

116TH CONGRESS  
1ST SESSION

# H. R. 5428

To amend the Energy Independence and Security Act of 2007 and the Energy Policy Act of 2005 to direct Federal research on grid modernization and security, and for other purposes.

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## IN THE HOUSE OF REPRESENTATIVES

DECEMBER 13, 2019

Mr. LAMB (for himself and Ms. HERRERA BEUTLER) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

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## A BILL

To amend the Energy Independence and Security Act of 2007 and the Energy Policy Act of 2005 to direct Federal research on grid modernization and security, 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 Research and Development Act of  
6 2019”.

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

- Sec. 1. Short title; table of contents.  
 Sec. 2. Smart grid regional demonstration initiative.  
 Sec. 3. Smart grid modeling, visualization, architecture, and controls.  
 Sec. 4. Enhancing grid resilience and emergency response.  
 Sec. 5. Hybrid energy systems.  
 Sec. 6. Grid integration research and development.  
 Sec. 7. Industry alliance.  
 Sec. 8. Coordination of efforts.  
 Sec. 9. Definitions.  
 Sec. 10. Technical amendments; authorization of appropriations.

1 **SEC. 2. SMART GRID REGIONAL DEMONSTRATION INITIA-**  
 2 **TIVE.**

3 Section 1304 of the Energy Independence and Secu-  
 4 rity Act of 2007 (42 U.S.C. 17384) is amended—

5 (1) in subsection (a), by inserting “research,  
 6 development, and demonstration” before “program”;

7 (2) in subsection (b)—

8 (A) by amending paragraph (1) to read as  
 9 follows:

10 “(1) The Secretary shall establish a smart grid  
 11 regional demonstration initiative (referred to in this  
 12 subsection as the ‘Initiative’) composed of dem-  
 13 onstration projects focused on cost-effective, ad-  
 14 vanced technologies for use in power grid sensing,  
 15 communications, analysis, power flow control, visual-  
 16 ization, distribution automation, industrial control  
 17 systems, dynamic line rating systems, grid redesign,  
 18 and the integration of distributed energy re-  
 19 sources.”; and

20 (B) in paragraph (2)—

1 (i) in subparagraph (D), by striking  
2 “and”;

3 (ii) in subparagraph (E), by striking  
4 the period and inserting “; and”; and

5 (iii) by inserting at the end the fol-  
6 lowing:

7 “(F) to encourage the commercial applica-  
8 tion of advanced distribution automation tech-  
9 nologies that improve system resilience.”.

10 **SEC. 3. SMART GRID MODELING, VISUALIZATION, ARCHI-**  
11 **TECTURE, AND CONTROLS.**

12 Title XIII of the Energy Independence and Security  
13 Act of 2007 (42 U.S.C. 17381 et seq.) is amended by in-  
14 serting after section 1304 the following:

15 **“SEC. 1304a. SMART GRID MODELING, VISUALIZATION, AR-**  
16 **CHITECTURE, AND CONTROLS.**

17 “(a) IN GENERAL.—Not later than 180 days after  
18 the enactment of the Grid Modernization Research and  
19 Development Act of 2019, the Secretary shall establish a  
20 program of research, development, demonstration, and  
21 commercial application on electric grid modeling, sensing,  
22 visualization, architecture development, and advanced op-  
23 eration and controls.

24 “(b) MODELING RESEARCH AND DEVELOPMENT.—  
25 The Secretary shall support development of models of

1 emerging technologies and systems to facilitate the secure  
2 and reliable design, planning, and operation of the electric  
3 grid for use by industry stakeholders. In particular, the  
4 Secretary shall support development of—

5           “(1) models to analyze and predict the effects  
6           of adverse physical and cyber events on the electric  
7           grid;

8           “(2) coupled models of electrical, physical, and  
9           cyber systems;

10           “(3) models of existing and emerging tech-  
11           nologies being deployed on the electric grid due to  
12           projected changes in the electric generation mix and  
13           loads, for a variety of regional characteristics; and

14           “(4) integrated models of the communications,  
15           transmission, distribution, and other interdependent  
16           systems for existing, new, and emerging tech-  
17           nologies.

18           “(c) SITUATIONAL AWARENESS RESEARCH AND DE-  
19           VELOPMENT.—

20           “(1) IN GENERAL.—The Secretary shall sup-  
21           port development of computational tools and tech-  
22           nologies to improve sensing, monitoring, and visual-  
23           ization of the electric grid for real-time situational  
24           awareness and decision support tools that enable im-  
25           proved operation of the power system, including util-

1       ity, non-utility, and customer grid-connected assets,  
2       for use by industry partners.

3           “(2) DATA USE.—In developing visualization  
4       capabilities under this section, the Secretary shall  
5       develop tools for industry stakeholders to use to ana-  
6       lyze data collected from advanced measurement and  
7       monitoring technologies, including data from phasor  
8       measurement units and advanced metering units.

9           “(3) SEVERE EVENTS.—The Secretary shall  
10      prioritize enhancing cyber and physical situational  
11      awareness of the electric grid during adverse man-  
12      made and naturally occurring events.

13          “(d) ARCHITECTURE.—The Secretary shall conduct  
14      research in collaboration with industry stakeholders to de-  
15      velop model grid architectures to assist with wide-area  
16      transmission and distribution planning that incorporate  
17      expected changes to the modern electric grid. In sup-  
18      porting the development of model grid architectures, the  
19      Secretary shall—

20           “(1) analyze a variety of grid architecture sce-  
21      narios that range from minor upgrades to existing  
22      transmission grid infrastructure to scenarios that in-  
23      volve the replacement of significant portions of exist-  
24      ing transmission grid infrastructure;

1           “(2) analyze the effects of the increasing pro-  
2           liferation of renewable and other zero emissions en-  
3           ergy generation sources, increasing use of distrib-  
4           uted resources owned by non-utility entities, and the  
5           use of digital and automated controls not managed  
6           by grid operators;

7           “(3) include a variety of new and emerging dis-  
8           tribution grid technologies, including distributed en-  
9           ergy resources, electric vehicle charging stations, dis-  
10          tribution automation technologies, energy storage,  
11          and renewable energy sources;

12          “(4) analyze the effects of local load balancing  
13          and other forms of decentralized control;

14          “(5) analyze the effects of changes to grid ar-  
15          chitectures resulting from modernizing electric grid  
16          systems, including communications, controls, mar-  
17          kets, consumer choice, emergency response, elec-  
18          trification, and cybersecurity concerns; and

19          “(6) develop integrated grid architectures that  
20          incorporate system resilience for cyber, physical, and  
21          communications systems.

22          “(e) OPERATION AND CONTROLS RESEARCH AND  
23          DEVELOPMENT.—The Secretary shall conduct research to  
24          develop improvements to the operation and controls of the

1 electric grid, in coordination with industry partners. Such  
2 activities shall include—

3 “(1) a training facility or facilities to allow grid  
4 operators to gain operational experience with ad-  
5 vanced grid control concepts and technologies;

6 “(2) development of cost-effective advanced op-  
7 eration and control concepts and technologies, such  
8 as adaptive islanding, dynamic line rating systems,  
9 power flow controllers, network topology optimiza-  
10 tion, smart circuit breakers, intelligent load shed-  
11 ding, and fault-tolerant control system architectures;

12 “(3) development of real-time control concepts  
13 using artificial intelligence and machine learning for  
14 improved electric grid resilience; and

15 “(4) utilization of advanced data analytics in-  
16 cluding load forecasting, power flow modeling, equip-  
17 ment failure prediction, resource optimization, risk  
18 analysis, and decision analysis.

19 “(f) COMPUTING RESOURCES AND DATA COORDINA-  
20 TION RESEARCH AND DEVELOPMENT.—In carrying out  
21 this section, the Secretary shall—

22 “(1) leverage existing computing resources at  
23 the National Laboratories;

24 “(2) develop voluntary standards for data  
25 taxonomies and communication protocols in coordi-

1 nation with public and private sector stakeholders;  
2 and

3 “(3) comply with section 8 of the Grid Mod-  
4 ernization Research and Development Act of 2019.

5 “(g) INFORMATION SHARING.—None of the activities  
6 authorized in this section shall require private entities to  
7 share information or data with the Secretary.”.

8 **SEC. 4. ENHANCING GRID RESILIENCE AND EMERGENCY**  
9 **RESPONSE.**

10 Title XIII of the Energy Independence and Security  
11 Act of 2007 (42 U.S.C. 17381 et. seq.) is amended by  
12 adding at the end the following:

13 **“SEC. 1310. GRID RESILIENCE AND EMERGENCY RESPONSE.**

14 “(a) IN GENERAL.—Not later than 180 days after  
15 the enactment of the Grid Modernization Research and  
16 Development Act of 2019, the Secretary shall establish a  
17 research, development, and demonstration program to en-  
18 hance resilience and strengthen emergency response and  
19 management pertaining to the electric grid.

20 “(b) GRANTS.—The Secretary shall award grants to  
21 eligible entities under subsection (c) on a competitive basis  
22 to conduct research and development with the purpose of  
23 improving the resilience and reliability of electric grid by—

24 “(1) developing methods to improve community  
25 and governmental preparation for and emergency re-

1        sponse to large-area, long-duration electricity inter-  
2        rptions, including through the use of energy effi-  
3        ciency, storage, and distributed generation tech-  
4        nologies;

5            “(2) developing tools to help utilities and com-  
6        munities ensure the continuous delivery of electricity  
7        to critical facilities;

8            “(3) developing tools to improve coordination  
9        between utilities and relevant Federal agencies to  
10       enable communication, information-sharing, and sit-  
11       uational awareness in the event of a physical or  
12       cyber attack on the electric grid;

13           “(4) developing technologies and capabilities to  
14       withstand and address the current and projected im-  
15       pact of the changing climate on electric grid infra-  
16       structure, including extreme weather events and  
17       other natural disasters;

18           “(5) developing technologies capable of early  
19       detection of deteriorating electrical equipment on the  
20       transmission and distribution grid, including detec-  
21       tion of spark ignition from wildfires and risks of  
22       vegetation contact; and

23           “(6) assessing upgrades and additions needed  
24       to electric grid infrastructure due to projected

1 changes in the electricity generation mix and elec-  
2 tricity demand.

3 “(c) ELIGIBLE ENTITIES.—The entities eligible to re-  
4 ceive grants under this section include—

5 “(1) an institution of higher education;

6 “(2) a nonprofit organization;

7 “(3) a National Laboratory;

8 “(4) a unit of State, local, or tribal government;

9 “(5) an electric utility or electric cooperative;

10 “(6) a retail service provider of electricity;

11 “(7) a private commercial entity;

12 “(8) a partnership or consortium of two or  
13 more entities described in subparagraphs (1)  
14 through (7).

15 “(d) RELEVANT ACTIVITIES.—Grants awarded under  
16 subsection (b) shall include funding for research and de-  
17 velopment activities related to the purpose described in  
18 subsection (b), such as—

19 “(1) development of technologies to use distrib-  
20 uted energy resources, such as solar photovoltaics,  
21 energy storage systems, electric vehicles, and  
22 microgrids to improve grid and critical end-user re-  
23 silience;

24 “(2) analysis of past large-area, long-duration  
25 electricity interruptions to identify common elements

1 and best practices for electricity restoration, mitiga-  
2 tion, and prevention of future disruptions;

3 “(3) development of advanced monitoring, ana-  
4 lytics, operation, and controls of electricity grid sys-  
5 tems to improve electric grid resilience;

6 “(4) analysis of technologies, methods, and con-  
7 cepts that can improve community resilience and  
8 survivability of frequent or long-duration power out-  
9 ages;

10 “(5) development of methodologies to maintain  
11 cybersecurity during restoration of electric grid in-  
12 frastructure and operation;

13 “(6) development of advanced power flow con-  
14 trol systems and components to improve electric grid  
15 resilience; and

16 “(7) any other relevant activities determined by  
17 the Secretary.

18 “(e) TECHNICAL ASSISTANCE.—

19 “(1) IN GENERAL.—The Secretary shall provide  
20 technical assistance to eligible entities for the com-  
21 mercial application of technologies to improve the re-  
22 siliance of the electric grid and commercial applica-  
23 tion of technologies to help entities develop plans for  
24 preventing and recovering from various power out-  
25 age scenarios at the local, regional, and State level.

1           “(2) TECHNICAL ASSISTANCE PROGRAM.—The  
2 technical assistance program established in para-  
3 graph (1) shall include assistance to eligible entities  
4 for—

5           “(A) the commercial application of tech-  
6 nologies developed from the grant program es-  
7 tablished in subsection (b), including municipal  
8 and cooperative utilities;

9           “(B) the development of methods to  
10 strengthen or otherwise mitigate adverse im-  
11 pacts on electric grid infrastructure against  
12 natural hazards;

13           “(C) the use of Department data and mod-  
14 eling tools for various purposes; and

15           “(D) a resource assessment and analysis of  
16 future demand and distribution requirements,  
17 including development of advanced grid archi-  
18 tectures and risk analysis.

19           “(3) ELIGIBLE ENTITIES.—The entities eligible  
20 to receive technical assistance for commercial appli-  
21 cation of technologies under this section include—

22           “(A) representatives of all sectors of the  
23 electric power industry, including electric utili-  
24 ties, trade organizations, and transmission and

1 distribution system organizations, owners, and  
2 operators;

3 “(B) State and local governments and reg-  
4 ulatory authorities, including public utility com-  
5 missions;

6 “(C) tribal and Alaska Native govern-  
7 mental entities;

8 “(D) partnerships among entities under  
9 subparagraphs (A) through (C);

10 “(E) regional partnerships; and

11 “(F) any other entities the Secretary  
12 deems appropriate.

13 “(4) AUTHORITY.—Nothing in this section shall  
14 authorize the Secretary to require any entity to  
15 adopt any model, tool, technology, plan, analysis, or  
16 assessment.

17 “(f) COORDINATION.—In carrying out this section,  
18 the Secretary shall comply with section 8 of the Grid Mod-  
19 ernization Research and Development Act of 2019.”.

20 **SEC. 5. HYBRID ENERGY SYSTEMS.**

21 Title XIII of the Energy Independence and Security  
22 Act of 2007 (42 U.S.C. 17381 et. seq.), as amended, is  
23 amended by adding at the end the following:

1 **“SEC. 1311. HYBRID ENERGY SYSTEMS.**

2 “(a) IN GENERAL.—Not later than 180 days after  
3 the enactment of the Grid Modernization Research and  
4 Development Act of 2019, the Secretary shall establish a  
5 research, development, and demonstration program to de-  
6 velop cost-effective hybrid energy systems, including—

7 “(1) development of computer modeling to de-  
8 sign different configurations of hybrid energy sys-  
9 tems and to optimize system operation;

10 “(2) research on system integration needed to  
11 plan, design, build, and operate hybrid energy sys-  
12 tems, including interconnection requirements with  
13 the electric grid;

14 “(3) development of hybrid energy systems for  
15 various applications, including—

16 “(A) thermal energy generation and stor-  
17 age for buildings and manufacturing;

18 “(B) electricity storage coupled with en-  
19 ergy generation;

20 “(C) desalination;

21 “(D) production of liquid and gaseous  
22 fuels; and

23 “(E) production of chemicals such as am-  
24 monia and ethylene;

25 “(4) development of testing facilities for hybrid  
26 energy systems; and

1           “(5) research on incorporation of various tech-  
2           nologies for hybrid energy systems, including nuclear  
3           energy, renewable energy, storage, and carbon cap-  
4           ture, utilization, and sequestration technologies.

5           “(b) STRATEGIC PLAN.—

6           “(1) IN GENERAL.—Not later than 1 year after  
7           the date of the enactment of the Grid Modernization  
8           Research and Development Act of 2019, the Sec-  
9           retary shall submit to the Committee on Science,  
10          Space, and Technology of the House of Representa-  
11          tives and the Committee on Energy and Natural Re-  
12          sources of the Senate a strategic plan that identifies  
13          opportunities, challenges, and standards needed for  
14          the development and commercial application of hy-  
15          brid energy systems. The strategic plan shall in-  
16          clude—

17                  “(A) analysis of the potential benefits of  
18                  development of hybrid electric systems on the  
19                  electric grid;

20                  “(B) analysis of the potential contributions  
21                  of hybrid energy systems to different grid archi-  
22                  tecture scenarios;

23                  “(C) research and development goals for  
24                  various hybrid energy systems, including those  
25                  identified in subsection (b);

1           “(D) assessment of policy and market bar-  
2           riers to the adoption of hybrid energy systems;

3           “(E) analysis of the technical and eco-  
4           nomic feasibility of adoption of different hybrid  
5           energy systems; and

6           “(F) a 10-year roadmap to guide the pro-  
7           gram established under subsection (a).

8           “(2) UPDATES.—Not less than once every 3  
9           years for the duration of this research program, the  
10          Secretary shall submit an updated version of the  
11          strategic plan to the Committee on Science, Space,  
12          and Technology of the House of Representatives and  
13          the Committee on Energy and Natural Resources of  
14          the Senate.

15          “(c) PROGRAM IMPLEMENTATION.—In carrying out  
16          the research, development, demonstration, and commercial  
17          application aims of section, the Secretary shall—

18                 “(1) implement the recommendations set forth  
19                 in the strategic plan in subsection (b);

20                 “(2) coordinate across all relevant program of-  
21                 fices at the Department, including—

22                         “(A) the Office of Energy Efficiency and  
23                         Renewable Energy;

24                         “(B) the Office of Nuclear Energy; and

25                         “(C) the Office of Fossil Energy;

1           “(3) leverage existing programs and resources  
2 of the Department;

3           “(4) prioritize activities that accelerate the de-  
4 velopment of integrated electricity generation, stor-  
5 age, and distribution systems with net zero green-  
6 house gas emissions; and

7           “(5) comply with section 8 of the Grid Mod-  
8 ernization Research and Development Act of 2019.

9           “(d) HYBRID ENERGY SYSTEM DEFINED.—The term  
10 ‘hybrid energy system’ means a system composed of two  
11 or more co-located or jointly operated sub-systems of en-  
12 ergy generation, energy storage, or other energy tech-  
13 nologies.”.

14 **SEC. 6. GRID INTEGRATION RESEARCH AND DEVELOP-**  
15 **MENT.**

16           (a) INTEGRATING DISTRIBUTED ENERGY RE-  
17 SOURCES ONTO THE ELECTRIC GRID.—Section 925(a) of  
18 the Energy Policy Act of 2005 (42 U.S.C. 16215) is  
19 amended by—

20           (1) redesignating paragraphs (10) and (11) as  
21 paragraphs (12) and (13), respectively; and

22           (2) inserting after paragraph (9) the following:

23           “(10) the development of cost-effective tech-  
24 nologies that enable two-way information and power

1 flow between distributed energy resources and the  
2 electric grid;

3 “(11) the development of technologies and con-  
4 cepts that enable interoperability between distributed  
5 energy resources and other behind-the-meter devices  
6 and the electric grid;”.

7 (b) INTEGRATING RENEWABLE ENERGY ONTO THE  
8 ELECTRIC GRID.—Subtitle C of title IX of the Energy  
9 Policy Act of 2005 (42 U.S.C. 16231 et seq.) is amended  
10 by adding at the end the following:

11 **“SEC. 936. RESEARCH AND DEVELOPMENT INTO INTE-**  
12 **GRATING RENEWABLE ENERGY ONTO THE**  
13 **ELECTRIC GRID.**

14 “(a) IN GENERAL.—Not later than 180 days after  
15 the enactment of the Grid Modernization Research and  
16 Development Act of 2019, the Secretary shall establish a  
17 research, development, and demonstration program on  
18 technologies that enable integration of renewable energy  
19 generation sources onto the electric grid across multiple  
20 program offices of the Department. The program shall in-  
21 clude—

22 “(1) forecasting for predicting generation from  
23 variable renewable energy sources;

24 “(2) development of cost-effective low-loss, long-  
25 distance transmission lines; and

1           “(3) development of cost-effective advanced  
2 technologies for variable renewable generation  
3 sources to provide grid services.

4           “(b) COORDINATION.—In carrying out this program,  
5 the Secretary shall—

6           “(1) coordinate across all relevant program of-  
7 fices at the Department to achieve the goals estab-  
8 lished in this section, including the Office of Elec-  
9 tricity; and

10           “(2) comply with section 8 of the Grid Mod-  
11 ernization Research and Development Act of 2019.

12           “(c) ADOPTION OF TECHNOLOGIES.—In carrying out  
13 this section, the Secretary shall consider barriers to adop-  
14 tion and commercial application of technologies that en-  
15 able integration of renewable energy sources onto the elec-  
16 tric grid, including cost and other economic barriers, and  
17 shall coordinate with relevant entities to reduce these bar-  
18 riers.”.

19           “(c) INTEGRATING ELECTRIC VEHICLES ONTO THE  
20 ELECTRIC GRID.—Subtitle B of title I of the Energy Inde-  
21 pendence and Security Act of 2007 (42 U.S.C. 17011 et  
22 seq.) is amended by adding at the end the following:

1 **“SEC. 137. RESEARCH AND DEVELOPMENT INTO INTE-**  
2 **GRATING ELECTRIC VEHICLES ONTO THE**  
3 **ELECTRIC GRID.**

4 “(a) IN GENERAL.—The Secretary shall establish a  
5 research, development, and demonstration program to ad-  
6 vance the integration of electric vehicles, including plug-  
7 in hybrid electric vehicles, onto the electric grid.

8 “(b) VEHICLES-TO-GRID INTEGRATION ASSESSMENT  
9 REPORT.—Not later than 1 year after the enactment of  
10 the Grid Modernization Research and Development Act of  
11 2019, the Secretary shall submit to the Committee on  
12 Science, Space, and Technology of the House of Rep-  
13 resentatives and the Committee on Energy and Natural  
14 Resources of the Senate a report on the results of a study  
15 that examines the research, development, and demonstra-  
16 tion opportunities, challenges, and standards needed for  
17 integrating electric vehicles onto the electric grid.

18 “(1) REPORT REQUIREMENTS.—The report  
19 shall include—

20 “(A) an evaluation of the use of electric ve-  
21 hicles to maintain the reliability of the electric  
22 grid, including—

23 “(i) the use of electric vehicles for de-  
24 mand response, load shaping, emergency  
25 power, and frequency regulation; and

1                   “(ii) the potential for the reuse of  
2                   spent electric vehicle batteries for sta-  
3                   tionary grid storage;

4                   “(B) the impact of grid integration on  
5                   electric vehicles, including—

6                   “(i) the impact of bi-directional elec-  
7                   tricity flow on battery degradation; and

8                   “(ii) the implications of the use of  
9                   electric vehicles for grid services on origi-  
10                  nal equipment manufacturer warranties;

11                  “(C) the impacts to the electric grid of in-  
12                  creased penetration of electric vehicles, includ-  
13                  ing—

14                  “(i) the distribution grid infrastruc-  
15                  ture needed to support an increase in  
16                  charging capacity;

17                  “(ii) strategies for integrating electric  
18                  vehicles onto the distribution grid while  
19                  limiting infrastructure upgrades;

20                  “(iii) the changes in electricity de-  
21                  mand over a 24-hour cycle due to electric  
22                  vehicle charging behavior;

23                  “(iv) the load increases expected from  
24                  electrifying the transportation sector;

1                   “(v) the potential for customer incen-  
2                   tives and other managed charging stations  
3                   strategies to shift charging off-peak;

4                   “(vi) the technology needed to achieve  
5                   bi-directional power flow on the distribu-  
6                   tion grid; and

7                   “(vii) the implementation of smart  
8                   charging techniques;

9                   “(D) research on the standards needed to  
10                  integrate electric vehicles with the grid, includ-  
11                  ing communications systems, protocols, and  
12                  charging stations, in collaboration with the Na-  
13                  tional Institute for Standards and Technology;

14                  “(E) the cybersecurity challenges and  
15                  needs associated with electrifying the transpor-  
16                  tation sector; and

17                  “(F) an assessment of the feasibility of  
18                  adopting technologies developed under the pro-  
19                  gram established under subsection (a) at De-  
20                  partment facilities.

21                  “(2) RECOMMENDATIONS.—As part of the Ve-  
22                  hicles-to-Grid Integration Assessment Report, the  
23                  Secretary shall develop a 10-year roadmap to guide  
24                  the research, development, and demonstration pro-

1       gram to integrate electric vehicles onto the electric  
2       grid.

3           “(3) CONSULTATION.—In developing this re-  
4       port, the Secretary shall consult with relevant stake-  
5       holders, including—

6           “(A) electric vehicle manufacturers;

7           “(B) electric utilities;

8           “(C) public utility commissions;

9           “(D) vehicle battery manufacturers;

10          “(E) electric vehicle supply equipment  
11       manufacturers;

12          “(F) charging infrastructure manufactur-  
13       ers;

14          “(G) the National Laboratories; and

15          “(H) other Federal agencies, as the Sec-  
16       retary determines appropriate.

17          “(4) UPDATES.—The Secretary shall update  
18       the report required under this section every 3 years  
19       for the duration of the program under section (a)  
20       and shall submit the updated report to the Com-  
21       mittee on Science, Space, and Technology of the  
22       House of Representatives and the Committee on En-  
23       ergy and Natural Resources of the Senate.

1       “(c) PROGRAM IMPLEMENTATION.—In carrying out  
2 the research, development, demonstration, and commercial  
3 application aims of section, the Secretary shall—

4               “(1) implement the recommendations set forth  
5 in the report in subsection (b);

6               “(2) coordinate across all relevant program of-  
7 fices at the Department to achieve the goals estab-  
8 lished in this section, including the Office of Elec-  
9 tricity; and

10              “(3) comply with section 8 of the Grid Mod-  
11 ernization Research and Development Act of 2019.

12       “(d) TESTING CAPABILITIES.—The Secretary shall  
13 coordinate with the National Laboratories to develop test-  
14 ing capabilities for the evaluation, rapid prototyping, and  
15 optimization of technologies enabling integration of elec-  
16 tric vehicles onto the electric grid.”.

17       (d) RESEARCH AND DEVELOPMENT ON INTEGRATING  
18 BUILDINGS ONTO THE ELECTRIC GRID.—Subtitle B of  
19 title IV of the Energy Independence and Security Act of  
20 2007 (42 U.S.C. 17081 et seq.) is amended by adding at  
21 the end the following:

22       **“SEC. 426. ADVANCED INTEGRATION OF BUILDINGS ONTO**  
23               **THE ELECTRIC GRID.**

24              “(a) IN GENERAL.—The Secretary shall establish a  
25 program of research, development, and demonstration to

1 enable components of commercial and residential buildings  
2 to serve as dynamic energy loads on and resources for the  
3 electric grid. The program shall focus on—

4           “(1) developing low-cost, low power, wireless  
5 sensors to—

6                   “(A) monitor building energy load;

7                   “(B) forecast building energy need; and

8                   “(C) enable building-level energy control;

9           “(2) developing data management capabilities  
10 and standard communication protocols to further  
11 interoperability at the building and grid-level;

12           “(3) developing advanced building-level energy  
13 management of components through integration of  
14 smart technologies, control systems, and data proc-  
15 essing, to enable energy efficiency and savings;

16           “(4) optimizing energy consumption at the  
17 building level to enable grid stability and resilience;

18           “(5) improving visualization of behind the  
19 meter equipment and technologies to provide better  
20 insight into the energy needs and energy forecasts of  
21 individual buildings;

22           “(6) reducing the cost of key components to ac-  
23 celerate the adoption of smart building technologies;

1           “(7) protecting against cybersecurity threats  
2           and addressing security vulnerabilities of building  
3           systems or equipment; and

4           “(8) other areas determined appropriate by the  
5           Secretary.

6           “(b) CONSIDERATIONS.—In carrying out the pro-  
7           gram under subsection (a), the Secretary shall—

8           “(1) work with utility partners, building own-  
9           ers, technology vendors, and building developers to  
10          test and validate technologies and encourage the  
11          commercial application of these technologies by  
12          building owners; and

13          “(2) consider the specific challenges of enabling  
14          greater interaction between components of—

15                 “(A) small- and medium-sized buildings  
16                 and the electric grid; and

17                 “(B) residential and commercial buildings  
18                 and the electric grid.

19          “(c) BUILDINGS-TO-GRID INTEGRATION REPORT.—

20          Not later than one year after the enactment of the Grid  
21          Modernization Research and Development Act of 2019,  
22          the Secretary shall submit to the Committee on Science,  
23          Space, and Technology of the House of Representatives  
24          and the Committee on Energy and Natural Resources of  
25          the Senate a report on the results of a study that examines

1 the research, development, and demonstration opportuni-  
2 ties, challenges, and standards needed to enable compo-  
3 nents of commercial and residential buildings to serve as  
4 dynamic energy loads on and resources for the electric  
5 grid.

6           “(1) REPORT REQUIREMENTS.—The report  
7 shall include—

8                   “(A) an assessment of the technologies  
9 needed to enable building components as dy-  
10 namic loads on and resources for the electric  
11 grid, including how such technologies can be—

12                           “(i) incorporated into new commercial  
13 and residential buildings; and

14                           “(ii) retrofitted in older buildings;

15                   “(B) guidelines for the design of new  
16 buildings and building components to enable  
17 modern grid interactivity and improve energy  
18 efficiency;

19                   “(C) an assessment of barriers to the  
20 adoption by building owners of advanced tech-  
21 nologies enabling greater integration of building  
22 components onto the electric grid; and

23                   “(D) an assessment of the feasibility of  
24 adopting technologies developed under the pro-

1           gram established under subsection (a) at De-  
2           partment facilities.

3           “(2) RECOMMENDATIONS.—As part of the re-  
4           port, the Secretary shall develop a 10-year roadmap  
5           to guide the research, development, and demonstra-  
6           tion program to enable components of commercial  
7           and residential buildings to serve as dynamic energy  
8           loads on and resources for the electric grid.

9           “(3) UPDATES.—The Secretary shall update  
10          the report required under this section every 3 years  
11          for the duration of the program under subsection (a)  
12          and shall submit the updated report to the Com-  
13          mittee on Science, Space, and Technology of the  
14          House of Representatives and the Committee on En-  
15          ergy and Natural Resources of the Senate.

16          “(d) PROGRAM IMPLEMENTATION.—In carrying out  
17          this section, the Secretary shall—

18                 “(1) implement the recommendations from the  
19                 report in subsection (c);

20                 “(2) coordinate across all relevant program of-  
21                 fices at the Department to achieve the goals estab-  
22                 lished in this section, including the Office of Elec-  
23                 tricity; and

24                 “(3) comply with section 8 of the Grid Mod-  
25                 ernization Research and Development Act of 2019.”.

1 **SEC. 7. INDUSTRY ALLIANCE.**

2 Title XIII of the Energy Independence and Security  
3 Act of 2007 (42 U.S.C. 17381 et. seq.), as amended, is  
4 amended by adding at the end the following:

5 **“SEC. 1312. INDUSTRY ALLIANCE.**

6 “(a) IN GENERAL.—Not later than 180 days after  
7 the enactment of the Grid Modernization Research and  
8 Development Act of 2019, the Secretary shall establish an  
9 advisory committee (to be known as the ‘Industry Alli-  
10 ance’) to advise the Secretary on the authorization of re-  
11 search, development, and demonstration projects under  
12 sections 1304 and 1304a.

13 “(b) MEMBERSHIP.—The Industry Alliance shall be  
14 composed of members selected by the Secretary that, as  
15 a group, are broadly representative of United States elec-  
16 tric grid research, development, infrastructure, operations,  
17 and manufacturing expertise.

18 “(c) RESPONSIBILITY.—The Secretary shall annually  
19 solicit from the Industry Alliance—

20 “(1) comments to identify grid modernization  
21 technology needs;

22 “(2) an assessment of the progress of the re-  
23 search activities on grid modernization; and

24 “(3) assistance in annually updating grid mod-  
25 ernization technology roadmaps.”.

1 **SEC. 8. COORDINATION OF EFFORTS.**

2 In carrying out the amendments made by this Act,  
3 the Secretary shall coordinate with relevant entities to the  
4 maximum extent practicable, including—

5 (1) electric utilities;

6 (2) private sector entities;

7 (3) representatives of all sectors of the electric  
8 power industry;

9 (4) transmission organizations;

10 (5) transmission owners and operators;

11 (6) distribution organizations;

12 (7) distribution asset owners and operators;

13 (8) State and local governments and regulatory  
14 authorities;

15 (9) academic institutions;

16 (10) the National Laboratories;

17 (11) other Federal agencies;

18 (12) nonprofit organizations;

19 (13) the Federal Energy Regulatory Commis-  
20 sion;

21 (14) the North American Reliability Corpora-  
22 tion;

23 (15) independent system operators; and

24 (16) programs and program offices at the De-  
25 partment.

1 **SEC. 9. DEFINITIONS.**

2 Title XIII of the Energy Independence and Security  
3 Act of 2007 (42 U.S.C. 17381 et. seq.), as amended, is  
4 amended by adding at the end the following:

5 **“SEC. 1313. DEFINITIONS.**

6 “In this title, the following definitions apply:

7 “(1) CRITICAL FACILITY.—The term ‘critical  
8 facility’ means a manmade structure that the Sec-  
9 retary determines vital to socioeconomic activities  
10 such that, if destroyed or damaged, such destruction  
11 or damage could cause substantial disruption to  
12 such socioeconomic activities.

13 “(2) DISTRIBUTION AUTOMATION.—The term  
14 ‘distribution automation’ means systems and tech-  
15 nologies that exert intelligent control over electrical  
16 grid functions at the distribution level.

17 “(3) RESILIENCE.—The term ‘resilience’ means  
18 the ability to withstand and reduce the magnitude or  
19 duration of disruptive events, which includes the ca-  
20 pability to anticipate, absorb, adapt to, or rapidly re-  
21 cover from such an event, including from deliberate  
22 attacks, accidents, and naturally occurring threats  
23 or incidents.”.

24 **SEC. 10. TECHNICAL AMENDMENTS; AUTHORIZATION OF**  
25 **APPROPRIATIONS.**

26 (a) TECHNICAL AMENDMENTS.—

1           (1) ENERGY INDEPENDENCE AND SECURITY  
2           ACT OF 2007.—Section 1(b) of the Energy Independ-  
3           ence and Security Act of 2007 is amended in the  
4           table of contents—

5                   (A) by inserting the following after the  
6           item related to section 136:

“Sec. 137. Research and development into integrating electric vehicles onto the electric grid.”.

7                   (B) by inserting the following after the  
8           item related to section 425:

“Sec. 426. Advanced integration of buildings onto the electric grid.”.

9                   (C) by inserting the following after the  
10          item related to section 1304:

“Sec. 1304a. Smart grid modeling, visualization, architecture, and controls.”;  
and

11                  (D) by inserting the following after the  
12          item related to section 1309:

“Sec. 1310. Grid resilience and emergency response.

“Sec. 1311. Hybrid energy systems.

“Sec. 1312. Industry Alliance.

“Sec. 1313. Definitions.”.

13           (2) ENERGY POLICY ACT OF 2005.—Section 1(b)  
14           of the Energy Policy Act of 2005 is amended in the  
15           table of contents by inserting the following after the  
16           item related to section 935:

“Sec. 936. Research and development into integrating renewable energy onto the electric grid.”.

17           (b) AUTHORIZATION OF APPROPRIATIONS.—There  
18           are authorized to be appropriated—

1           (1) to carry out sections 7 and 8 and the  
2 amendments made by sections 2 and 3 of this Act—

3                   (A) \$170,000,000 for fiscal year 2020;

4                   (B) \$175,000,000 for fiscal year 2021;

5                   (C) \$180,000,000 for fiscal year 2022;

6                   (D) \$185,000,000 for fiscal year 2023;

7           and

8                   (E) \$190,000,000 for fiscal year 2024;

9           (2) to carry out section 5 of this Act—

10                   (A) \$20,000,000 for fiscal year 2020;

11                   (B) \$21,000,000 for fiscal year 2021;

12                   (C) \$22,050,000 for fiscal year 2022;

13                   (D) \$23,153,000 for fiscal year 2023; and

14                   (E) \$24,310,000 for fiscal year 2024; and

15           (3) to carry out section 6 of this Act—

16                   (A) \$50,000,000 for fiscal year 2020;

17                   (B) \$52,500,000 for fiscal year 2021;

18                   (C) \$55,152,000 for fiscal year 2022;

19                   (D) \$57,882,000 for fiscal year 2023; and

20                   (E) \$60,775,000 for fiscal year 2024.

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