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H. R. 5428

[Report No. 116-]

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.

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

MARCH --, 2020

Reported with an amendment, committed to the Committee of the Whole House on the State of the Union, and ordered to be printed

[Strike out all after the enacting clause and insert the part printed in *italie*]

[For text of introduced bill, see copy of bill as introduced on December 13, 2019]

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 *2020”.*

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.

9 **SEC. 2. SMART GRID REGIONAL DEMONSTRATION INITIA-**
10 **TIVE.**

11 *Section 1304 of the Energy Independence and Security*
12 *Act of 2007 (42 U.S.C. 17384) is amended—*

13 (1) *in subsection (a), by inserting “research, de-*
14 *velopment, and demonstration” before “program”;*

15 (2) *in subsection (b)—*

16 (A) *by amending paragraph (1) to read as*
17 *follows:*

18 “(1) *IN GENERAL.*—*The Secretary shall establish*
19 *a smart grid regional demonstration initiative (re-*
20 *ferred to in this subsection as the ‘Initiative’) com-*

1 *posed of demonstration projects focused on cost-effec-*
2 *tive, advanced technologies for use in power grid sens-*
3 *ing, communications, analysis, power flow control,*
4 *visualization, distribution automation, industrial*
5 *control systems, dynamic line rating systems, grid re-*
6 *design, and the integration of distributed energy re-*
7 *sources.”; and*

8 *(B) in paragraph (2)—*

9 *(i) in subparagraph (D), by striking*
10 *“and” at the end;*

11 *(ii) in subparagraph (E), by striking*
12 *the period and inserting “; and”; and*

13 *(iii) by inserting at the end the fol-*
14 *lowing:*

15 *“(F) to encourage the commercial applica-*
16 *tion of advanced distribution automation tech-*
17 *nologies that improve system resilience.”.*

18 **SEC. 3. SMART GRID MODELING, VISUALIZATION, ARCHI-**
19 **TECTURE, AND CONTROLS.**

20 *Title XIII of the Energy Independence and Security*
21 *Act of 2007 (42 U.S.C. 17381 et seq.) is amended by insert-*
22 *ing after section 1304 the following:*

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

3 *“(a) IN GENERAL.—Not later than 180 days after the*
4 *enactment of the Grid Modernization Research and Devel-*
5 *opment Act of 2020, the Secretary shall establish a program*
6 *of research, development, demonstration, and commercial*
7 *application on electric grid modeling, sensing, visualiza-*
8 *tion, architecture development, and advanced operation and*
9 *controls.*

10 *“(b) MODELING RESEARCH AND DEVELOPMENT.—The*
11 *Secretary shall support development of models of emerging*
12 *technologies and systems to facilitate the secure and reliable*
13 *design, planning, and operation of the electric grid for use*
14 *by industry stakeholders. In particular, the Secretary shall*
15 *support development of—*

16 *“(1) models to analyze and predict the effects of*
17 *adverse physical and cyber events on the electric grid;*

18 *“(2) coupled models of electrical, physical, and*
19 *cyber systems;*

20 *“(3) models of existing and emerging technologies*
21 *being deployed on the electric grid due to projected*
22 *changes in the electric generation mix and loads, for*
23 *a variety of regional characteristics; and*

24 *“(4) integrated models of the communications,*
25 *transmission, distribution, and other interdependent*
26 *systems for existing, new, and emerging technologies.*

1 “(c) *SITUATIONAL AWARENESS RESEARCH AND DE-*
2 *VELOPMENT.*—

3 “(1) *IN GENERAL.*—*The Secretary shall support*
4 *development of computational tools and technologies*
5 *to improve sensing, monitoring, and visualization of*
6 *the electric grid for real-time situational awareness*
7 *and decision support tools that enable improved oper-*
8 *ation of the power system, including utility, non-util-*
9 *ity, and customer grid-connected assets, for use by in-*
10 *dustry partners.*

11 “(2) *DATA USE.*—*In developing visualization ca-*
12 *pabilities under this section, the Secretary shall de-*
13 *velop tools for industry stakeholders to use to analyze*
14 *data collected from advanced measurement and moni-*
15 *toring technologies, including data from phasor meas-*
16 *urement units and advanced metering units.*

17 “(3) *SEVERE EVENTS.*—*The Secretary shall*
18 *prioritize enhancing cyber and physical situational*
19 *awareness of the electric grid during adverse man-*
20 *made and naturally-occurring events.*

21 “(d) *ARCHITECTURE.*—*The Secretary shall conduct re-*
22 *search in collaboration with industry stakeholders to de-*
23 *velop model grid architectures to assist with wide-area*
24 *transmission and distribution planning that incorporate*
25 *expected changes to the modern electric grid. In supporting*

1 *the development of model grid architectures, the Secretary*
2 *shall—*

3 “(1) *analyze a variety of grid architecture sce-*
4 *narios that range from minor upgrades to existing*
5 *transmission grid infrastructure to scenarios that in-*
6 *volve the replacement of significant portions of exist-*
7 *ing transmission grid infrastructure;*

8 “(2) *analyze the effects of the increasing pro-*
9 *liferation of renewable and other zero emissions en-*
10 *ergy generation sources, increasing use of distributed*
11 *resources owned by non-utility entities, and the use of*
12 *digital and automated controls not managed by grid*
13 *operators;*

14 “(3) *include a variety of new and emerging dis-*
15 *tribution grid technologies, including distributed en-*
16 *ergy resources, electric vehicle charging stations, dis-*
17 *tribution automation technologies, energy storage, and*
18 *renewable energy sources;*

19 “(4) *analyze the effects of local load balancing*
20 *and other forms of decentralized control;*

21 “(5) *analyze the effects of changes to grid archi-*
22 *tectures resulting from modernizing electric grid sys-*
23 *tems, including communications, controls, markets,*
24 *consumer choice, emergency response, electrification,*
25 *and cybersecurity concerns; and*

1 “(6) *develop integrated grid architectures that*
2 *incorporate system resilience for cyber, physical, and*
3 *communications systems.*

4 “(e) *OPERATION AND CONTROLS RESEARCH AND DE-*
5 *VELOPMENT.—The Secretary shall conduct research to de-*
6 *velop improvements to the operation and controls of the*
7 *electric grid, in coordination with industry partners. Such*
8 *activities shall include—*

9 “(1) *a training facility or facilities to allow grid*
10 *operators to gain operational experience with ad-*
11 *vanced grid control concepts and technologies;*

12 “(2) *development of cost-effective advanced oper-*
13 *ation and control concepts and technologies, such as*
14 *adaptive islanding, dynamic line rating systems,*
15 *power flow controllers, network topology optimization,*
16 *smart circuit breakers, intelligent load shedding, and*
17 *fault-tolerant control system architectures;*

18 “(3) *development of real-time control concepts*
19 *using artificial intelligence and machine learning for*
20 *improved electric grid resilience; and*

21 “(4) *utilization of advanced data analytics in-*
22 *cluding load forecasting, power flow modeling, equip-*
23 *ment failure prediction, resource optimization, risk*
24 *analysis, and decision analysis.*

1 “(f) *INTEROPERABILITY RESEARCH AND DEVELOP-*
2 *MENT.—The Secretary shall conduct research and develop-*
3 *ment on tools and technologies that improve the interoper-*
4 *ability and compatibility of new and emerging components,*
5 *technologies, and systems with existing electric grid infra-*
6 *structure.*

7 “(g) *COMPUTING RESOURCES AND DATA COORDINA-*
8 *TION RESEARCH AND DEVELOPMENT.—In carrying out this*
9 *section, the Secretary shall—*

10 “(1) *leverage existing computing resources at the*
11 *National Laboratories;*

12 “(2) *develop voluntary standards for data*
13 *taxonomies and communication protocols in coordi-*
14 *nation with public and private sector stakeholders;*
15 *and*

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

18 “(h) *INFORMATION SHARING.—None of the activities*
19 *authorized in this section shall require private entities to*
20 *share information or data with the Secretary.”.*

21 **SEC. 4. ENHANCING GRID RESILIENCE AND EMERGENCY**
22 **RESPONSE.**

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

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

2 “(a) *IN GENERAL.*—Not later than 180 days after the
3 enactment of the Grid Modernization Research and Devel-
4 opment Act of 2019, the Secretary shall establish a research,
5 development, and demonstration program to enhance resil-
6 ience and strengthen emergency response and management
7 pertaining to the electric grid.

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

12 “(1) *developing methods to improve community*
13 *and governmental preparation for and emergency re-*
14 *sponse to large-area, long-duration electricity inter-*
15 *ruptions, including through the use of energy effi-*
16 *ciency, storage, and distributed generation tech-*
17 *nologies;*

18 “(2) *developing tools to help utilities and com-*
19 *munities ensure the continuous delivery of electricity*
20 *to critical facilities;*

21 “(3) *developing tools to improve coordination be-*
22 *tween utilities and relevant Federal agencies to enable*
23 *communication, information-sharing, and situational*
24 *awareness in the event of a physical or cyber attack*
25 *on the electric grid;*

1 “(4) *developing technologies and capabilities to*
2 *withstand and address the current and projected im-*
3 *port of the changing climate on electric grid infra-*
4 *structure, including extreme weather events and other*
5 *natural disasters;*

6 “(5) *developing technologies capable of early de-*
7 *tection of deteriorating electrical equipment on the*
8 *transmission and distribution grid, including detec-*
9 *tion of spark ignition from wildfires and risks of*
10 *vegetation contact; and*

11 “(6) *assessing upgrades and additions needed to*
12 *electric grid infrastructure due to projected changes in*
13 *the electricity generation mix and electricity demand.*

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

16 “(1) *an institution of higher education;*

17 “(2) *a nonprofit organization;*

18 “(3) *a National Laboratory;*

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

20 “(5) *an electric utility or electric cooperative;*

21 “(6) *a retail service provider of electricity;*

22 “(7) *a private commercial entity; and*

23 “(8) *a partnership or consortium of 2 or more*
24 *entities described in subparagraphs (1) through (7).*

1 “(d) *RELEVANT ACTIVITIES.*—Grants awarded under
2 subsection (b) shall include funding for research and devel-
3 opment activities related to the purpose described in sub-
4 section (b), such as—

5 “(1) development of technologies to use distrib-
6 uted energy resources, such as solar photovoltaics, en-
7 ergy storage systems, electric vehicles, and microgrids
8 to improve grid and critical end-user resilience;

9 “(2) analysis of non-technical barriers to greater
10 integration and use of technologies on the distribution
11 grid;

12 “(3) analysis of past large-area, long-duration
13 electricity interruptions to identify common elements
14 and best practices for electricity restoration, mitiga-
15 tion, and prevention of future disruptions;

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

19 “(5) analysis of technologies, methods, and con-
20 cepts that can improve community resilience and sur-
21 vivability of frequent or long-duration power outages;

22 “(6) development of methodologies to maintain
23 cybersecurity during restoration of electric grid infra-
24 structure and operation;

1 “(7) *development of advanced power flow control*
2 *systems and components to improve electric grid resil-*
3 *ience; and*

4 “(8) *any other relevant activities determined by*
5 *the Secretary.*

6 “(e) *TECHNICAL ASSISTANCE.*—

7 “(1) *IN GENERAL.*—*The Secretary shall provide*
8 *technical assistance to eligible entities for the commer-*
9 *cial application of technologies to improve the resil-*
10 *ience of the electric grid and commercial application*
11 *of technologies to help entities develop plans for pre-*
12 *venting and recovering from various power outage*
13 *scenarios at the local, regional, and State level.*

14 “(2) *TECHNICAL ASSISTANCE PROGRAM.*—*The*
15 *technical assistance program established in paragraph*
16 *(1) shall include assistance to eligible entities for—*

17 “(A) *the commercial application of tech-*
18 *nologies developed from the grant program estab-*
19 *lished in subsection (b), including municipal*
20 *and cooperative utilities;*

21 “(B) *the development of methods to*
22 *strengthen or otherwise mitigate adverse impacts*
23 *on electric grid infrastructure against natural*
24 *hazards;*

1 “(C) *the use of Department data and mod-*
2 *eling tools for various purposes; and*

3 “(D) *a resource assessment and analysis of*
4 *future demand and distribution requirements,*
5 *including development of advanced grid architec-*
6 *tures and risk analysis.*

7 “(3) *ELIGIBLE ENTITIES.—The entities eligible*
8 *to receive technical assistance for commercial applica-*
9 *tion of technologies under this section include—*

10 “(A) *representatives of all sectors of the elec-*
11 *tric power industry, including electric utilities,*
12 *trade organizations, and transmission and dis-*
13 *tribution system organizations, owners, and op-*
14 *erators;*

15 “(B) *State and local governments and regu-*
16 *latory authorities, including public utility com-*
17 *missions;*

18 “(C) *tribal and Alaska Native governmental*
19 *entities;*

20 “(D) *partnerships among entities under*
21 *subparagraphs (A) through (C);*

22 “(E) *regional partnerships; and*

23 “(F) *any other entities the Secretary deems*
24 *appropriate.*

1 “(4) *AUTHORITY.*—*Nothing in this section shall*
2 *authorize the Secretary to require any entity to adopt*
3 *any model, tool, technology, plan, analysis, or assess-*
4 *ment.*

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

8 **SEC. 5. HYBRID ENERGY SYSTEMS.**

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

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

13 “(a) *IN GENERAL.*—*Not later than 180 days after the*
14 *enactment of the Grid Modernization Research and Devel-*
15 *opment Act of 2019, the Secretary shall establish a research,*
16 *development, and demonstration program to develop cost-*
17 *effective hybrid energy systems, including—*

18 “(1) *development of computer modeling to design*
19 *different configurations of hybrid energy systems and*
20 *to optimize system operation;*

21 “(2) *research on system integration needed to*
22 *plan, design, build, and operate hybrid energy sys-*
23 *tems, including interconnection requirements with the*
24 *electric grid;*

1 “(3) *development of hybrid energy systems for*
2 *various applications, including—*

3 “(A) *thermal energy generation and storage*
4 *for buildings and manufacturing;*

5 “(B) *electricity storage coupled with energy*
6 *generation;*

7 “(C) *desalination;*

8 “(D) *production of liquid and gaseous fuels;*
9 *and*

10 “(E) *production of chemicals such as am-*
11 *monia and ethylene;*

12 “(4) *development of testing facilities for hybrid*
13 *energy systems; and*

14 “(5) *research on incorporation of various tech-*
15 *nologies for hybrid energy systems, including nuclear*
16 *energy, renewable energy, storage, and carbon cap-*
17 *ture, utilization, and sequestration technologies.*

18 “(b) *STRATEGIC PLAN.—*

19 “(1) *IN GENERAL.—Not later than 1 year after*
20 *the date of the enactment of the Grid Modernization*
21 *Research and Development Act of 2019, the Secretary*
22 *shall submit to the Committee on Science, Space, and*
23 *Technology of the House of Representatives and the*
24 *Committee on Energy and Natural Resources of the*
25 *Senate a strategic plan that identifies opportunities,*

1 *challenges, and standards needed for the development*
2 *and commercial application of hybrid energy systems.*

3 *The strategic plan shall include—*

4 *“(A) analysis of the potential benefits of de-*
5 *velopment of hybrid electric systems on the elec-*
6 *tric grid;*

7 *“(B) analysis of the potential contributions*
8 *of hybrid energy systems to different grid archi-*
9 *tecture scenarios;*

10 *“(C) research and development goals for*
11 *various hybrid energy systems, including those*
12 *identified in subsection (b);*

13 *“(D) assessment of policy and market bar-*
14 *riers to the adoption of hybrid energy systems;*

15 *“(E) analysis of the technical and economic*
16 *feasibility of adoption of different hybrid energy*
17 *systems; and*

18 *“(F) a 10-year roadmap to guide the pro-*
19 *gram established under subsection (a).*

20 *“(2) UPDATES.—Not less than once every 3 years*
21 *for the duration of this research program, the Sec-*
22 *retary shall submit an updated version of the stra-*
23 *tegic plan to the Committee on Science, Space, and*
24 *Technology of the House of Representatives and the*

1 *Committee on Energy and Natural Resources of the*
2 *Senate.*

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

6 “(1) *implement the recommendations set forth in*
7 *the strategic plan in subsection (b);*

8 “(2) *coordinate across all relevant program of-*
9 *fices at the Department, including—*

10 “(A) *the Office of Energy Efficiency and*
11 *Renewable Energy;*

12 “(B) *the Office of Nuclear Energy; and*

13 “(C) *the Office of Fossil Energy;*

14 “(3) *leverage existing programs and resources of*
15 *the Department;*

16 “(4) *prioritize activities that accelerate the devel-*
17 *opment of integrated electricity generation, storage,*
18 *and distribution systems with net zero greenhouse gas*
19 *emissions; and*

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

22 “(d) *HYBRID ENERGY SYSTEM DEFINED.—The term*
23 *‘hybrid energy system’ means a system composed of 2 or*
24 *more co-located or jointly operated sub-systems of energy*
25 *generation, energy storage, or other energy technologies.”.*

1 **SEC. 6. GRID INTEGRATION RESEARCH AND DEVELOPMENT.**

2 (a) *INTEGRATING DISTRIBUTED ENERGY RESOURCES*

3 *ONTO THE ELECTRIC GRID.*—Section 925(a) of the Energy

4 *Policy Act of 2005 (42 U.S.C. 16215) is amended—*

5 (1) *by redesignating paragraphs (10) and (11)*

6 *as paragraphs (12) and (13), respectively; and*

7 (2) *by inserting after paragraph (9) the fol-*

8 *lowing:*

9 “(10) *the development of cost-effective tech-*
10 *nologies that enable two-way information and power*
11 *flow between distributed energy resources and the elec-*
12 *tric grid;*

13 “(11) *the development of technologies and con-*
14 *cepts that enable interoperability between distributed*
15 *energy resources and other behind-the-meter devices*
16 *and the electric grid;”.*

17 (b) *INTEGRATING RENEWABLE ENERGY ONTO THE*

18 *ELECTRIC GRID.*—Subtitle C of title IX of the Energy Pol-

19 *icy Act of 2005 (42 U.S.C. 16231 et seq.) is amended by*

20 *adding at the end the following:*

21 **“SEC. 936. RESEARCH AND DEVELOPMENT INTO INTE-**

22 **GRATING RENEWABLE ENERGY ONTO THE**

23 **ELECTRIC GRID.**

24 “(a) *IN GENERAL.*—Not later than 180 days after the

25 *enactment of the Grid Modernization Research and Devel-*

26 *opment Act of 2019, the Secretary shall establish a research,*

1 *development, and demonstration program on technologies*
2 *that enable integration of renewable energy generation*
3 *sources onto the electric grid across multiple program offices*
4 *of the Department. The program shall include—*

5 *“(1) forecasting for predicting generation from*
6 *variable renewable energy sources;*

7 *“(2) development of cost-effective low-loss, long-*
8 *distance transmission lines; and*

9 *“(3) development of cost-effective advanced tech-*
10 *nologies for variable renewable generation sources to*
11 *provide grid services.*

12 *“(b) COORDINATION.—In carrying out this program,*
13 *the Secretary shall—*

14 *“(1) coordinate across all relevant program of-*
15 *fices at the Department to achieve the goals estab-*
16 *lished in this section, including the Office of Elec-*
17 *tricity; and*

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

20 *“(c) ADOPTION OF TECHNOLOGIES.—In carrying out*
21 *this section, the Secretary shall consider barriers to adop-*
22 *tion and commercial application of technologies that enable*
23 *integration of renewable energy sources onto the electric*
24 *grid, including cost and other economic barriers, and shall*
25 *coordinate with relevant entities to reduce these barriers.”.*

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

5 **“SEC. 137. RESEARCH AND DEVELOPMENT INTO INTE-**
6 **GRATING ELECTRIC VEHICLES ONTO THE**
7 **ELECTRIC GRID.**

8 “(a) *IN GENERAL.*—*The Secretary shall establish a re-*
9 *search, development, and demonstration program to ad-*
10 *vance the integration of electric vehicles, including plug-in*
11 *hybrid electric vehicles, onto the electric grid.*

12 “(b) *VEHICLES-TO-GRID INTEGRATION ASSESSMENT*
13 *REPORT.*—*Not later than 1 year after the enactment of the*
14 *Grid Modernization Research and Development Act of 2019,*
15 *the Secretary shall submit to the Committee on Science,*
16 *Space, and Technology of the House of Representatives and*
17 *the Committee on Energy and Natural Resources of the Sen-*
18 *ate a report on the results of a study that examines the*
19 *research, development, and demonstration opportunities,*
20 *challenges, and standards needed for integrating electric ve-*
21 *hicles onto the electric grid.*

22 “(1) *REPORT REQUIREMENTS.*—*The report shall*
23 *include—*

1 “(A) an evaluation of the use of electric ve-
2 hicles to maintain the reliability of the electric
3 grid, including—

4 “(i) the use of electric vehicles for de-
5 mand response, load shaping, emergency
6 power, and frequency regulation; and

7 “(ii) the potential for the reuse of spent
8 electric vehicle batteries for stationary grid
9 storage;

10 “(B) the impact of grid integration on elec-
11 tric vehicles, including—

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

14 “(ii) the implications of the use of elec-
15 tric vehicles for grid services on original
16 equipment manufacturer warranties;

17 “(C) the impacts to the electric grid of in-
18 creased penetration of electric vehicles, includ-
19 ing—

20 “(i) the distribution grid infrastruc-
21 ture needed to support an increase in charg-
22 ing capacity;

23 “(ii) strategies for integrating electric
24 vehicles onto the distribution grid while
25 limiting infrastructure upgrades;

1 “(iii) the changes in electricity demand
2 over a 24-hour cycle due to electric vehicle
3 charging behavior;

4 “(iv) the load increases expected from
5 electrifying the transportation sector;

6 “(v) the potential for customer incen-
7 tives and other managed charging stations
8 strategies to shift charging off-peak;

9 “(vi) the technology needed to achieve
10 bi-directional power flow on the distribution
11 grid; and

12 “(vii) the implementation of smart
13 charging techniques;

14 “(D) research on the standards needed to
15 integrate electric vehicles with the grid, includ-
16 ing communications systems, protocols, and
17 charging stations, in collaboration with the Na-
18 tional Institute for Standards and Technology;

19 “(E) the cybersecurity challenges and needs
20 associated with electrifying the transportation
21 sector; and

22 “(F) an assessment of the feasibility of
23 adopting technologies developed under the pro-
24 gram established under subsection (a) at Depart-
25 ment facilities.

1 “(2) *RECOMMENDATIONS.*—As part of the *Vehi-*
2 *cles-to-Grid Integration Assessment Report*, the *Sec-*
3 *retary shall develop a 10-year roadmap to guide the*
4 *research, development, and demonstration program to*
5 *integrate electric vehicles onto the electric grid.*

6 “(3) *CONSULTATION.*—In developing this report,
7 *the Secretary shall consult with relevant stakeholders,*
8 *including—*

9 “(A) *electric vehicle manufacturers;*

10 “(B) *electric utilities;*

11 “(C) *public utility commissions;*

12 “(D) *vehicle battery manufacturers;*

13 “(E) *electric vehicle supply equipment man-*
14 *ufacturers;*

15 “(F) *charging infrastructure manufacturers;*

16 “(G) *the National Laboratories; and*

17 “(H) *other Federal agencies, as the Sec-*
18 *retary determines appropriate.*

19 “(4) *UPDATES.*—The Secretary shall update the
20 *report required under this section every 3 years for*
21 *the duration of the program under section (a) and*
22 *shall submit the updated report to the Committee on*
23 *Science, Space, and Technology of the House of Rep-*
24 *resentatives and the Committee on Energy and Nat-*
25 *ural 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 in*
5 *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 co-*
13 *ordinate with the National Laboratories to develop testing*
14 *capabilities for the evaluation, rapid prototyping, and opti-*
15 *mization of technologies enabling integration of electric ve-*
16 *hicles onto the electric grid.”.*

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

1 *able components of commercial and residential buildings to*
2 *serve as dynamic energy loads on and resources for the elec-*
3 *tric grid. The program shall focus on—*

4 *“(1) developing low-cost, low power, wireless sen-*
5 *sors 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 meter*
19 *equipment and technologies to provide better insight*
20 *into the energy needs and energy forecasts of indi-*
21 *vidual 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 and*
2 *addressing security vulnerabilities of building systems*
3 *or equipment; and*

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

6 “(b) *CONSIDERATIONS.—In carrying out the program*
7 *under subsection (a), the Secretary shall—*

8 “(1) *work with utility partners, building owners,*
9 *technology vendors, and building developers to test*
10 *and validate technologies and encourage the commer-*
11 *cial application of these technologies by building own-*
12 *ers; 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.—Not*
20 *later than one year after the enactment of the Grid Mod-*
21 *ernization Research and Development Act of 2019, the Sec-*
22 *retary shall submit to the Committee on Science, Space, and*
23 *Technology of the House of Representatives and the Com-*
24 *mittee on Energy and Natural Resources of the Senate a*
25 *report on the results of a study that examines the research,*

1 *development, and demonstration opportunities, challenges,*
2 *and standards needed to enable components of commercial*
3 *and residential buildings to serve as dynamic energy loads*
4 *on and resources for the electric grid.*

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

7 “(A) *an assessment of the technologies need-*
8 *ed to enable building components as dynamic*
9 *loads on and resources for the electric grid, in-*
10 *cluding how such technologies can be—*

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

13 “(ii) *retrofitted in older buildings;*

14 “(B) *guidelines for the design of new build-*
15 *ings and building components to enable modern*
16 *grid interactivity and improve energy efficiency;*

17 “(C) *an assessment of barriers to the adop-*
18 *tion by building owners of advanced technologies*
19 *enabling greater integration of building compo-*
20 *nents onto the electric grid; and*

21 “(D) *an assessment of the feasibility of*
22 *adopting technologies developed under the pro-*
23 *gram established under subsection (a) at Depart-*
24 *ment facilities.*

1 “(2) *RECOMMENDATIONS.*—As part of the report,
2 the Secretary shall develop a 10-year roadmap to
3 guide the research, development, and demonstration
4 program to enable components of commercial and res-
5 idential buildings to serve as dynamic energy loads
6 on and resources for the electric grid.

7 “(3) *UPDATES.*—The Secretary shall update the
8 report required under this section every 3 years for
9 the duration of the program under subsection (a) and
10 shall submit the updated report to the Committee on
11 Science, Space, and Technology of the House of Rep-
12 resentatives and the Committee on Energy and Nat-
13 ural Resources of the Senate.

14 “(d) *PROGRAM IMPLEMENTATION.*—In carrying out
15 this section, the Secretary shall—

16 “(1) implement the recommendations from the
17 report in subsection (c);

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

22 “(3) comply with section 8 of the Grid Mod-
23 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 the*
7 *enactment of the Grid Modernization Research and Devel-*
8 *opment Act of 2019, the Secretary shall establish an advi-*
9 *sory committee (to be known as the ‘Industry Alliance’) to*
10 *advise the Secretary on the authorization of research, devel-*
11 *opment, and demonstration projects under sections 1304*
12 *and 1304a.*

13 *“(b) MEMBERSHIP.—The Industry Alliance shall be*
14 *composed of members selected by the Secretary that, as a*
15 *group, are broadly representative of United States electric*
16 *grid research, development, infrastructure, operations, and*
17 *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 research*
23 *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, the*
3 *Secretary shall coordinate with relevant entities to the max-*
4 *imum 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 Commission;*

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

22 *(15) independent system operators; and*

23 *(16) programs and program offices at the De-*
24 *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 fa-*
8 *cility’ means a manmade structure that the Secretary*
9 *determines vital to socioeconomic activities such that,*
10 *if destroyed or damaged, such destruction or damage*
11 *could cause substantial disruption to such socio-*
12 *economic 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 or*
23 *incidents.”.*

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

26 *(a) TECHNICAL AMENDMENTS.—*

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

5 (A) *by inserting the following after the item*
6 *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 item*
8 *related to section 425:*

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

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

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

11 (D) *by inserting the following after the item*
12 *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 are*
18 *authorized to be appropriated—*

1 (1) *to carry out sections 7 and 8 and the amend-*
2 *ments 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; and*

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

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

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

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

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

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

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

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

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

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

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

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

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