negative impacts of solar energy systems on wildlife,
22 including bird species and local flora and fauna.

23 (f) STEWARDSHIP OF NATIONAL LABORATORY RE-
24 SOURCES.—In awarding grants under this Act, the Sec-

1 retary shall steward relevant capabilities and programs of
2 the National Laboratories.

3 (g) CONFORMING REPEALS.—The following provi-
4 sions of law are hereby repealed:

5 (1) The Solar Energy Research, Development,
6 and Demonstration Act of 1974 (42 U.S.C. 5551 et
7 seq.), except for section 10.

8 (2) The Solar Photovoltaic Energy Research,
9 Development, and Demonstration Act of 1978 (42
10 U.S.C. 5581 et seq.).

11 (3) Paragraphs (2) and (3) of section 4(a) of
12 the Renewable Energy and Energy Efficiency Tech-
13 nology Competitiveness Act of 1989 (42 U.S.C.
14 12003(a)).

15 (4) Subparagraph (A) of section 931(a)(2) of
16 the Energy Policy Act of 2005 (42 U.S.C.
17 16231(a)(2)).

18 (5) Sections 606 and 607 of the Energy Inde-
19 pendence and Security Act of 2007 (42 U.S.C.
20 17174 and 17175).

21 (h) DEFINITIONS.—In this Act:

22 (1) The term “eligible entity” means any of the
23 following entities:

24 (A) An institution of higher education.

25 (B) A National laboratory.

1 (C) A Federal research agency.

2 (D) A State research agency.

3 (E) A nonprofit research organization.

4 (F) An industrial entity or a multi-institu-
5 tional consortium thereof.

6 (2) The term “institution of higher education”
7 has the meaning given such term in section 101 of
8 the Higher Education Act of 1965 (20 U.S.C.
9 1001).

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

13 (4) The term “photovoltaic device” includes
14 photovoltaic cells and the electronic and electrical
15 components of such devices.

16 (5) The term “Secretary” means the Secretary
17 of Energy.

18 **SEC. 3. SOLAR ENERGY TECHNOLOGY DEMONSTRATION**
19 **PROJECTS.**

20 (a) IN GENERAL.—In carrying out the program es-
21 tablished under section 2(a), the Secretary shall award
22 grants on a competitive, merit-reviewed basis to eligible
23 entities for demonstration projects to advance the develop-
24 ment of solar energy technologies and systems production.

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

3 (1) are located in geographically diverse regions
4 of the United States;

5 (2) can be replicated in a variety of regions and
6 climates;

7 (3) demonstrate technologies that address
8 intermittency, variability, storage challenges, behind-
9 the-meter operations, and independent operational
10 capability;

11 (4) coordinate solar technologies with other dis-
12 tributed and large-scale energy resources;

13 (5) facilitate identification of optimum ap-
14 proaches among competing solar energy tech-
15 nologies;

16 (6) include business commercialization plans
17 that have the potential for production of solar en-
18 ergy equipment at high volumes;

19 (7) support the development of advanced manu-
20 facturing technologies that have the potential to im-
21 prove United States competitiveness in the inter-
22 national solar energy manufacturing sector;

23 (8) provide the greatest potential to reduce en-
24 ergy costs, as well as promote accessibility and com-

1 munity implementation of demonstrated tech-
2 nologies, for consumers;

3 (9) increase disclosure and transparency of in-
4 formation to all market participants to help in mak-
5 ing optimal decisions;

6 (10) promote overall electric infrastructure reli-
7 ability and resilience should grid functions be dis-
8 rupted or damaged; and

9 (11) satisfy any other criteria that the Sec-
10 retary determines appropriate.

11 (c) USE OF FUNDS.—Grants under this section may
12 be used, to the extent that funding is not otherwise avail-
13 able through other Federal programs or power purchase
14 agreements, for—

15 (1) any necessary site engineering study;

16 (2) an economic assessment of site-specific con-
17 ditions;

18 (3) appropriate feasibility studies to determine
19 whether the demonstration can be replicated;

20 (4) installation of equipment, service, and sup-
21 port;

22 (5) operation for at least the minimum amount
23 of time required to fully assess the project's results
24 and objectives, as determined by a peer-reviewed
25 process; and

1 (6) validation of technical, economic, and envi-
2 ronmental assumptions and documentation of les-
3 sons learned.

4 (d) SOLICITATION.—Not later than 90 days after the
5 date of enactment of this Act and annually thereafter, the
6 Secretary shall conduct a national solicitation for applica-
7 tions for grants under this section.

8 (e) ORGANIC PHOTOVOLTAIC CELL TECH-
9 NOLOGIES.—At least 1 grant awarded under this section
10 during fiscal year 2020 shall be for a project to dem-
11 onstrate organic photovoltaic cell technologies.

12 **SEC. 4. NEXT GENERATION SOLAR ENERGY MANUFAC-**
13 **TURING INITIATIVE.**

14 (a) IN GENERAL.—In carrying out the program es-
15 tablished under section 2(a), the Secretary shall provide
16 multi-year grants on a competitive, merit-reviewed basis
17 to eligible entities for research, development, and dem-
18 onstration projects to advance new solar energy manufac-
19 turing technologies and techniques, including those that
20 manufacture solar cells, hardware, and enabling devices.

21 (b) STRATEGIC VISION REPORT.—

22 (1) IN GENERAL.—Not later than September 1,
23 2020, the Secretary shall submit to the Committee
24 on Science, Space, and Technology of the House of
25 Representatives, the Committee on Energy and Nat-

1 ural Resources of the Senate, and any other commit-
2 tees of Congress deemed appropriate by the Sec-
3 retary a report on the results of a study that exam-
4 ines the viable market opportunities available for
5 solar energy technology manufacturing in the United
6 States, including solar cells, hardware, and enabling
7 technologies.

8 (2) REPORT REQUIREMENTS.—The report
9 under paragraph (1) shall include—

10 (A) a description of—

11 (i) the ability to competitively manu-
12 facture solar technology in the United
13 States, including the manufacture of—

14 (I) new and advanced materials,
15 such as cells made with new, cost-ef-
16 fective, high efficiency materials;

17 (II) solar module equipment and
18 enabling technologies, including smart
19 inverters, sensors, and tracking equip-
20 ment;

21 (III) innovative solar module de-
22 signs and applications, including those
23 that can directly integrate with new
24 and existing buildings and other infra-
25 structure; and

1 (IV) other research areas as de-
2 termined by the Secretary; and

3 (ii) opportunities and barriers within
4 the United States and international solar
5 energy technology supply chains;

6 (B) policy recommendations for enhancing
7 solar energy technology manufacturing in the
8 United States; and

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

13 (c) PROGRAM IMPLEMENTATION.—In carrying out
14 the research, development, and demonstration program
15 under this section, to the extent practicable, the Secretary
16 shall follow the recommendations included in the report
17 under subsection (b) and make grants for solar energy
18 manufacturing projects that—

19 (1) reduce capital expenditures or provide
20 lower-cost manufacturing option;

21 (2) eliminate manufacturing process steps;

22 (3) reduce energy, water and material inputs;

23 (4) establish alternative supply chains for mate-
24 rials and components; and

1 (5) take advantage of rapid prototyping, small
2 batch manufacturing, and roll-to-roll processing.

3 (d) PROGRAM EVALUATION.—Beginning not later
4 than 3 years after the completion of the report under sub-
5 section (b), and every 4 years thereafter, the Secretary
6 shall provide, and make available to the public and the
7 relevant authorizing and appropriations committees of
8 Congress, an independent review of the program author-
9 ized under this section to evaluate its progress toward
10 meeting the policy recommendations and targets deter-
11 mined in the report.

12 **SEC. 5. PHOTOVOLTAIC DEVICE RECYCLING RESEARCH,**
13 **DEVELOPMENT, AND DEMONSTRATION.**

14 (a) IN GENERAL.—In carrying out the program, the
15 Secretary shall award, on a competitive, merit-reviewed
16 basis, multiyear grants to eligible entities for research, de-
17 velopment, and demonstration projects to create innova-
18 tive and practical approaches to increase reuse and recy-
19 cling of photovoltaic devices.

20 (b) PURPOSE.—The Secretary shall award grants
21 under subsection (a) for projects that address—

22 (1) technology to increase the efficiency of pho-
23 tovoltaic device recycling and maximize the recovery
24 of valuable raw materials for use in new products
25 while minimizing the life-cycle environmental im-

1 pacts such as greenhouse gas emissions and water
2 usage;

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

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

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

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

15 (6) tools and methods to aid in assessing the
16 environmental impacts of the production of photo-
17 voltaic devices and photovoltaic device recycling and
18 disposal;

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

23 (8) strategies to increase consumer acceptance
24 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
5 grant under this section shall submit to the Secretary an
6 application that includes a description of—

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

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

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

18 (d) DISSEMINATION OF RESULTS.—The Secretary
19 shall publish the results of projects supported under this
20 section through—

21 (1) development of best practices or training
22 materials for use in the photovoltaics manufacturing,
23 design, installation, refurbishing, or recycling indus-
24 tries;

25 (2) dissemination at industry conferences;

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

4 (4) demonstration projects; and

5 (5) educational materials for the public pro-
6 duced in conjunction with State and local govern-
7 ments or nonprofit organizations on the problems
8 and solutions related to reuse and recycling of pho-
9 tovoltaic devices.

10 (e) PHOTOVOLTAIC MATERIALS PHYSICAL PROP-
11 PERTY DATABASE.—

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

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

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

21 (C) amounts of these materials projected
22 to be available through mining or recycling of
23 photovoltaic and other electronic devices; and

24 (D) a list of other significant uses for each
25 of these materials.

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

8 (3) COORDINATION.—The Secretary shall co-
9 ordinate with the Director of the National Institute
10 of Standards and Technology, the Administrator of
11 the Environmental Protection Agency, and the Ad-
12 ministrator of the Department of Interior to facili-
13 tate the incorporation of the database under this
14 subsection with any existing database for materials
15 involved in electronic manufacturing and recycling.

16 **SEC. 6. AUTHORIZATION OF APPROPRIATIONS.**

17 There are authorized to be appropriated to the Sec-
18 retary to carry out this Act—

19 (1) \$270,000,000 for fiscal year 2020;

20 (2) \$283,500,000 for fiscal year 2021;

21 (3) \$297,675,000 for fiscal year 2022;

22 (4) \$312,558,750 for fiscal year 2023; and

23 (5) \$328,186,688 for fiscal year 2024.