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[Report No. 115–115]

To enable civilian research and development of advanced nuclear energy technologies by private and public institutions, to expand theoretical and practical knowledge of nuclear physics, chemistry, and materials science, and for other purposes.

IN THE SENATE OF THE UNITED STATES

JANUARY 11, 2017

Mr. CRAPO (for himself, Mr. WHITEHOUSE, Mr. BOOKER, Mr. RISCH, Mr. HATCH, Ms. MURKOWSKI, Mr. DURBIN, and Mr. STRANGE) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

JUNE 21, 2017

Reported by Ms. MURKOWSKI, without amendment

A BILL

To enable civilian research and development of advanced nuclear energy technologies by private and public institutions, to expand theoretical and practical knowledge of nuclear physics, chemistry, and materials science, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the ''Nuclear Energy Innovation Capabilities Act of 2017''.

SEC. 2. NUCLEAR ENERGY INNOVATION CAPABILITIES.

(a) NUCLEAR ENERGY.—Section 951 of the Energy Policy Act of 2005 (42 U.S.C. 16271) is amended to read as follows:

''SEC. 951. NUCLEAR ENERGY.

''(a) MISSION.—

''(1) IN GENERAL.—The Secretary shall carry out programs of civilian nuclear research, development, demonstration, and commercial application, including activities under this subtitle.

''(2) CONSIDERATIONS.—The programs carried out under paragraph (1) shall take into consideration the following objectives:

''(A) Providing research infrastructure to promote scientific progress and enable users from academia, the National Laboratories, and the private sector to make scientific discoveries relevant for nuclear, chemical, and materials science engineering.

''(B) Maintaining nuclear energy research and development programs at the National Laboratories and institutions of higher education, including infrastructure at the National

Laboratories and institutions of higher education.

''(C) Providing the technical means to reduce the likelihood of nuclear proliferation.

''(D) Increasing confidence margins for public safety of nuclear energy systems.

''(E) Reducing the environmental impact of activities relating to nuclear energy.

''(F) Supporting technology transfer from the National Laboratories to the private sector.

''(G) Enabling the private sector to partner with the National Laboratories to demonstrate novel reactor concepts for the purpose of resolving technical uncertainty associated with the objectives described in subparagraphs (A) through (F).

''(b) DEFINITIONS.—In this subtitle:

''(1) ADVANCED NUCLEAR REACTOR.—The term 'advanced nuclear reactor' means—

''(A) a nuclear fission reactor with significant improvements over the most recent generation of nuclear fission reactors, which may include—

''(i) inherent safety features;

''(ii) lower waste yields;

''(iii) greater fuel utilization;

''(iv) superior reliability;

''(v) resistance to proliferation;

''(vi) increased thermal efficiency; and

''(vii) the ability to integrate into electric and nonelectric applications; or

''(B) a nuclear fusion reactor.

''(2) COMMISSION.—The term 'Commission' means the Nuclear Regulatory Commission.

''(3) FAST NEUTRON.—The term 'fast neutron' means a neutron with kinetic energy above 100 kiloelectron volts.

''(4) NATIONAL LABORATORY.—

''(A) IN GENERAL.—Except as provided in subparagraph (B), the term 'National Laboratory' has the meaning given the term in section 2.

''(B) LIMITATION.—With respect to the Lawrence Livermore National Laboratory, the Los Alamos National Laboratory, and the Sandia National Laboratories, the term 'National Laboratory' means only the civilian activities of the laboratory.

''(5) NEUTRON FLUX.—The term 'neutron flux' means the intensity of neutron radiation measured as a rate of flow of neutrons applied over an area.

''(6) NEUTRON SOURCE.—The term 'neutron source' means a research machine that provides neutron irradiation services for—

''(A) research on materials sciences and nuclear physics; and

''(B) testing of advanced materials, nuclear fuels, and other related components for reactor systems.''.

(b) NUCLEAR ENERGY RESEARCH PROGRAMS.—

(1) IN GENERAL.—Section 952 of the Energy Policy Act of 2005 (42 U.S.C. 16272) is amended—

(A) by striking subsection (c); and

(B) by redesignating subsections (d) and (e) as subsections (c) and (d), respectively.

(2) CONFORMING AMENDMENT.—Section 641(b)(1) of the Energy Policy Act of 2005 (42 U.S.C. 16021(b)(1)) is amended by striking ''section 942(d)'' and inserting ''section 952(c)''.

(c) ADVANCED FUEL CYCLE INITIATIVE.—Section 953(a) of the Energy Policy Act of 2005 (42 U.S.C. 16273(a)) is amended by striking '', acting through the

Director of the Office of Nuclear Energy, Science and Technology,''.

(d) UNIVERSITY NUCLEAR SCIENCE AND ENGINEERING SUPPORT.—Section 954(d)(4) of the Energy Policy Act of 2005 (42 U.S.C. 16274(d)(4)) is amended by striking ''as part of a taking into consideration effort that emphasizes'' and inserting ''that emphasize''.

(e) DEPARTMENT OF ENERGY CIVILIAN NUCLEAR INFRASTRUCTURE AND FACILITIES.—Section 955 of the Energy Policy Act of 2005 (42 U.S.C. 16275) is amended—

(1) by striking subsections (c) and (d); and

(2) by adding at the end the following:

''(c) VERSATILE NEUTRON SOURCE.—

''(1) MISSION NEED.—

''(A) IN GENERAL.—Not later than December 31, 2017, the Secretary shall determine the mission need for a versatile reactor-based fast neutron source, which shall operate as a national user facility.

''(B) CONSULTATIONS REQUIRED.—In carrying out subparagraph (A), the Secretary shall consult with the private sector, institutions of higher education, the National Laboratories, and relevant Federal agencies to ensure that

the user facility described in subparagraph (A) will meet the research needs of the largest practicable majority of prospective users.

''(2) ESTABLISHMENT.—As soon as practicable after determining the mission need under paragraph (1)(A), the Secretary shall submit to the appropriate committees of Congress a detailed plan for the establishment of the user facility.

''(3) FACILITY REQUIREMENTS.—

''(A) CAPABILITIES.—The Secretary shall ensure that the user facility will provide, at a minimum, the following capabilities:

''(i) Fast neutron spectrum irradiation capability.

''(ii) Capacity for upgrades to accommodate new or expanded research needs.

''(B) CONSIDERATIONS.—In carrying out the plan submitted under paragraph (2), the Secretary shall consider the following:

''(i) Capabilities that support experimental high-temperature testing.

''(ii) Providing a source of fast neutrons at a neutron flux, higher than that at which current research facilities operate,

sufficient to enable research for an optimal base of prospective users.

''(iii) Maximizing irradiation flexibility and irradiation volume to accommodate as many concurrent users as possible.

''(iv) Capabilities for irradiation with neutrons of a lower energy spectrum.

''(v) Multiple loops for fuels and materials testing in different coolants.

''(vi) Additional pre-irradiation and post-irradiation examination capabilities.

''(vii) Lifetime operating costs and lifecycle costs.

''(4) DEADLINE FOR ESTABLISHMENT.—The Secretary shall, to the maximum extent practicable, complete construction of, and approve the start of operations for, the user facility by not later than December 31, 2025.

''(5) REPORTING.—The Secretary shall include in the annual budget request of the Department an explanation for any delay in the progress of the Department in completing the user facility by the deadline described in paragraph (4).

''(6) COORDINATION.—The Secretary shall leverage the best practices for management, construc-

tion, and operation of national user facilities from the Office of Science.''.

(f) SECURITY OF NUCLEAR FACILITIES.—Section 956 of the Energy Policy Act of 2005 (42 U.S.C. 16276) is amended by striking '', acting through the Director of the Office of Nuclear Energy, Science and Technology,''.

(g) HIGH-PERFORMANCE COMPUTATION AND SUPPORTIVE RESEARCH.—Section 957 of the Energy Policy Act of 2005 (42 U.S.C. 16277) is amended to read as follows:

''SEC. 957. HIGH-PERFORMANCE COMPUTATION AND SUPPORTIVE RESEARCH.

''(a) MODELING AND SIMULATION.—The Secretary shall carry out a program to enhance the capabilities of the United States to develop new reactor technologies through high-performance computation modeling and simulation techniques.

''(b) COORDINATION.—In carrying out the program under subsection (a), the Secretary shall coordinate with relevant Federal agencies as described by the National Strategic Computing Initiative established by Executive Order 13702 (80 Fed. Reg. 46177 (July 29, 2015)), while taking into account the following objectives:

''(1) Using expertise from the private sector, institutions of higher education, and the National

Laboratories to develop computational software and capabilities that prospective users may access to accelerate research and development of advanced nuclear reactor systems and reactor systems for space exploration.

''(2) Developing computational tools to simulate and predict nuclear phenomena that may be validated through physical experimentation.

''(3) Increasing the utility of the research infrastructure of the Department by coordinating with the Advanced Scientific Computing Research program within the Office of Science.

''(4) Leveraging experience from the Energy Innovation Hub for Modeling and Simulation.

''(5) Ensuring that new experimental and computational tools are accessible to relevant research communities, including private sector entities engaged in nuclear energy technology development.

''(c) SUPPORTIVE RESEARCH ACTIVITIES.—The Secretary shall consider support for additional research activities to maximize the utility of the research facilities of the Department, including physical processes—

''(1) to simulate degradation of materials and behavior of fuel forms; and

''(2) for validation of computational tools.''.

(h) ENABLING NUCLEAR ENERGY INNOVATION.—Subtitle E of title IX of the Energy Policy Act of 2005 (42 U.S.C. 16271 et seq.) is amended by adding at the end the following:

"SEC. 958. ENABLING NUCLEAR ENERGY INNOVATION.

"(a) NATIONAL REACTOR INNOVATION CENTER.—There is authorized a program to enable the testing and demonstration of reactor concepts to be proposed and funded, in whole or in part, by the private sector.

"(b) TECHNICAL EXPERTISE.—In carrying out the program under subsection (a), the Secretary shall leverage the technical expertise of relevant Federal agencies and the National Laboratories in order to minimize the time required to enable construction and operation of privately funded experimental reactors at National Laboratories or other Department-owned sites.

"(c) OBJECTIVES.—The reactors described in subsection (b) shall operate to meet the following objectives:

"(1) Enabling physical validation of advanced nuclear reactor concepts.

"(2) Resolving technical uncertainty and increasing practical knowledge relevant to safety, resilience, security, and functionality of advanced nuclear reactor concepts.

''(3) General research and development to improve nascent technologies.

''(d) SHARING TECHNICAL EXPERTISE.—In carrying out the program under subsection (a), the Secretary may enter into a memorandum of understanding with the Chairman of the Commission in order to share technical expertise and knowledge through—

''(1) enabling the testing and demonstration of advanced nuclear reactor concepts to be proposed and funded, in whole or in part, by the private sector;

''(2) operating a database to store and share data and knowledge relevant to nuclear science and engineering between Federal agencies and the private sector;

''(3) developing and testing electric and non-electric integration and energy conversion systems relevant to advanced nuclear reactors;

''(4) leveraging expertise from the Commission with respect to safety analysis; and

''(5) enabling technical staff of the Commission to actively observe and learn about technologies developed under the program.

''(e) AGENCY COORDINATION.—The Chairman of the Commission and the Secretary shall enter into a memorandum of understanding regarding the following:

''(1) Ensuring that—

''(A) the Department has sufficient technical expertise to support the timely research, development, demonstration, and commercial application by the civilian nuclear industry of safe and innovative advanced nuclear reactor technology; and

''(B) the Commission has sufficient technical expertise to support the evaluation of applications for licenses, permits, and design certifications and other requests for regulatory approval for advanced nuclear reactors.

''(2) The use of computers and software codes to calculate the behavior and performance of advanced nuclear reactors based on mathematical models of the physical behavior of advanced nuclear reactors.

''(3) Ensuring that—

''(A) the Department maintains and develops the facilities necessary to enable the timely research, development, demonstration, and commercial application by the civilian nuclear in-

dustry of safe and innovative reactor technology; and

''(B) the Commission has access to the facilities described in subparagraph (A), as needed.

''(f) REPORTING REQUIREMENTS.—

''(1) IN GENERAL.—Not later than 180 days after the date of enactment of the Nuclear Energy Innovation Capabilities Act of 2017, the Secretary, in consultation with the National Laboratories, relevant Federal agencies, and other stakeholders, shall submit to the appropriate committees of Congress a report assessing the capabilities of the Department to authorize, host, and oversee privately funded experimental advanced nuclear reactors as described in subsection (b).

''(2) CONTENTS.—The report submitted under paragraph (1) shall address—

''(A) the safety review and oversight capabilities of the Department, including options to leverage expertise from the Commission and the National Laboratories;

''(B) options to regulate privately proposed and funded experimental reactors hosted by the Department;

''(C) potential sites capable of hosting privately funded experimental advanced nuclear reactors;

''(D) the efficacy of the available contractual mechanisms of the Department to partner with the private sector and Federal agencies, including cooperative research and development agreements, strategic partnership projects, and agreements for commercializing technology;

''(E) the liability of the Federal Government with respect to the disposal of low-level radioactive waste, spent nuclear fuel, or high-level radioactive waste (as those terms are defined in section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101));

''(F) the impact on the aggregate inventory in the United States of low-level radioactive waste, spent nuclear fuel, or high-level radioactive waste (as those terms are defined in section 2 of the Nuclear Waste Policy Act of 1982 (42 U.S.C. 10101));

''(G) potential cost structures relating to physical security, decommissioning, liability, and other long-term project costs; and

''(H) other challenges or considerations identified by the Secretary.

''(3) UPDATES.—Once every 2 years, the Secretary shall update relevant provisions of the report submitted under paragraph (1) and submit to the appropriate committees of Congress the update.

''(g) SAVINGS CLAUSES.—

''(1) LICENSING REQUIREMENT.—Nothing in this section authorizes the Secretary or any person to construct or operate a nuclear reactor for the purpose of demonstrating the suitability for commercial application of the nuclear reactor unless licensed by the Commission in accordance with section 202 of the Energy Reorganization Act of 1974 (42 U.S.C. 5842).

''(2) FINANCIAL PROTECTION.—Any activity carried out under this section that involves the risk of public liability shall be subject to the financial protection or indemnification requirements of section 170 of the Atomic Energy Act of 1954 (42 U.S.C. 2210) (commonly known as the 'Price-Anderson Act').''.

(i) BUDGET PLAN.—Subtitle E of title IX of the Energy Policy Act of 2005 (42 U.S.C. 16271 et seq.) (as

amended by subsection (h)) is amended by adding at the end the following:

"SEC. 959. BUDGET PLAN.

"(a) IN GENERAL.—Not later than 1 year after the date of enactment of the Nuclear Energy Innovation Capabilities Act of 2017, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Science, Space, and Technology of the House of Representatives 2 alternative 10-year budget plans for civilian nuclear energy research and development by the Secretary, as described in subsections (b) through (d).

"(b) BUDGET PLAN ALTERNATIVE 1.—One of the budget plans submitted under subsection (a) shall assume constant annual funding for 10 years at the appropriated level for the civilian nuclear energy research and development of the Department for fiscal year 2016.

"(c) BUDGET PLAN ALTERNATIVE 2.—One of the budget plans submitted under subsection (a) shall be an unconstrained budget.

"(d) INCLUSIONS.—Each alternative budget plan submitted under subsection (a) shall include—

"(1) a prioritized list of the programs, projects, and activities of the Department to best support the

development of advanced nuclear reactor technologies;

''(2) realistic budget requirements for the Department to implement sections 955(c), 957, and 958; and

''(3) the justification of the Department for continuing or terminating existing civilian nuclear energy research and development programs.''.

(j) REPORT ON FUSION INNOVATION.—

(1) IN GENERAL.—Not later than 180 days after the date of enactment of this Act, the Secretary of Energy shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report identifying engineering designs for innovative fusion energy systems that have the potential to demonstrate net energy production not later than 15 years after the start of construction.

(2) INCLUSIONS.—The report submitted under paragraph (1) shall identify budgetary requirements that would be necessary for the Department of Energy to carry out a fusion innovation initiative to accelerate research and development of the engineering designs identified in the report.

(k) CONFORMING AMENDMENTS.—The table of contents for the Energy Policy Act of 2005 is amended by striking the item relating to section 957 and inserting the following:

''957. High-performance computation and supportive research.
''958. Enabling nuclear energy innovation.
''959. Budget plan.''.

SEC. 3. ADVANCED NUCLEAR ENERGY LICENSING COST-SHARE GRANT PROGRAM.

(a) DEFINITIONS.—In this section:

(1) COMMISSION.—The term ''Commission'' means the Nuclear Regulatory Commission.

(2) PROGRAM.—The term ''program'' means the Advanced Nuclear Energy Cost-Share Grant Program established under subsection (b).

(3) SECRETARY.—The term ''Secretary'' means the Secretary of Energy.

(b) ESTABLISHMENT.—The Secretary shall establish a grant program, to be known as the ''Advanced Nuclear Energy Cost-Share Grant Program'', under which the Secretary shall make cost-share grants to applicants for the purpose of funding a portion of the Commission fees of the applicant for pre-application review activities and application review activities.

(c) REQUIREMENT.—The Secretary shall seek out technology diversity in making grants under the program.

(d) COST-SHARE AMOUNT.—The Secretary shall determine the cost-share amount for each grant under the program.

(e) USE OF FUNDS.—A recipient of a grant under the program may use the grant funds to cover Commission fees, including those fees associated with—

(1) developing a licensing project plan;

(2) obtaining a statement of licensing feasibility;

(3) reviewing topical reports; and

(4) other—

(A) pre-application review activities;

(B) application review activities; and

(C) interactions with the Commission.

(f) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary to carry out this section such sums as are necessary.

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A BILL

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JUNE 21, 2017

Reported without amendment