COMMITTEE PRINT

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SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the ''Grid Modernization Research and Development Act of 2019''.

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

SEC. 2. SMART GRID REGIONAL DEMONSTRATION INITIATIVE.

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

(1) in subsection (a), by inserting ''research, development, and demonstration'' before ''program'';

(2) in subsection (b)—

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

''(1) The Secretary shall establish a smart grid regional demonstration initiative (referred to in this subsection as the 'Initiative') composed of demonstration projects focused on cost-effective, advanced technologies for use in power grid sensing, communications, analysis, power flow control, visualization, distribution automation, industrial control systems, dynamic line rating systems, grid redesign, and the integration of distributed energy resources.''; and

(B) in paragraph (2)—

(i) in subparagraph (D), by striking ''and'';

(ii) in subparagraph (E), by striking the period and inserting ''; and''; and

(iii) by inserting at the end the following:

''(F) to encourage the commercial application of advanced distribution automation technologies that improve system resilience.''.

SEC. 3. SMART GRID MODELING, VISUALIZATION, ARCHITECTURE, AND CONTROLS.

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

"SEC. 1304a. SMART GRID MODELING, VISUALIZATION, ARCHITECTURE, AND CONTROLS.

"(a) IN GENERAL.—Not later than 180 days after the enactment of the Grid Modernization Research and Development Act of 2019, the Secretary shall establish a program of research, development, demonstration, and commercial application on electric grid modeling, sensing, visualization, architecture development, and advanced operation and controls.

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

"(1) models to analyze and predict the effects of adverse physical and cyber events on the electric grid;

"(2) coupled models of electrical, physical, and cyber systems;

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

"(4) integrated models of the communications, transmission, distribution, and other interdependent

systems for existing, new, and emerging technologies.

''(c) SITUATIONAL AWARENESS RESEARCH AND DEVELOPMENT.—

''(1) IN GENERAL.—The Secretary shall support development of computational tools and technologies to improve sensing, monitoring, and visualization of the electric grid for real-time situational awareness and decision support tools that enable improved operation of the power system, including utility, non-utility, and customer grid-connected assets, for use by industry partners.

''(2) DATA USE.—In developing visualization capabilities under this section, the Secretary shall develop tools for industry stakeholders to use to analyze data collected from advanced measurement and monitoring technologies, including data from phasor measurement units and advanced metering units.

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

''(d) ARCHITECTURE.—The Secretary shall conduct research in collaboration with industry stakeholders to develop model grid architectures to assist with wide-area

transmission and distribution planning that incorporate expected changes to the modern electric grid. In supporting the development of model grid architectures, the Secretary shall—

''(1) analyze a variety of grid architecture scenarios that range from minor upgrades to existing transmission grid infrastructure to scenarios that involve the replacement of significant portions of existing transmission grid infrastructure;

''(2) analyze the effects of the increasing proliferation of renewable and other zero emissions energy generation sources, increasing use of distributed resources owned by non-utility entities, and the use of digital and automated controls not managed by grid operators;

''(3) include a variety of new and emerging distribution grid technologies, including distributed energy resources, electric vehicle charging stations, distribution automation technologies, energy storage, and renewable energy sources;

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

''(5) analyze the effects of changes to grid architectures resulting from modernizing electric grid systems, including communications, controls, mar-

kets, consumer choice, emergency response, electrification, and cybersecurity concerns; and

''(6) develop integrated grid architectures that incorporate system resilience for cyber, physical, and communications systems.

''(e) OPERATION AND CONTROLS RESEARCH AND DEVELOPMENT.—The Secretary shall conduct research to develop improvements to the operation and controls of the electric grid, in coordination with industry partners. Such activities shall include—

''(1) a training facility or facilities to allow grid operators to gain operational experience with advanced grid control concepts and technologies;

''(2) development of cost-effective advanced operation and control concepts and technologies, such as adaptive islanding, dynamic line rating systems, power flow controllers, network topology optimization, smart circuit breakers, intelligent load shedding, and fault-tolerant control system architectures;

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

''(4) utilization of advanced data analytics including load forecasting, power flow modeling, equip-

ment failure prediction, resource optimization, risk analysis, and decision analysis.

''(f) COMPUTING RESOURCES AND DATA COORDINATION RESEARCH AND DEVELOPMENT.—In carrying out this section, the Secretary shall—

''(1) leverage existing computing resources at the National Laboratories;

''(2) develop voluntary standards for data taxonomies and communication protocols in coordination with public and private sector stakeholders; and

''(3) comply with section 8 of the Grid Modernization Research and Development Act of 2019.

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

SEC. 4. ENHANCING GRID RESILIENCE AND EMERGENCY RESPONSE.

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

''SEC. 1310. GRID RESILIENCE AND EMERGENCY RESPONSE.

''(a) IN GENERAL.—Not later than 180 days after the enactment of the Grid Modernization Research and Development Act of 2019, the Secretary shall establish a

research, development, and demonstration program to enhance resilience and strengthen emergency response and management pertaining to the electric grid.

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

''(1) developing methods to improve community and governmental preparation for and emergency response to large-area, long-duration electricity interruptions, including through the use of energy efficiency, storage, and distributed generation technologies;

''(2) developing tools to help utilities and communities ensure the continuous delivery of electricity to critical facilities;

''(3) developing tools to improve coordination between utilities and relevant Federal agencies to enable communication, information-sharing, and situational awareness in the event of a physical or cyber attack on the electric grid;

''(4) developing technologies and capabilities to withstand and address the current and projected impact of the changing climate on electric grid infra-

structure, including extreme weather events and other natural disasters;

''(5) developing technologies capable of early detection of deteriorating electrical equipment on the transmission and distribution grid, including detection of spark ignition from wildfires and risks of vegetation contact; and

''(6) assessing upgrades and additions needed to electric grid infrastructure due to projected changes in the electricity generation mix and electricity demand.

''(c) ELIGIBLE ENTITIES.—The entities eligible to receive grants under this section include—

''(1) an institution of higher education;

''(2) a nonprofit organization;

''(3) a National Laboratory;

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

''(5) an electric utility or electric cooperative;

''(6) a retail service provider of electricity;

''(7) a private commercial entity;

''(8) a partnership or consortium of 2 or more entities described in subparagraphs (1) through (7).

''(d) RELEVANT ACTIVITIES.—Grants awarded under subsection (b) shall include funding for research and de-

velopment activities related to the purpose described in subsection (b), such as—

''(1) development of technologies to use distributed energy resources, such as solar photovoltaics, energy storage systems, electric vehicles, and microgrids to improve grid and critical end-user resilience;

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

''(3) analysis of past large-area, long-duration electricity interruptions to identify common elements and best practices for electricity restoration, mitigation, and prevention of future disruptions;

''(4) development of advanced monitoring, analytics, operation, and controls of electricity grid systems to improve electric grid resilience;

''(5) analysis of technologies, methods, and concepts that can improve community resilience and survivability of frequent or long-duration power outages;

''(6) development of methodologies to maintain cybersecurity during restoration of electric grid infrastructure and operation;

''(7) development of advanced power flow control systems and components to improve electric grid resilience; and

''(8) any other relevant activities determined by the Secretary.

''(e) TECHNICAL ASSISTANCE.—

''(1) IN GENERAL.—The Secretary shall provide technical assistance to eligible entities for the commercial application of technologies to improve the resilience of the electric grid and commercial application of technologies to help entities develop plans for preventing and recovering from various power outage scenarios at the local, regional, and State level.

''(2) TECHNICAL ASSISTANCE PROGRAM.—The technical assistance program established in paragraph (1) shall include assistance to eligible entities for—

''(A) the commercial application of technologies developed from the grant program established in subsection (b), including municipal and cooperative utilities;

''(B) the development of methods to strengthen or otherwise mitigate adverse impacts on electric grid infrastructure against natural hazards;

''(C) the use of Department data and modeling tools for various purposes; and

''(D) a resource assessment and analysis of future demand and distribution requirements, including development of advanced grid architectures and risk analysis.

''(3) ELIGIBLE ENTITIES.—The entities eligible to receive technical assistance for commercial application of technologies under this section include—

''(A) representatives of all sectors of the electric power industry, including electric utilities, trade organizations, and transmission and distribution system organizations, owners, and operators;

''(B) State and local governments and regulatory authorities, including public utility commissions;

''(C) tribal and Alaska Native governmental entities;

''(D) partnerships among entities under subparagraphs (A) through (C);

''(E) regional partnerships; and

''(F) any other entities the Secretary deems appropriate.

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

''(f) COORDINATION.—In carrying out this section, the Secretary shall comply with section 8 of the Grid Modernization Research and Development Act of 2019.''.

SEC. 5. HYBRID ENERGY SYSTEMS.

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

''SEC. 1311. HYBRID ENERGY SYSTEMS.

''(a) IN GENERAL.—Not later than 180 days after the enactment of the Grid Modernization Research and Development Act of 2019, the Secretary shall establish a research, development, and demonstration program to develop cost-effective hybrid energy systems, including—

''(1) development of computer modeling to design different configurations of hybrid energy systems and to optimize system operation;

''(2) research on system integration needed to plan, design, build, and operate hybrid energy systems, including interconnection requirements with the electric grid;

''(3) development of hybrid energy systems for various applications, including—

''(A) thermal energy generation and storage for buildings and manufacturing;

''(B) electricity storage coupled with energy generation;

''(C) desalination;

''(D) production of liquid and gaseous fuels; and

''(E) production of chemicals such as ammonia and ethylene;

''(4) development of testing facilities for hybrid energy systems; and

''(5) research on incorporation of various technologies for hybrid energy systems, including nuclear energy, renewable energy, storage, and carbon capture, utilization, and sequestration technologies.

''(b) STRATEGIC PLAN.—

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

opportunities, challenges, and standards needed for the development and commercial application of hybrid energy systems. The strategic plan shall include—

''(A) analysis of the potential benefits of development of hybrid electric systems on the electric grid;

''(B) analysis of the potential contributions of hybrid energy systems to different grid architecture scenarios;

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

''(D) assessment of policy and market barriers to the adoption of hybrid energy systems;

''(E) analysis of the technical and economic feasibility of adoption of different hybrid energy systems; and

''(F) a 10-year roadmap to guide the program established under subsection (a).

''(2) UPDATES.—Not less than once every 3 years for the duration of this research program, the Secretary shall submit an updated version of the strategic plan to the Committee on Science, Space, and Technology of the House of Representatives and

the Committee on Energy and Natural Resources of the Senate.

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

''(1) implement the recommendations set forth in the strategic plan in subsection (b);

''(2) coordinate across all relevant program offices at the Department, including—

''(A) the Office of Energy Efficiency and Renewable Energy;

''(B) the Office of Nuclear Energy; and

''(C) the Office of Fossil Energy;

''(3) leverage existing programs and resources of the Department;

''(4) prioritize activities that accelerate the development of integrated electricity generation, storage, and distribution systems with net zero greenhouse gas emissions; and

''(5) comply with section 8 of the Grid Modernization Research and Development Act of 2019.

''(d) HYBRID ENERGY SYSTEM DEFINED.—The term 'hybrid energy system' means a system composed of 2 or more co-located or jointly operated sub-systems of energy generation, energy storage, or other energy technologies.''.

SEC. 6. GRID INTEGRATION RESEARCH AND DEVELOPMENT.

(a) INTEGRATING DISTRIBUTED ENERGY RESOURCES ONTO THE ELECTRIC GRID.—Section 925(a) of the Energy Policy Act of 2005 (42 U.S.C. 16215) is amended by—

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

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

''(10) the development of cost-effective technologies that enable two-way information and power flow between distributed energy resources and the electric grid;

''(11) the development of technologies and concepts that enable interoperability between distributed energy resources and other behind-the-meter devices and the electric grid;''.

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

''SEC. 936. RESEARCH AND DEVELOPMENT INTO INTEGRATING RENEWABLE ENERGY ONTO THE ELECTRIC GRID.

''(a) IN GENERAL.—Not later than 180 days after the enactment of the Grid Modernization Research and

Development Act of 2019, the Secretary shall establish a research, development, and demonstration program on technologies that enable integration of renewable energy generation sources onto the electric grid across multiple program offices of the Department. The program shall include—

''(1) forecasting for predicting generation from variable renewable energy sources;

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

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

''(b) COORDINATION.—In carrying out this program, the Secretary shall—

''(1) coordinate across all relevant program offices at the Department to achieve the goals established in this section, including the Office of Electricity; and

''(2) comply with section 8 of the Grid Modernization Research and Development Act of 2019.

''(c) ADOPTION OF TECHNOLOGIES.—In carrying out this section, the Secretary shall consider barriers to adoption and commercial application of technologies that enable integration of renewable energy sources onto the elec-

tric grid, including cost and other economic barriers, and shall coordinate with relevant entities to reduce these barriers.''.

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

''SEC. 137. RESEARCH AND DEVELOPMENT INTO INTEGRATING ELECTRIC VEHICLES ONTO THE ELECTRIC GRID.

''(a) IN GENERAL.—The Secretary shall establish a research, development, and demonstration program to advance the integration of electric vehicles, including plug-in hybrid electric vehicles, onto the electric grid.

''(b) VEHICLES-TO-GRID INTEGRATION ASSESSMENT REPORT.—Not later than 1 year after the enactment of the Grid Modernization Research and Development Act of 2019, the Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on the results of a study that examines the research, development, and demonstration opportunities, challenges, and standards needed for integrating electric vehicles onto the electric grid.

''(1) REPORT REQUIREMENTS.—The report shall include—

''(A) an evaluation of the use of electric vehicles to maintain the reliability of the electric grid, including—

''(i) the use of electric vehicles for demand response, load shaping, emergency power, and frequency regulation; and

''(ii) the potential for the reuse of spent electric vehicle batteries for stationary grid storage;

''(B) the impact of grid integration on electric vehicles, including—

''(i) the impact of bi-directional electricity flow on battery degradation; and

''(ii) the implications of the use of electric vehicles for grid services on original equipment manufacturer warranties;

''(C) the impacts to the electric grid of increased penetration of electric vehicles, including—

''(i) the distribution grid infrastructure needed to support an increase in charging capacity;

''(ii) strategies for integrating electric vehicles onto the distribution grid while limiting infrastructure upgrades;

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

''(iv) the load increases expected from electrifying the transportation sector;

''(v) the potential for customer incentives and other managed charging stations strategies to shift charging off-peak;

''(vi) the technology needed to achieve bi-directional power flow on the distribution grid; and

''(vii) the implementation of smart charging techniques;

''(D) research on the standards needed to integrate electric vehicles with the grid, including communications systems, protocols, and charging stations, in collaboration with the National Institute for Standards and Technology;

''(E) the cybersecurity challenges and needs associated with electrifying the transportation sector; and

''(F) an assessment of the feasibility of adopting technologies developed under the program established under subsection (a) at Department facilities.

''(2) RECOMMENDATIONS.—As part of the Vehicles-to-Grid Integration Assessment Report, the Secretary shall develop a 10-year roadmap to guide the research, development, and demonstration program to integrate electric vehicles onto the electric grid.

''(3) CONSULTATION.—In developing this report, the Secretary shall consult with relevant stakeholders, including—

''(A) electric vehicle manufacturers;

''(B) electric utilities;

''(C) public utility commissions;

''(D) vehicle battery manufacturers;

''(E) electric vehicle supply equipment manufacturers;

''(F) charging infrastructure manufacturers;

''(G) the National Laboratories; and

''(H) other Federal agencies, as the Secretary determines appropriate.

''(4) UPDATES.—The Secretary shall update the report required under this section every 3 years for the duration of the program under section (a) and shall submit the updated report to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate.

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

''(1) implement the recommendations set forth in the report in subsection (b);

''(2) coordinate across all relevant program offices at the Department to achieve the goals established in this section, including the Office of Electricity; and

''(3) comply with section 8 of the Grid Modernization Research and Development Act of 2019.

''(d) TESTING CAPABILITIES.—The Secretary shall coordinate with the National Laboratories to develop testing capabilities for the evaluation, rapid prototyping, and optimization of technologies enabling integration of electric vehicles onto the electric grid.''.

(d) RESEARCH AND DEVELOPMENT ON INTEGRATING BUILDINGS ONTO THE ELECTRIC GRID.—Subtitle B of

title IV of the Energy Independence and Security Act of 2007 (42 U.S.C. 17081 et seq.) is amended by adding at the end the following:

"SEC. 426. ADVANCED INTEGRATION OF BUILDINGS ONTO THE ELECTRIC GRID.

''(a) IN GENERAL.—The Secretary shall establish a program of research, development, and demonstration to enable components of commercial and residential buildings to serve as dynamic energy loads on and resources for the electric grid. The program shall focus on—

''(1) developing low-cost, low power, wireless sensors to—

''(A) monitor building energy load;

''(B) forecast building energy need; and

''(C) enable building-level energy control;

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

''(3) developing advanced building-level energy management of components through integration of smart technologies, control systems, and data processing, to enable energy efficiency and savings;

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

''(5) improving visualization of behind the meter equipment and technologies to provide better insight into the energy needs and energy forecasts of individual buildings;

''(6) reducing the cost of key components to accelerate the adoption of smart building technologies;

''(7) protecting against cybersecurity threats and addressing security vulnerabilities of building systems or equipment; and

''(8) other areas determined appropriate by the Secretary.

''(b) CONSIDERATIONS.—In carrying out the program under subsection (a), the Secretary shall—

''(1) work with utility partners, building owners, technology vendors, and building developers to test and validate technologies and encourage the commercial application of these technologies by building owners; and

''(2) consider the specific challenges of enabling greater interaction between components of—

''(A) small- and medium-sized buildings and the electric grid; and

''(B) residential and commercial buildings and the electric grid.

''(c) BUILDINGS-TO-GRID INTEGRATION REPORT.—Not later than one year after the enactment of the Grid Modernization Research and Development Act of 2019, the Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report on the results of a study that examines the research, development, and demonstration opportunities, challenges, and standards needed to enable components of commercial and residential buildings to serve as dynamic energy loads on and resources for the electric grid.

''(1) REPORT REQUIREMENTS.—The report shall include—

''(A) an assessment of the technologies needed to enable building components as dynamic loads on and resources for the electric grid, including how such technologies can be—

''(i) incorporated into new commercial and residential buildings; and

''(ii) retrofitted in older buildings;

''(B) guidelines for the design of new buildings and building components to enable modern grid interactivity and improve energy efficiency;

''(C) an assessment of barriers to the adoption by building owners of advanced technologies enabling greater integration of building components onto the electric grid; and

''(D) an assessment of the feasibility of adopting technologies developed under the program established under subsection (a) at Department facilities.

''(2) RECOMMENDATIONS.—As part of the report, the Secretary shall develop a 10-year roadmap to guide the research, development, and demonstration program to enable components of commercial and residential buildings to serve as dynamic energy loads on and resources for the electric grid.

''(3) UPDATES.—The Secretary shall update the report required under this section every 3 years for the duration of the program under subsection (a) and shall submit the updated report to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate.

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

''(1) implement the recommendations from the report in subsection (c);

''(2) coordinate across all relevant program offices at the Department to achieve the goals established in this section, including the Office of Electricity; and

''(3) comply with section 8 of the Grid Modernization Research and Development Act of 2019.''.

SEC. 7. INDUSTRY ALLIANCE.

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

''SEC. 1312. INDUSTRY ALLIANCE.

''(a) IN GENERAL.—Not later than 180 days after the enactment of the Grid Modernization Research and Development Act of 2019, the Secretary shall establish an advisory committee (to be known as the 'Industry Alliance') to advise the Secretary on the authorization of research, development, and demonstration projects under sections 1304 and 1304a.

''(b) MEMBERSHIP.—The Industry Alliance shall be composed of members selected by the Secretary that, as a group, are broadly representative of United States electric grid research, development, infrastructure, operations, and manufacturing expertise.

''(c) RESPONSIBILITY.—The Secretary shall annually solicit from the Industry Alliance—

''(1) comments to identify grid modernization technology needs;

''(2) an assessment of the progress of the research activities on grid modernization; and

''(3) assistance in annually updating grid modernization technology roadmaps.''.

SEC. 8. COORDINATION OF EFFORTS.

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

(1) electric utilities;

(2) private sector entities;

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

(4) transmission organizations;

(5) transmission owners and operators;

(6) distribution organizations;

(7) distribution asset owners and operators;

(8) State and local governments and regulatory authorities;

(9) academic institutions;

(10) the National Laboratories;

(11) other Federal agencies;

(12) nonprofit organizations;

(13) the Federal Energy Regulatory Commission;

(14) the North American Reliability Corporation;

(15) independent system operators; and

(16) programs and program offices at the Department.

SEC. 9. DEFINITIONS.

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

"SEC. 1313. DEFINITIONS.

''In this title, the following definitions apply:

''(1) CRITICAL FACILITY.—The term 'critical facility' means a manmade structure that the Secretary determines vital to socioeconomic activities such that, if destroyed or damaged, such destruction or damage could cause substantial disruption to such socioeconomic activities.

''(2) DISTRIBUTION AUTOMATION.—The term 'distribution automation' means systems and technologies that exert intelligent control over electrical grid functions at the distribution level.

''(3) RESILIENCE.—The term 'resilience' means the ability to withstand and reduce the magnitude or

duration of disruptive events, which includes the capability to anticipate, absorb, adapt to, or rapidly recover from such an event, including from deliberate attacks, accidents, and naturally occurring threats or incidents.''.

SEC. 10. TECHNICAL AMENDMENTS; AUTHORIZATION OF APPROPRIATIONS.

(a) TECHNICAL AMENDMENTS.—

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

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

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

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

''Sec. 426. Advanced integration of buildings onto the electric grid.''.

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

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

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

''Sec. 1310. Grid resilience and emergency response.
''Sec. 1311. Hybrid energy systems.
''Sec. 1312. Industry Alliance.
''Sec. 1313. Definitions.''.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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