

115TH CONGRESS  
1ST SESSION

**S.** \_\_\_\_\_

To provide for the modernization of the electric grid, and for other purposes.

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IN THE SENATE OF THE UNITED STATES

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Ms. CANTWELL introduced the following bill; which was read twice and referred to the Committee on \_\_\_\_\_

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**A BILL**

To provide for the modernization of the electric grid, 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; TABLE OF CONTENTS.**

4 (a) SHORT TITLE.—This Act may be cited as the  
5 “Grid Modernization Act”.

6 (b) TABLE OF CONTENTS.—The table of contents for  
7 this Act is as follows:

- Sec. 1. Short title; table of contents.
- Sec. 2. Definitions.
- Sec. 3. Grid storage program.
- Sec. 4. Technology demonstration on the distribution system.
- Sec. 5. Micro-grid and hybrid micro-grid systems program.
- Sec. 6. Electric grid architecture, scenario development, and modeling.
- Sec. 7. Voluntary model pathways.
- Sec. 8. Performance metrics for electricity infrastructure providers.

Sec. 9. Voluntary State, regional, and local electricity distribution planning.

Sec. 10. Authorization of appropriations.

1 **SEC. 2. DEFINITIONS.**

2 In this Act:

3 (1) DEPARTMENT.—The term “Department”  
4 means the Department of Energy.

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

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

11 **SEC. 3. GRID STORAGE PROGRAM.**

12 (a) IN GENERAL.—The Secretary shall conduct a  
13 program of research, development, and demonstration of  
14 electric grid energy storage that addresses the principal  
15 challenges identified in the 2013 Department of Energy  
16 Strategic Plan for Grid Energy Storage.

17 (b) AREAS OF FOCUS.—The program under this sec-  
18 tion shall focus on—

19 (1) materials, electric thermal,  
20 electromechanical, and electrochemical systems re-  
21 search;

22 (2) power conversion technologies research;

23 (3) developing—

1 (A) empirical and science-based industry  
2 standards to compare the storage capacity,  
3 cycle length and capabilities, and reliability of  
4 different types of electricity storage; and

5 (B) validation and testing techniques;

6 (4) other fundamental and applied research  
7 critical to widespread deployment of electricity stor-  
8 age;

9 (5) device development that builds on results  
10 from research described in paragraphs (1), (2), and  
11 (4), including combinations of power electronics, ad-  
12 vanced optimizing controls, and energy storage as a  
13 general purpose element of the electric grid;

14 (6) grid-scale testing and analysis of storage  
15 devices, including test-beds and field trials;

16 (7) cost-benefit analyses that inform capital ex-  
17 penditure planning for regulators and owners and  
18 operators of components of the electric grid;

19 (8) electricity storage device safety and reli-  
20 ability, including potential failure modes, mitigation  
21 measures, and operational guidelines;

22 (9) standards for storage device performance,  
23 control interface, grid interconnection, and inter-  
24 operability; and

1           (10) maintaining a public database of energy  
2           storage projects, policies, codes, standards, and reg-  
3           ulations.

4           (c) ASSISTANCE TO STATES.—The Secretary may  
5           provide technical and financial assistance to States, Indian  
6           Tribes, or units of local government to participate in or  
7           use research, development, or demonstration of technology  
8           developed under this section.

9           (d) AUTHORIZATION OF APPROPRIATIONS.—There is  
10          authorized to be appropriated to the Secretary to carry  
11          out this section \$50,000,000 for each of fiscal years 2018  
12          through 2027.

13          (e) NO EFFECT ON OTHER PROVISIONS OF LAW.—  
14          Nothing in this Act or an amendment made by this Act  
15          authorizes regulatory actions that would duplicate or con-  
16          flict with regulatory requirements, mandatory standards,  
17          or related processes under section 215 of the Federal  
18          Power Act (16 U.S.C. 824o).

19          (f) USE OF FUNDS.—To the maximum extent prac-  
20          ticable, in carrying out this section, the Secretary shall  
21          ensure that the use of funds to carry out this section is  
22          coordinated among different offices within the Grid Mod-  
23          ernization Initiative of the Department and other pro-  
24          grams conducting energy storage research.

1 **SEC. 4. TECHNOLOGY DEMONSTRATION ON THE DISTRIBUTION SYSTEM.**  
2

3 (a) IN GENERAL.—The Secretary shall establish a  
4 grant program to carry out eligible projects related to the  
5 modernization of the electric grid, including the applica-  
6 tion of technologies to improve observability, advanced  
7 controls, and prediction of system performance on the dis-  
8 tribution system.

9 (b) ELIGIBLE PROJECTS.—To be eligible for a grant  
10 under subsection (a), a project shall—

11 (1) be designed to improve the performance and  
12 efficiency of the future electric grid, while ensuring  
13 the continued provision of safe, secure, reliable, and  
14 affordable power;

15 (2) demonstrate—

16 (A) secure integration and management of  
17 2 or more energy resources, including distrib-  
18 uted energy generation, combined heat and  
19 power, microgrids, energy storage, electric vehi-  
20 cles, energy efficiency, demand response, and  
21 intelligent loads; and

22 (B) secure integration and interoperability  
23 of communications and information tech-  
24 nologies; and

1           (3) be subject to the requirements of section  
2           545(a) of the Energy Security and Independence Act  
3           of 2007 (42 U.S.C. 17155(a)).

4 **SEC. 5. MICRO-GRID AND HYBRID MICRO-GRID SYSTEMS**  
5           **PROGRAM.**

6           (a) DEFINITIONS.—In this section:

7           (1) HYBRID MICRO-GRID SYSTEM.—The term  
8           “hybrid micro-grid system” means a stand-alone  
9           electrical system that—

10                   (A) is comprised of conventional generation  
11                   and at least 1 alternative energy resource; and

12                   (B) may use grid-scale energy storage.

13           (2) ISOLATED COMMUNITY.—The term “iso-  
14           lated community” means a community that is pow-  
15           ered by a stand-alone electric generation and dis-  
16           tribution system without the economic and reliability  
17           benefits of connection to a regional electric grid.

18           (3) MICRO-GRID SYSTEM.—The term “micro-  
19           grid system” means a standalone electrical system  
20           that uses grid-scale energy storage.

21           (4) STRATEGY.—The term “strategy” means  
22           the strategy developed pursuant to subsection  
23           (b)(2)(B).

24           (b) PROGRAM.—

1           (1) ESTABLISHMENT.—The Secretary shall es-  
2           tablish a program to promote the development of—

3                   (A) hybrid micro-grid systems for isolated  
4           communities; and

5                   (B) micro-grid systems to increase the re-  
6           silience of critical infrastructure.

7           (2) PHASES.—The program established under  
8           paragraph (1) shall be divided into the following  
9           phases:

10                   (A) Phase I, which shall consist of the de-  
11           velopment of a feasibility assessment for—

12                           (i) hybrid micro-grid systems in iso-  
13           lated communities; and

14                           (ii) micro-grid systems to enhance the  
15           resilience of critical infrastructure.

16                   (B) Phase II, which shall consist of the de-  
17           velopment of an implementation strategy, in ac-  
18           cordance with paragraph (3), to promote the  
19           development of hybrid micro-grid systems for  
20           isolated communities, particularly for those  
21           communities exposed to extreme weather condi-  
22           tions and high energy costs, including elec-  
23           tricity, space heating and cooling, and transpor-  
24           tation.

1           (C) Phase III, which shall be carried out  
2           in parallel with Phase II and consist of the de-  
3           velopment of an implementation strategy to  
4           promote the development of micro-grid systems  
5           that increase the resilience of critical infrastruc-  
6           ture.

7           (D) Phase IV, which shall consist of cost-  
8           shared demonstration projects, based upon the  
9           strategies developed under subparagraph (B)  
10          that include the development of physical and cy-  
11          bersecurity plans to take appropriate measures  
12          to protect and secure the electric grid.

13          (E) Phase V, which shall establish a bene-  
14          fits analysis plan to help inform regulators, pol-  
15          icymakers, and industry stakeholders about the  
16          affordability, environmental and resilience bene-  
17          fits associated with Phases II, III, and IV.

18          (3) REQUIREMENTS FOR STRATEGY.—In devel-  
19          oping the strategy under paragraph (2)(B), the Sec-  
20          retary shall consider—

21                 (A) establishing future targets for the eco-  
22                 nomic displacement of conventional generation  
23                 using hybrid micro-grid systems, including dis-  
24                 placement of conventional generation used for



1 electric power generation, heating and cooling,  
2 and transportation;

3 (B) the potential for renewable resources,  
4 including wind, solar, and hydropower, to be in-  
5 tegrated into a hybrid micro-grid system;

6 (C) opportunities for improving the effi-  
7 ciency of existing hybrid micro-grid systems;

8 (D) the capacity of the local workforce to  
9 operate, maintain, and repair a hybrid micro-  
10 grid system;

11 (E) opportunities to develop the capacity of  
12 the local workforce to operate, maintain, and  
13 repair a hybrid micro-grid system;

14 (F) leveraging existing capacity within  
15 local or regional research organizations, such as  
16 organizations based at institutions of higher  
17 education, to support development of hybrid  
18 micro-grid systems, including by testing novel  
19 components and systems prior to field deploy-  
20 ment;

21 (G) the need for basic infrastructure to de-  
22 velop, deploy, and sustain a hybrid micro-grid  
23 system;

1 (H) input of traditional knowledge from  
2 local leaders of isolated communities in the de-  
3 velopment of a hybrid micro-grid system;

4 (I) the impact of hybrid micro-grid systems  
5 on defense, homeland security, economic devel-  
6 opment, and environmental interests;

7 (J) opportunities to leverage existing inter-  
8 agency coordination efforts and recommenda-  
9 tions for new interagency coordination efforts to  
10 minimize unnecessary overhead, mobilization,  
11 and other project costs; and

12 (K) any other criteria the Secretary deter-  
13 mines appropriate.

14 (c) COLLABORATION.—The program established  
15 under subsection (b)(1) shall be carried out in collabora-  
16 tion with relevant stakeholders, including, as appro-  
17 priate—

18 (1) States;

19 (2) Indian Tribes;

20 (3) regional entities and regulators;

21 (4) units of local government;

22 (5) institutions of higher education; and

23 (6) private sector entities.

24 (d) REPORT.—Not later than 180 days after the date  
25 of enactment of this Act, and annually thereafter until cal-

1 endar year 2026, the Secretary shall submit to the Com-  
2 mittee on Energy and Natural Resources of the Senate  
3 and the Committee on Energy and Commerce of the  
4 House of Representatives a report on the efforts to imple-  
5 ment the program established under subsection (b)(1) and  
6 the status of the strategy developed under subsection  
7 (b)(2)(B).

8 **SEC. 6. ELECTRIC GRID ARCHITECTURE, SCENARIO DEVEL-**  
9 **OPMENT, AND MODELING.**

10 (a) GRID ARCHITECTURE AND SCENARIO DEVELOP-  
11 MENT.—

12 (1) IN GENERAL.—Subject to paragraph (2),  
13 the Secretary shall establish and facilitate a collabo-  
14 rative process to develop model grid architecture and  
15 a set of future scenarios for the electric grid to ex-  
16 amine the impacts of different combinations of re-  
17 sources (including different quantities of distributed  
18 energy resources and large-scale, central generation)  
19 on the electric grid.

20 (2) MARKET STRUCTURE.—The grid architec-  
21 ture and scenarios developed under paragraph (1)  
22 shall account for differences in market structure, in-  
23 cluding an examination of the potential for stranded  
24 costs in each type of market structure.

1           (3) FINDINGS.—Based on the findings of grid  
2 architecture developed under paragraph (1), the Sec-  
3 retary shall—

4                   (A) determine whether any additional  
5 standards are necessary to ensure the interoper-  
6 ability of grid systems and associated commu-  
7 nications networks; and

8                   (B) if the Secretary makes a determination  
9 that additional standards are necessary under  
10 subparagraph (A), make recommendations for  
11 additional standards, including, as may be ap-  
12 propriate, to the Electric Reliability Organiza-  
13 tion under section 215 of the Federal Power  
14 Act (16 U.S.C. 824o). The Electric Reliability  
15 Organization shall not be under any obligation  
16 to establish any process to consider such rec-  
17 ommendations.

18           (b) MODELING.—Subject to subsection (c), the Sec-  
19 retary shall—

20                   (1) conduct modeling based on the scenarios de-  
21 veloped under subsection (a); and

22                   (2) analyze and evaluate the technical and fi-  
23 nancial impacts of the models to assist States, utili-  
24 ties, and other stakeholders in—

25                           (A) enhancing strategic planning efforts;

1 (B) avoiding stranded costs; and

2 (C) maximizing the cost-effectiveness of fu-  
3 ture grid-related investments.

4 (c) INPUT.—The Secretary shall develop the sce-  
5 narios and conduct the modeling and analysis under sub-  
6 sections (a) and (b) with participation or input, as appro-  
7 priate, from—

8 (1) the National Laboratories;

9 (2) States;

10 (3) State regulatory authorities;

11 (4) transmission organizations;

12 (5) representatives of all sectors of the electric  
13 power industry;

14 (6) academic institutions;

15 (7) independent research institutes; and

16 (8) other entities.

17 (d) EFFECT.—Nothing in this section grants any per-  
18 son a right to receive or review confidential, proprietary,  
19 or otherwise protected information concerning grid archi-  
20 tecture or scenarios.

21 **SEC. 7. VOLUNTARY MODEL PATHWAYS.**

22 (a) ESTABLISHMENT OF VOLUNTARY MODEL PATH-  
23 WAYS.—

24 (1) ESTABLISHMENT.—Not later than 90 days  
25 after the date of enactment of this Act, the Sec-

1       retary, in consultation with the steering committee  
2       established under paragraph (3), shall initiate the  
3       development of voluntary model pathways for mod-  
4       ernizing the electric grid through a collaborative,  
5       public-private effort that—

6               (A) produces illustrative policy pathways  
7               encompassing a diverse range of technologies  
8               that can be adapted for State and regional ap-  
9               plications by regulators and policymakers;

10              (B) facilitates the modernization of the  
11              electric grid and associated communications  
12              networks to achieve the objectives described in  
13              paragraph (2);

14              (C) ensures a reliable, resilient, affordable,  
15              safe, and secure electric grid; and

16              (D) acknowledges and accounts for dif-  
17              ferent priorities, electric systems, and rate  
18              structures across States and regions.

19              (2) OBJECTIVES.—The pathways established  
20              under paragraph (1) shall facilitate achievement of  
21              as many of the following objectives as practicable:

22                      (A) Near real-time situational awareness of  
23                      the electric system.

24                      (B) Data visualization.

1 (C) Advanced monitoring and control of  
2 the advanced electric grid.

3 (D) Enhanced certainty of policies for in-  
4 vestment in the electric grid.

5 (E) Increased innovation.

6 (F) Greater consumer empowerment.

7 (G) Enhanced grid resilience, reliability,  
8 and robustness.

9 (H) Improved—

10 (i) integration of distributed energy  
11 resources;

12 (ii) interoperability of the electric sys-  
13 tem; and

14 (iii) predictive modeling and capacity  
15 forecasting.

16 (I) Reduced cost of service for consumers.

17 (J) Diversification of generation sources.

18 (3) STEERING COMMITTEE.—Not later than 90  
19 days after the date of enactment of this Act, the  
20 Secretary shall establish a steering committee to  
21 help develop the pathways under paragraph (1), to  
22 be composed of members appointed by the Secretary,  
23 consisting of persons with appropriate expertise rep-  
24 resenting a diverse range of interests in the public,

1 private, and academic sectors, including representa-  
2 tives of—

3 (A) the Federal Energy Regulatory Com-  
4 mission;

5 (B) the National Laboratories;

6 (C) States;

7 (D) State regulatory authorities;

8 (E) transmission organizations;

9 (F) representatives of all sectors of the  
10 electric power industry;

11 (G) institutions of higher education;

12 (H) independent research institutes; and

13 (I) other entities.

14 (b) TECHNICAL ASSISTANCE.—The Secretary may  
15 provide technical assistance to States, Indian Tribes, or  
16 units of local government to adopt or implement 1 or more  
17 elements of the pathways developed under subsection  
18 (a)(1), including on a pilot basis.

19 **SEC. 8. PERFORMANCE METRICS FOR ELECTRICITY INFRA-**  
20 **STRUCTURE PROVIDERS.**

21 (a) IN GENERAL.—Not later than 2 years after the  
22 date of enactment of this Act, the Secretary, in consulta-  
23 tion with the steering committee established under section  
24 7(a)(3), shall submit to the Committee on Energy and  
25 Natural Resources of the Senate and the Committee on



1 Energy and Commerce of the House of Representatives  
2 a report that includes—

3 (1) an evaluation of the performance of the  
4 electric grid as of the date of the report; and

5 (2) a description of the projected range of  
6 measurable costs and benefits associated with the  
7 changes evaluated under the scenarios developed  
8 under section 6.

9 (b) CONSIDERATIONS FOR DEVELOPMENT OF  
10 METRICS.—In developing metrics for the evaluation and  
11 projections under subsection (a), the Secretary shall con-  
12 sider—

13 (1) standard methodologies for calculating im-  
14 provements or deteriorations in the performance  
15 metrics, such as reliability, grid efficiency, power  
16 quality, consumer satisfaction, sustainability, and fi-  
17 nancial incentives;

18 (2) standard methodologies for calculating po-  
19 tential costs and measurable benefits value to rate-  
20 payers, applying the performance metrics developed  
21 under paragraph (1);

22 (3) identification of tools, resources, and de-  
23 ployment models that may enable improved perform-  
24 ance through the adoption of emerging, commer-

1 cially available or advanced grid technologies or solu-  
2 tions, including—

3 (A) multicustomer micro-grids;

4 (B) distributed energy resources;

5 (C) energy storage;

6 (D) electric vehicles;

7 (E) electric vehicle charging infrastructure;

8 (F) integrated information and commu-  
9 nications systems;

10 (G) transactive energy systems; and

11 (H) advanced demand management sys-  
12 tems; and

13 (4) the role of States and local regulatory au-  
14 thorities in enabling a robust future electric grid to  
15 ensure that—

16 (A) electric utilities remain financially via-  
17 ble;

18 (B) electric utilities make the needed in-  
19 vestments that ensure a reliable, secure, and re-  
20 silient grid; and

21 (C) costs incurred to transform to an inte-  
22 grated grid are allocated and recovered respon-  
23 sibly, efficiently, and equitably.

1 **SEC. 9. VOLUNTARY STATE, REGIONAL, AND LOCAL ELEC-**  
2 **TRICITY DISTRIBUTION PLANNING.**

3 (a) IN GENERAL.—On the request of a State, re-  
4 gional organization, or electric utility, the Secretary shall  
5 provide assistance to States, regional organizations, and  
6 electric utilities to facilitate the development of State, re-  
7 gional, and local electricity distribution plans by—

8 (1) conducting a resource assessment and anal-  
9 ysis of future demand and distribution requirements;  
10 and

11 (2) developing open source tools for State, re-  
12 gional, and local planning and operations.

13 (b) RISK AND SECURITY ANALYSIS.—The assessment  
14 under subsection (a)(1) shall include—

15 (1) the evaluation of the physical security, cy-  
16 bersecurity, and associated communications needs of  
17 an advanced distribution management system and  
18 the integration of distributed energy resources; and

19 (2) advanced use of grid architecture to analyze  
20 risks in an all-hazards approach that includes com-  
21 munications infrastructure, control systems architec-  
22 ture, and power systems architecture.

23 (c) DESIGNATION.—The information collected for the  
24 assessment and analysis under subsection (a)(1)—

1           (1) shall be considered to be critical electric in-  
2           frastructure information under section 215A of the  
3           Federal Power Act (16 U.S.C. 824o–1); and

4           (2) shall only be released in compliance with  
5           regulations implementing that section.

6           (d) TECHNICAL ASSISTANCE.—For the purpose of  
7           assisting in the development of State and regional elec-  
8           tricity distribution plans, the Secretary shall provide tech-  
9           nical assistance to—

10           (1) States;

11           (2) regional reliability entities; and

12           (3) other distribution asset owners and opera-  
13           tors.

14           (e) WITHDRAWAL.—A State or any entity that has  
15           requested technical assistance under this section may  
16           withdraw the request for technical assistance at any time,  
17           and on such withdrawal, the Secretary shall terminate all  
18           assistance efforts.

19           (f) EFFECT.—Nothing in this section authorizes the  
20           Secretary to require any State, regional organization, re-  
21           gional reliability entity, asset owner, or asset operator to  
22           adopt any model, tool, plan, analysis, or assessment.

1 **SEC. 10. AUTHORIZATION OF APPROPRIATIONS.**

2       There is authorized to be appropriated to the Sec-  
3 retary to carry out section 4 through this section  
4 \$200,000,000 for each of fiscal years 2018 through 2027.