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 21, 2016

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

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 Representa-
tives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the “Nuclear Energy Inno-
vation Capabilities Act”.

SEC. 2. DEFINITIONS.

In this Act:
(1) **Advanced Fission Reactor.**—The term “advanced fission reactor” means a nuclear fission reactor with significant improvements over the most recent generation of nuclear reactors, including improvements such as—

(A) inherent safety features;

(B) lower waste yields;

(C) greater fuel utilization;

(D) superior reliability;

(E) resistance to proliferation;

(F) increased thermal efficiency; and

(G) ability to integrate into electric and nonelectric applications.

(2) **Department.**—The term “Department” means the Department of Energy.

(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 of the Energy Policy Act of 2005 (42 U.S.C. 15801).
(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.

(7) SECRETARY.—The term “Secretary” means the Secretary of Energy.

SEC. 3. MISSION.

Section 951 of the Energy Policy Act of 2005 (42 U.S.C. 16271) is amended by striking subsection (a) and inserting the following:

“(a) IN GENERAL.—The Secretary shall conduct programs of civilian nuclear research, development, dem-
onstration, and commercial application, including activities described in this subtitle, that take into consideration the following objectives:

“(1) Providing research infrastructure—

“(A) to promote scientific progress; and

“(B) to enable users from academia, the National Laboratories, and the private sector to make scientific discoveries relevant for nuclear, chemical, and materials science engineering.

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

“(3) Providing the technical means to reduce the likelihood of nuclear weapons proliferation.

“(4) Ensuring public safety.

“(5) Reducing the environmental impact of nuclear energy-related activities.

“(6) Supporting technology transfer from the National Laboratories to the private sector.

“(7) 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 this subsection.”.

SEC. 4. SENSE OF CONGRESS.

It is the sense of Congress that—

(1) nuclear energy, through fission or fusion, represents the highest energy density of any known attainable source and yields low air emissions;

(2) nuclear energy is of national importance to scientific progress, national security, electricity generation, heat generation for industrial applications, and space exploration; and

(3) considering the inherent complexity and regulatory burden associated with nuclear energy, the Department should focus civilian nuclear research and development activities of the Department on programs that enable the private sector, National Laboratories, and institutions of higher education to carry out experiments to promote scientific progress and enhance practical knowledge of nuclear engineering.

SEC. 5. HIGH-PERFORMANCE COMPUTATION AND SUPPORTIVE RESEARCH.

(a) MODELING AND SIMULATION PROGRAM.—

(1) IN GENERAL.—The Secretary shall carry out a program to enhance the capabilities of the
United States to develop new reactor technologies and related systems technologies through high-performance computation modeling and simulation techniques (referred to in this subsection as the “program”).

(2) COORDINATION REQUIRED.—In carrying out the program, the Secretary shall coordinate with relevant Federal agencies through the National Strategic Computing Initiative established by Executive Order 13702 (80 Fed. Reg. 46177) (July 29, 2015).

(3) OBJECTIVES.—In carrying out the program, the Secretary shall take into consideration the following objectives:

(A) Using expertise from the private sector, institutions of higher education, and National Laboratories to develop computational software and capabilities that prospective users may access to accelerate research and development of advanced fission reactor systems, nuclear fusion systems, and reactor systems for space exploration.

(B) Developing computational tools to simulate and predict nuclear phenomena that may be validated through physical experimentation.
(C) Increasing the utility of the research infrastructure of the Department by coordinating with the Advanced Scientific Computing Research program of the Office of Science.

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

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

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

(1) on physical processes to simulate degradation of materials and behavior of fuel forms; and

(2) for validation of computational tools.

SEC. 6. VERSATILE NEUTRON SOURCE.

(a) DETERMINATION OF MISSION NEED.—

(1) IN GENERAL.—Not later than December 31, 2016, the Secretary shall determine the mission need for a versatile reactor-based fast neutron
source, which shall operate as a national user facility
(referred to in this section as the “user facility”).

(2) Consultation Required.—In carrying out paragraph (1), 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 will meet the research needs of the largest possible majority of prospective users.

(b) Plan for Establishment.—On the determination of the mission need under subsection (a), the Secretary, as expeditiously as practicable, 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 detailed plan for the establishment of the user facility (referred to in this section as the “plan”).

(c) Deadline for Establishment.—The Secretary shall make every effort to complete construction of, and approve the start of operations for, the user facility by December 31, 2025.

(d) Facility Requirements.—

(1) Capabilities.—The Secretary shall ensure that the user facility shall provide, at a minimum—
(A) fast neutron spectrum irradiation capability; and

(B) capacity for upgrades to accommodate new or expanded research needs.

(2) CONSIDERATIONS.—In carrying out the plan, the Secretary shall consider—

(A) capabilities that support experimental high-temperature testing;

(B) providing a source of fast neutrons—

(i) at a neutron flux that is higher than the neutron flux at which research facilities operate before establishment of the user facility; and

(ii) sufficient to enable research for an optimal base of prospective users;

(C) maximizing irradiation flexibility and irradiation volume to accommodate as many concurrent users as possible;

(D) capabilities for irradiation with neutrons of a lower energy spectrum;

(E) multiple loops for fuels and materials testing in different coolants; and

(F) additional pre-irradiation and post-irradiation examination capabilities.
(c) COORDINATION.—In carrying out this section, the Secretary shall leverage the best practices of the Office of Science for the management, construction, and operation of national user facilities.

(f) REPORT.—The Secretary shall include in the annual budget request of the Department an explanation for any delay in carrying out this section.

SEC. 7. ENABLING NUCLEAR ENERGY INNOVATION.

(a) ESTABLISHMENT OF NATIONAL NUCLEAR INNOVATION CENTER.—The Secretary may enter into a memorandum of understanding with the Chairman of the Nuclear Regulatory Commission to establish a center to be known as the “National Nuclear Innovation Center” (referred to in this section as the “Center”)—

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

(2) to establish and operate a database to store and share data and knowledge on nuclear science between Federal agencies and private industry; and

(3) to establish capabilities to develop and test reactor electric and nonelectric integration and energy conversion systems.

(b) ROLE OF NRC.—In operating the Center, the Secretary shall—
(1) consult with the Nuclear Regulatory Commission on safety issues; and

(2) permit staff of the Nuclear Regulatory Commission to actively observe and learn about the technology being developed at the Center.

(c) Objectives.—A reactor developed under subsection (a)(1) shall have the following objectives:

(1) Enabling physical validation of fusion and advanced fission experimental reactors at the National Laboratories or other facilities of the Department.

(2) Resolving technical uncertainty and increase practical knowledge relevant to safety, resilience, security, and functionality of novel reactor concepts.

(3) Conducting general research and development to improve novel reactor technologies.

(d) Use of Technical Expertise.—In operating the Center, the Secretary shall leverage the technical expertise of relevant Federal agencies and National Laboratories—

(1) to minimize the time required to carry out subsection (c); and

(2) to ensure reasonable safety for individuals working at the National Laboratories or other facilities of the Department to carry out that subsection.
(c) Reporting Requirement.—

(1) In General.—Not later than 180 days after the date of enactment of this Act, the Secretary, in consultation with the National Laboratories, relevant Federal agencies, and other stakeholders, shall submit to the Committee on Energy and Natural Resources and the Committee on Environment and Public Works of the Senate and the Committee on Science, Space, and Technology and the Committee on Energy and Commerce of the House of Representatives a report assessing the capabilities of the Department to authorize, host, and oversee privately proposed and funded reactors (as described in subsection (a)(1)).

(2) Contents.—The report shall address—

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

(B) potential sites capable of hosting the activities described in subsection (a);

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

(D) how the Federal Government and the private sector will address potential intellectual property concerns;

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

(F) other challenges or considerations identified by the Secretary.

SEC. 8. BUDGET PLAN.

(a) In General.—Not later than 1 year after the date of enactment of this Act, 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 3 alternative 10-year budget plans for civilian nuclear energy research and development by the Department in accordance with subsection (b).

(b) Description of Plans.—

(1) In General.—The 3 alternative 10-year budget plans submitted under subsection (a) shall be the following:

(A) A plan that assumes constant annual funding at the level of appropriations for fiscal
year 2016 for the civilian nuclear energy re-
search and development of the Department,
particularly for programs critical to advanced
nuclear projects and development.

(B) A plan that assumes 2 percent annual
increases to the level of appropriations de-
scribed in subparagraph (A).

(C) A plan that uses an unconstrained
budget.

(2) INCLUSIONS.—Each plan shall include—

(A) a prioritized list of the programs,
projects, and activities of the Department that
best support the development, licensing, and de-
ployment of advanced nuclear energy tech-
nologies;

(B) realistic budget requirements for the
Department to carry out sections 5, 6, and 7;

and

(C) the justification of the Department for
continuing or terminating existing civilian nu-
clear energy research and development pro-
grams.

SEC. 9. NUCLEAR REGULATORY COMMISSION REPORT.

Not later than December 31, 2016, the Chairman of
the Nuclear Regulatory Commission shall submit to the
Committee on Energy and Natural Resources and the Committee on Environment and Public Works of the Senate and the Committee on Science, Space, and Technology and the Committee on Energy and Commerce of the House of Representatives a report describing—

(1) the extent to which the Nuclear Regulatory Commission is capable of licensing advanced reactor designs that are developed pursuant to this Act by the end of the 4-year period beginning on the date on which an application is received under part 50 or 52 of title 10, Code of Federal Regulations (or successor regulations); and

(2) any organizational or institutional barriers the Nuclear Regulatory Commission will need to overcome to be able to license the advanced reactor designs that are developed pursuant to this Act by the end of the 4-year period described in paragraph (1).