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SENATE

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NUCLEAR ENERGY RENEWAL ACT OF 2019

JANUARY 9, 2020.—Ordered to be printed

Ms. MURKOWSKI, from the Committee on Energy and Natural Resources, submitted the following

R E P O R T

[To accompany S. 2368]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 2368) to amend the Atomic Energy Act of 1954 and the Energy Policy Act of 2005 to support licensing and relicensing of certain nuclear facilities and nuclear energy research, demonstration, and development, and for other purposes, having considered the same, reports favorably thereon with an amendment in the nature of a substitute and an amendment to the title and recommends that the bill, as amended, do pass.

AMENDMENTS

The amendments are as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the “Nuclear Energy Renewal Act of 2019”.

SEC. 2. LIGHT WATER REACTOR SUSTAINABILITY PROGRAM.

Section 952 of the Energy Policy Act of 2005 (42 U.S.C. 16272) is amended by striking subsection (b) and inserting the following:

“(b) **LIGHT WATER REACTOR SUSTAINABILITY PROGRAM.**—The Secretary shall carry out a light water reactor sustainability program—

“(1) to ensure the achievement of maximum benefits from existing nuclear generation;

“(2) to accommodate the increase in applications for nuclear power plant license renewals expected as of the date of enactment of this subsection;

“(3) to enable the continued operation of existing nuclear power plants through technology development;

“(4) to improve the performance and reduce the operation and maintenance costs of nuclear power plants;

“(5) to promote the use of high-performance computing to simulate nuclear reactor processes;

“(6) to coordinate with other research and development programs of the Office of Nuclear Energy to ensure that developed technologies and capabilities are part of an integrated investment strategy, the overall focus of which is improving the safety, security, reliability, and economics of operating nuclear power plants; and

“(7) to focus on—

“(A) new capabilities relating to nuclear energy research and development;

“(B) enabling technologies beyond individual programs;

“(C) coordinating capabilities among the research and development programs of the Office of Nuclear Energy;

“(D) examining new classes of materials not considered for nuclear applications;

“(E) high-risk research, which could potentially overcome technological limitations; and

“(F) the potential for industry partnerships to develop technologies relating to storage, hydrogen production, high-temperature process heat, and other relevant areas.”.

SEC. 3. NUCLEAR ENERGY RESEARCH, DEVELOPMENT, AND DEMONSTRATION.

Section 952 of the Energy Policy Act of 2005 (42 U.S.C. 16272) is amended by adding at the end the following:

“(e) ADVANCED REACTOR TECHNOLOGIES DEVELOPMENT PROGRAM.—

“(1) IN GENERAL.—The Secretary shall carry out a program under which the Secretary shall conduct research relating to the development of innovative nuclear reactor technologies that may offer improved safety, functionality, and affordability.

“(2) REQUIREMENTS.—The program under this subsection shall—

“(A) support efforts to reduce long-term technical barriers for advanced nuclear energy systems; and

“(B) be carried out in consultation with the Nuclear Regulatory Commission to ensure identification of any relevant concerns.”.

SEC. 4. ADVANCED FUELS DEVELOPMENT.

Section 953 of the Energy Policy Act of 2005 (42 U.S.C. 16273) is amended—

(1) by redesignating subsections (a) through (d) as paragraphs (1), (3), (4), and (5), respectively, and indenting appropriately;

(2) in paragraph (1) (as so redesignated)—

(A) by striking “this section” and inserting “this subsection”;

(B) by striking “minimize environmental” and inserting “improve fuel cycle performance while minimizing the cost and complexity of processing, environmental impacts,”; and

(C) by striking “the Generation IV”;

(3) by inserting after paragraph (1) (as so redesignated) the following:

“(2) CONSIDERATIONS.—In carrying out activities under the program, the Secretary shall consider the potential benefits of those activities for civilian nuclear applications, environmental remediation, and national security.”;

(4) by inserting after paragraph (5) (as so redesignated) the following:

“(6) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to the Secretary to carry out the program \$40,000,000 for each of fiscal years 2020 through 2024.”;

(5) by inserting before paragraph (1) (as so redesignated) the following:

“(a) MATERIAL RECOVERY AND WASTE FORM DEVELOPMENT.—”; and

(6) by adding at the end the following:

“(b) ADVANCED FUELS.—

“(1) IN GENERAL.—The Secretary shall carry out a program to conduct research relating to—

“(A) next-generation light water reactor fuels that demonstrate improved—

“(i) performance; and

“(ii) accident tolerance; and

“(B) advanced reactor fuels that demonstrate improved—

“(i) proliferation resistance; and

“(ii) use of resources.

“(2) REQUIREMENTS.—In carrying out the program under this subsection, the Secretary shall—

“(A) focus on the development of accident-tolerant fuel and cladding concepts that are capable of achieving initial commercialization by December 31, 2025;

“(B) conduct studies regarding the means by which those concepts would impact reactor economics, the fuel cycle, operations, safety, and the environment;

“(C) subject to paragraph (3), publish the results of the studies conducted under subparagraph (B); and

“(D) cooperate with institutions of higher education through the Nuclear Energy University and Integrated Research Projects programs of the Department.

“(3) SENSITIVE INFORMATION.—The Secretary shall not publish any information under paragraph (2)(C) that is detrimental to national security, as determined by the Secretary.

“(4) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to the Secretary to carry out the program under this subsection \$120,000,000 for each of fiscal years 2020 through 2024.”.

SEC. 5. NUCLEAR SCIENCE AND ENGINEERING SUPPORT.

(a) IN GENERAL.—Section 954 of the Energy Policy Act of 2005 (42 U.S.C. 16274) is amended—

(1) in the section heading, by striking “University nuclear” and inserting “Nuclear”;

(2) in subsection (b)—

(A) in the matter preceding paragraph (1), by striking “this section” and inserting “this subsection”; and

(B) by redesignating paragraphs (1) through (5) as subparagraphs (A) through (E), respectively, and indenting appropriately;

(3) in subsection (c), by redesignating paragraphs (1) and (2) as subparagraphs (A) and (B), respectively, and indenting appropriately;

(4) in subsection (d)—

(A) in the matter preceding paragraph (1), by striking “this section” and inserting “this subsection”; and

(B) by redesignating paragraphs (1) through (4) as subparagraphs (A) through (D), respectively, and indenting appropriately;

(5) in subsection (e), by striking “this section” and inserting “this subsection”;

(6) in subsection (f)—

(A) by striking “this section” and inserting “this subsection”; and

(B) by striking “subsection (b)(2)” and inserting “paragraph (2)(B)”;

(7) by redesignating subsections (a) through (f) as paragraphs (1), (2), (3), (4), (6), and (7), respectively, and indenting appropriately;

(8) by inserting after paragraph (4) (as so redesignated) the following:

“(5) RADIOLOGICAL FACILITIES MANAGEMENT.—

“(A) IN GENERAL.—The Secretary shall carry out a program under which the Secretary shall provide project management, technical support, quality engineering and inspection, and nuclear material support to research reactors located at universities.

“(B) AUTHORIZATION OF APPROPRIATIONS.—In addition to any amounts appropriated to carry out the program under this subsection, there is authorized to be appropriated to the Secretary to carry out the program under this paragraph \$15,000,000 for each of fiscal years 2020 through 2024.”;

(9) by inserting before paragraph (1) (as so redesignated) the following:

“(a) UNIVERSITY NUCLEAR SCIENCE AND ENGINEERING SUPPORT.—”; and

(10) by adding at the end the following:

“(b) NUCLEAR ENERGY APPRENTICESHIP SUBPROGRAM.—

“(1) ESTABLISHMENT.—In carrying out the program under subsection (a), the Secretary shall establish a nuclear energy apprenticeship subprogram under which the Secretary shall establish competitively awarded traineeships and apprenticeships in industries that are represented by skilled labor unions and with universities to provide focused, graduate-level training to meet highly focused needs through a tailored academic graduate program that delivers a curriculum with a rigorous thesis or dissertation research requirement aligned with the critical needs of the Department with respect to mission-driven workforce.

“(2) REQUIREMENTS.—In carrying out the subprogram under this subsection, the Secretary shall—

“(A) encourage appropriate partnerships among National Laboratories, affected universities, and industry; and

“(B) on an annual basis, evaluate the needs of the nuclear energy community to implement traineeships for focused topical areas addressing mission-specific workforce needs.

“(3) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to the Secretary to carry out the subprogram under this subsection \$5,000,000 for each of fiscal years 2020 through 2024.”.

(b) CONFORMING AMENDMENT.—The table of contents of the Energy Policy Act of 2005 (Public Law 109—58; 119 Stat. 600) is amended by striking the item relating to section 954 and inserting the following:

“SEC. 954. NUCLEAR SCIENCE AND ENGINEERING SUPPORT.”.

SEC. 6. INTERNATIONAL NUCLEAR ENERGY COOPERATION.

(a) IN GENERAL.—Subtitle H of Title IX of the Energy Policy Act of 2005 (42 U.S.C. 16341 et seq.) is amended by adding at the end the following:

“SEC. 986B. INTERNATIONAL NUCLEAR ENERGY COOPERATION. —

“(a) IN GENERAL.—The Secretary shall carry out a program to develop bilateral collaboration initiatives with a variety of countries through—

“(1) research and development agreements;

“(2) other relevant arrangements and action plan updates; and

“(3) maintaining existing multilateral cooperation commitments of—

“(A) the International Framework for Nuclear Energy Cooperation;

“(B) the Generation IV International Forum;

“(C) the International Atomic Energy Agency; and

“(D) any other international collaborative effort with respect to advanced nuclear reactor operations and safety.

“(b) SUBPROGRAM.—

“(1) IN GENERAL.—In carrying out the program under subsection (a), the Secretary shall establish a subprogram that shall—

“(A) support diplomatic, nonproliferation, climate, and international economic objectives for the safe, secure, and peaceful use of nuclear technology in countries developing nuclear energy programs, with a focus on countries that have increased civil nuclear cooperation with Russia and China; and

“(B) be modeled after the International Military Education and Training program of the Department of State.

“(2) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to the Secretary to carry out the subprogram under this subsection \$5,500,000 for each of fiscal years 2020 through 2024.

“(c) REQUIREMENTS.—The program under subsection (a) shall be carried out—

“(1) to facilitate, to the maximum extent practicable, workshops and expert-based exchanges to engage industry, stakeholders, and foreign governments regarding international civil nuclear issues, such as training, financing, safety, and options for multinational cooperation on used nuclear fuel disposal; and

“(2) in coordination with—

“(A) the National Security Council;

“(B) the Secretary of State;

“(C) the Secretary of Commerce; and

“(D) the Nuclear Regulatory Commission.”.

(b) CONFORMING AMENDMENT.—The table of contents of the Energy Policy Act of 2005 (Public Law 109—58; 119 Stat. 600) is amended by inserting after the item relating to section 986A the following:

“SEC. 986B. INTERNATIONAL NUCLEAR ENERGY COOPERATION.”.

Amend the title so as to read: “A bill to amend the Energy Policy Act of 2005 to support nuclear energy research, development, and demonstration, and for other purposes.”.

PURPOSE

The purpose of S. 2368, as ordered reported, is to amend the Energy Policy Act of 2005 (EPAcT ’05, Public Law 109—58) to support nuclear energy research, development, and demonstration.

BACKGROUND AND NEED

According to a 2019 report by the International Energy Agency (IEA), nuclear energy is the second largest source of low-carbon electricity in the world, and is essential to meeting global clean energy and climate goals. The report also finds that the nuclear fleet in advanced economies is 35 years old on average and many plants are nearing the end of their designed lifetimes. IEA expects 25 per-

cent of existing nuclear capacity in advanced economies to be shut down by 2025.

This trend is evident in the United States, where nuclear energy is the largest source of zero-emission electricity. Due to a combination of aging and economic pressure, nine nuclear reactors have closed since 2013 and another eight reactors have announced closure by 2025. Only one new reactor has begun operation in that time and only two new reactors are currently under construction.

Conducting research on existing nuclear power plants can enable those facilities to continue to operate safely for longer periods of time. Other research programs into advanced reactors have the potential to support new concepts that can be more economically competitive than existing reactors.

S. 2368 would authorize many programs the Department of Energy (DOE) is currently undertaking in nuclear energy research. It would also modify the focus of several existing programs, including international nuclear energy cooperation, increase research and development focus on industrial applications, and nuclear energy licensing support.

LEGISLATIVE HISTORY

S. 2368 was introduced by Senators Coons and McSally on July 31, 2019. The Energy Subcommittee held a hearing on the measure on September 11, 2019.

The Senate Committee on Energy and Natural Resources met in open business session on November 19, 2019, and ordered S. 2368 favorably reported, as amended.

COMMITTEE RECOMMENDATION

The Senate Committee on Energy and Natural Resources, in open business session on November 19, 2019, by a majority voice vote of a quorum present, recommends that the Senate pass S. 2368, if amended as described herein. Senators Lee and Hirono asked to be recorded as voting no.

COMMITTEE AMENDMENTS

During its consideration of S. 2368, the Committee adopted an amendment in the nature of a substitute and an amendment to the title.

Section 2 of the substitute amendment establishes the light water reactor sustainability program (discussed in the section-by-section analysis) by amending section 952 of EPAct '05, relating to light water reactor research, development, and deployment programs, rather than section 621 of EPAct '05, as was proposed by the underlying bill. Section 2 of the substitute amendment also provides additional program guidance and removes the authorization of appropriations authorization found in the underlying bill.

The substitute amendment omits amendments to section 103 of the Atomic Energy Act of 1954 proposed to be made by section 3 of the underlying bill. In its place, section 3 of the substitute amendment amends section 952 of EPAct '05 to establish an advanced reactor technologies development program. The substitute amendment requires the program to support efforts to reduce long-term technical barriers for advanced nuclear energy systems in

consultation with the Nuclear Regulatory Commission, but does not contain the specific focus areas of research and development (R&D); the requirement that the Secretary provide assistance to applicants with respect to licensing nuclear advanced nuclear production facilities; or the appropriations authorization found in the underlying bill.

The substitute amendment omits amendments to section 952 of EAct '05 relating to an advanced reactor technologies development program proposed to be made by section 4 of the underlying bill. In its place, section 4 of the substitute amends section 953 of EAct '05, relating to advanced nuclear fuel development. Unlike section 4 of the underlying bill, section 4 of the substitute amendment does not require the advanced fuels program to focus on fast reactors, high-temperature, gas-cooled reactors, or molten salt reactors. In addition, unlike the underlying bill, the substitute amendment does not require DOE to develop supercritical carbon dioxide technologies.

The substitute amendment also adds a new section 5. Section 5 of the substitute amends section 954 of EAct '05 by adding a new subsection (a)(5), which authorizes the Secretary to provide project management, technical support, quality engineering and inspection, and nuclear material support to university research reactors. Section 5 of the substitute also amends section 954 of EAct '05 to require the Secretary to establish a nuclear energy apprenticeship program.

Finally, the substitute amendment adds a new section 6, which amends title IX of EAct '05 to add a new section 986B, relating to international nuclear energy cooperation. The new section 986B is similar to section 952(k) for EAct '05 as proposed to be added by the underlying bill, except that the substitute amendment adds requirements to coordinate with the International Framework for Nuclear Energy Cooperation, the Generation IV International Forum, and the International Atomic Energy Agency. It also modifies the new subprogram on nuclear energy training to be focused on countries that have increased civil nuclear cooperation with Russia and China.

The title amendment removes the reference to the Atomic Energy Act of 1954.

SECTION-BY-SECTION ANALYSIS

Section 1. Short title

Section 1 sets forth the short title of the bill.

Section 2. Light Water Reactor Sustainability Program

Section 2 amends section 952(b) of EAct '05 by replacing DOE's existing Nuclear Energy Systems Support Program with a new Light Water Reactor Sustainability Program, intended to achieve maximum benefit from existing nuclear generation, enable continued operation of existing nuclear power plants through technology development, and improve performance and reduce plant operating and maintenance costs.

Section 3. Nuclear energy research, demonstration, and development

Section 3 adds a new subsection (e) to section 952 of EPAct '05 to authorize an advanced nuclear energy research program to develop innovative technologies that may offer improved safety, functionality, and affordability by enhancing existing nuclear technologies.

Section 4. Advanced fuels development

Section 4 amends section 953 of EPAct '05 by restructuring the current section as subsection (a) and redesignating the current subsections as paragraphs. It amends the redesignated subsection (a)(1) to require DOE to evaluate technologies that improve fuel cycle performance and reduce processing cost and complexity, as well as minimize environmental and public health and safety impacts. It also inserts a new subsection (a)(2), which requires DOE to consider potential benefits for civilian nuclear applications, environmental remediation, and national security, and a new subsection (a)(6), which authorizes \$40 million annually for fiscal years (FYs) 2020 through 2024 for the modified section 953(a) of EPAct '05.

In addition, section 4 further amends section 953 of EPAct '05 by adding a new subsection (b), which directs the Secretary to carry out a research program on next-generation light water reactor and advanced reactor fuels, and authorizes \$120 million annually for the new section 953(b) of EPAct '05 for FYs 2020 through 2024.

Section 5. Nuclear science and engineering support

Section 5 amends section 954 of EPAct '05 by restructuring the current section as subsection (a) and redesignating the current subsections as paragraphs. It adds a new paragraph (5) to the redesignated subsection (a), which directs the Secretary to carry out a radiological facilities management program to provide project management, technical support, and nuclear material support to university research reactors, and authorizes \$15 million annually for FYs 2020 through 2024.

In addition, section 5 amends section 952 to EPAct '05 by adding a new subsection (b), which directs the Secretary to establish a nuclear energy apprenticeship program, and authorizes \$5 million annually for FYs years 2020 through 2024 to carry out the apprenticeship program.

Section 6. International nuclear energy cooperation

Section 6 adds a new section 986B to EPAct '05 to authorize an international nuclear energy cooperation program for bilateral R&D agreements with foreign countries, including a subprogram to develop nuclear energy in other countries to be modeled after the International Military Education and Training program of the Department of State. This section also authorizes \$5.5 million annually for this new subprogram for FYs 2020 through 2024.

COST AND BUDGETARY CONSIDERATIONS

The Congressional Budget Office estimate of the costs of this measure has been requested but was not received at the time the

report was filed. When the Congressional Budget Office completes its cost estimate, it will be posted on the internet at www.cbo.gov.

REGULATORY IMPACT EVALUATION

In compliance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee makes the following evaluation of the regulatory impact which would be incurred in carrying out S. 2368. The bill is not a regulatory measure in the sense of imposing Government-established standards or significant economic responsibilities on private individuals and businesses.

No personal information would be collected in administering the program. Therefore, there would be no impact on personal privacy.

Little, if any, additional paperwork would result from the enactment of S. 2368, as ordered reported.

CONGRESSIONALLY DIRECTED SPENDING

S. 2368, as ordered reported, does not contain any congressionally directed spending items, limited tax benefits, or limited tariff benefits as defined in rule XLIV of the Standing Rules of the Senate.

EXECUTIVE COMMUNICATIONS

The testimony provided by the Department of the Energy at the September 11, 2019, hearing on S. 2368 follows:

TESTIMONY OF UNDER SECRETARY OF ENERGY MARK W. MENEZES, U.S. DEPARTMENT OF ENERGY

INTRODUCTION

Chairman Cassidy, Ranking Member Heinrich, and Members of the Subcommittee, it is a privilege and an honor to serve at the Department of Energy (DOE or the Department), which is tasked with, among other important responsibilities: overseeing the Nation's nuclear energy research and development programs; creating and sustaining American leadership in the transition to a global clean energy economy; working effectively with the States on our Nation's energy challenges; and supporting our current, and developing our Nation's future, energy workforce. Thank you for the opportunity to testify today on behalf of the Department regarding legislation pertinent to DOE that is now pending in the Senate.

I have been asked to testify on nine (9) bills today. The Administration continues to review all of these bills. I appreciate the ongoing bipartisan efforts to address our Nation's energy challenges and I look forward to working with the Committee.

NUCLEAR ENERGY

As the major source of clean, reliable, and resilient base-load electricity, nuclear energy is a strategic national asset for the United States. It is an essential element of the Nation's diverse energy portfolio helping to sustain the U.S. economy and support our national goals. A strong domestic

nuclear industry enabled by the existing nuclear fleet and enhanced by innovative technology developers is critical to our national security interests as well.

S. 2368—Nuclear Energy Renewal Act

S. 2368, the Nuclear Energy Renewal Act, reauthorizes many nuclear energy research and development programs and authorizes several new activities to support the existing fleet of nuclear power plants while simultaneously accelerating the development of innovative advanced nuclear technologies. It supports licensing and relicensing of certain nuclear facilities and nuclear energy research, demonstration, and development.

The Department will continue to review the legislation and looks forward to working with Congress as the legislative process moves forward.

CONCLUSION

Thank you again for the opportunity to be here today. The Department appreciates the ongoing bipartisan efforts to address our Nation's energy challenges, and looks forward to working with the Committee on the legislation on today's agenda and any future legislation. I would be happy to answer your questions.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, the changes in existing law made by S. 2368, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

ENERGY POLICY ACT OF 2005

Public Law 109–58, as Amended

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SECTION 1.—SHORT TITLE; TABLE OF CONTENTS.

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

TITLE IX—RESEARCH AND DEVELOPMENT

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Subtitle E—Nuclear Energy

Sec. 951. Nuclear energy.

Sec. 952. Nuclear energy research programs.

Sec. 953. Advanced fuel cycle initiative.

[Sec. 954. University nuclear science and engineering support.]

Sec. 954. Nuclear science and engineering support.

Sec. 955. Department of Energy civilian nuclear infrastructure and facilities.

Sec. 956. Security of nuclear facilities.

* * * * *

Subtitle H—International Cooperation

Sec. 985. Western Hemisphere energy cooperation.
 Sec. 986. Cooperation between United States and Israel.
 Sec. 986A. International energy training.
 Sec. 986B. *International nuclear energy cooperation.*

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TITLE IX—RESEARCH AND DEVELOPMENT

* * * * *

Subtitle E—Nuclear Energy

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SEC. 952. NUCLEAR ENERGY RESEARCH PROGRAMS.

(a) NUCLEAR ENERGY RESEARCH INITIATIVE.—The Secretary shall carry out a Nuclear Energy Research Initiative for research and development related to nuclear energy.

[(b) NUCLEAR ENERGY SYSTEMS SUPPORT PROGRAM.—The Secretary shall carry out a Nuclear Energy Systems Support Program to support research and development activities addressing reliability, availability, productivity, component aging, safety, and security of existing nuclear power plants.]

(b) LIGHT WATER REACTOR SUSTAINABILITY PROGRAM.—*The Secretary shall carry out a light water reactor sustainability program—*

(1) *to ensure the achievement of maximum benefits from existing nuclear generation;*

(2) *to accommodate the increase in applications for nuclear power plant license renewals expected as of the date of enactment of this subsection;*

(3) *to enable the continued operation of existing nuclear power plants through technology development;*

(4) *to improve the performance and reduce the operation and maintenance costs of nuclear power plants;*

(5) *to promote the use of high-performance computing to simulate nuclear reactor processes;*

(6) *to coordinate with other research and development programs of the Office of Nuclear Energy to ensure that developed technologies and capabilities are part of an integrated investment strategy, the overall focus of which is improving the safety, security, reliability, and economics of operating nuclear power plants; and (7) to focus on—*

(A) *new capabilities relating to nuclear energy research and development;*

(B) *enabling technologies beyond individual programs;*

(C) *coordinating capabilities among the research and development programs of the Office of Nuclear Energy;*

(D) *examining new classes of materials not considered for nuclear applications;*

(E) *high-risk research, which could potentially overcome technological limitations; and*

(F) the potential for industry partnerships to develop technologies relating to storage, hydrogen production, high-temperature process heat, and other relevant areas.

(c) GENERATION IV NUCLEAR ENERGY SYSTEMS INITIATIVE.—

(1) IN GENERAL.—The Secretary shall carry out a Generation IV Nuclear Energy Systems Initiative to develop an overall technology plan for and to support research and development necessary to make an informed technical decision about the most promising candidates for eventual commercial application.

(2) ADMINISTRATION.—In conducting the Initiative, the Secretary shall examine advanced proliferation-resistant and passively safe reactor designs, including designs that—

(A) are economically competitive with other electric power generation plants;

(B) have higher efficiency, lower cost, and improved safety compared to reactors in operation on the date of enactment of this Act;

(C) use fuels that are proliferation resistant and have substantially reduced production of high-level waste per unit of output; and

(D) use improved instrumentation.

(d) REACTOR PRODUCTION OF HYDROGEN.—The Secretary shall carry out research to examine designs for high-temperature reactors capable of producing large-scale quantities of hydrogen.

(e) ADVANCED REACTOR TECHNOLOGIES DEVELOPMENT PROGRAM.—

(1) IN GENERAL.—*The Secretary shall carry out a program under which the Secretary shall conduct research relating to the development of innovative nuclear reactor technologies that may offer improved safety, functionality, and affordability.*

(2) REQUIREMENTS.—*The program under this subsection shall—*

(A) support efforts to reduce long-term technical barriers for advanced nuclear energy systems; and

(B) be carried out in consultation with the Nuclear Regulatory Commission to ensure identification of any relevant concerns.

SEC. 953. ADVANCED FUEL CYCLE INITIATIVE.

(a) MATERIAL RECOVERY AND WASTE FORM DEVELOPMENT.—

[(a)] (1) IN GENERAL.—The Secretary shall conduct an advanced fuel recycling technology research, development, and demonstration program (referred to in this **[section]** *subsection* as the “program”) to evaluate proliferation-resistant fuel recycling and transmutation technologies that **[minimize environmental]** *improve fuel cycle performance while minimizing the cost and complexity of processing, environmental impacts,* and public health and safety impacts as an alternative to aqueous reprocessing technologies deployed as of the date of enactment of this Act in support of evaluation of alternative national strategies for spent nuclear fuel and the **[Generation IV]** advanced reactor concepts.

(2) CONSIDERATIONS.—In carrying out activities under the program, the Secretary shall consider the potential benefits of those activities for civilian nuclear applications, environmental remediation, and national security.

[(b)] (3) ANNUAL REVIEW.—The program shall be subject to annual review by the Nuclear Energy Research Advisory Committee of the Department or other independent entity, as appropriate.

[(c)] (4) INTERNATIONAL COOPERATION.—In carrying out the program, the Secretary is encouraged to seek opportunities to enhance the progress of the program through international cooperation.

[(d)] (5) REPORTS.—The Secretary shall submit, as part of the annual budget submission of the Department, a report on the activities of the program.

(6) AUTHORIZATION OF APPROPRIATIONS.—*There is authorized to be appropriated to the Secretary to carry out the program \$40,000,000 for each of fiscal years 2020 through 2024.*

(b) ADVANCED FUELS.—

(1) IN GENERAL.—*The Secretary shall carry out a program to conduct research relating to—*

(A) *next-generation light water reactor fuels that demonstrate improved—*

(i) performance; and

(ii) accident tolerance; and

(B) *advanced reactor fuels that demonstrate improved—*

(i) proliferation resistance; and

(ii) use of resources.

(2) REQUIREMENTS.—*In carrying out the program under this subsection, the Secretary shall—*

(A) *focus on the development of accident-tolerant fuel and cladding concepts that are capable of achieving initial commercialization by December 31, 2025;*

(B) *conduct studies regarding the means by which those concepts would impact reactor economics, the fuel cycle, operations, safety, and the environment;*

(C) *subject to paragraph (3), publish the results of the studies conducted under subparagraph (B); and*

(D) *cooperate with institutions of higher education through the Nuclear Energy University and Integrated Research Projects programs of the Department.*

(3) SENSITIVE INFORMATION.—*The Secretary shall not publish any information under paragraph (2)(C) that is detrimental to national security, as determined by the Secretary.*

(4) AUTHORIZATION OF APPROPRIATIONS.—*There is authorized to be appropriated to the Secretary to carry out the program under this subsection \$120,000,000 for each of fiscal years 2020 through 2024.*”

SEC. 954. [UNIVERSITY NUCLEAR] NUCLEAR SCIENCE AND ENGINEERING SUPPORT.

(a) UNIVERSITY NUCLEAR SCIENCE AND ENGINEERING SUPPORT.—

[(A)] (1) IN GENERAL.—The Secretary shall conduct a program to invest in human resources and infrastructure in the nuclear sciences and related fields, including health physics, nuclear engineering, and radiochemistry, consistent with missions of the Department related to civilian nuclear research, development, demonstration, and commercial application.

[(b)] (2) REQUIREMENTS.—In carrying out the program under [this section] *this subsection*, the Secretary shall—

[(1)] (A) conduct a graduate and undergraduate fellowship program to attract new and talented students, which may in-

clude fellowships for students to spend time at National Laboratories in the areas of nuclear science, engineering, and health physics with a member of the National Laboratory staff acting as a mentor;

[(2)] (B) conduct a junior faculty research initiation grant program to assist universities in recruiting and retaining new faculty in the nuclear sciences and engineering by awarding grants to junior faculty for research on issues related to nuclear energy engineering and science;

[(3)] (C) support fundamental nuclear sciences, engineering, and health physics research through a nuclear engineering education and research program;

[(4)] (D) encourage collaborative nuclear research among industry, National Laboratories, and universities; and

[(5)] (E) support communication and outreach related to nuclear science, engineering, and health physics.

[(c)] (3) UNIVERSITY NATIONAL LABORATORY INTERACTIONS.—The Secretary shall conduct—

[(1)] (A) a fellowship program for professors at universities to spend sabbaticals at National Laboratories in the areas of nuclear science and technology; and

[(2)] (B) a visiting scientist program in which National Laboratory staff can spend time in academic nuclear science and engineering departments.

[(d)] (4) STRENGTHENING UNIVERSITY RESEARCH AND TRAINING REACTORS AND ASSOCIATED INFRASTRUCTURE.—In carrying out the program under this [section] *this subsection*, the Secretary may support—

[(1)] (A) converting research reactors from high-enrichment fuels to low-enrichment fuels and upgrading operational instrumentation;

[(2)] (B) consortia of universities to broaden access to university research reactors;

[(3)] (C) student training programs, in collaboration with the United States nuclear industry, in relicensing and upgrading reactors, including through the provision of technical assistance; and

[(4)] (D) reactor improvements that emphasize research, training, and education, including through the Innovations in Nuclear Infrastructure and Education Program or any similar program.

(5) RADIOLOGICAL FACILITIES MANAGEMENT.—

(A) *IN GENERAL.*—*The Secretary shall carry out a program under which the Secretary shall provide project management, technical support, quality engineering and inspection, and nuclear material support to research reactors located at universities.*

(B) *AUTHORIZATION OF APPROPRIATIONS.*—*In addition to any amounts appropriated to carry out the program under this subsection, there is authorized to be appropriated to the Secretary to carry out the program under this paragraph \$15,000,000 for each of fiscal years 2020 through 2024.*

[(e)] (6) OPERATIONS AND MAINTENANCE.—Funding for a project provided under [this section] *this subsection* may be used for a

portion of the operating and maintenance costs of a research reactor at a university used in the project.

[(f)] (7) DEFINITION.—In [this section] *this subsection*, the term “junior faculty” means a faculty member who was awarded a doctorate less than 10 years before receipt of an award from the grant program described in [subsection (b)(2)] *paragraph (2)(B)*.

(b) NUCLEAR ENERGY APPRENTICESHIP SUBPROGRAM.—

(1) ESTABLISHMENT.—*In carrying out the program under subsection (a), the Secretary shall establish a nuclear energy apprenticeship subprogram under which the Secretary shall establish competitively awarded traineeships and apprenticeships in industries that are represented by skilled labor unions and with universities to provide focused, graduate-level training to meet highly focused needs through a tailored academic graduate program that delivers a curriculum with a rigorous thesis or dissertation research requirement aligned with the critical needs of the Department with respect to mission-driven workforce.*

(2) REQUIREMENTS.—*In carrying out the subprogram under this subsection, the Secretary shall—*

(A) *encourage appropriate partnerships among National Laboratories, affected universities, and industry; and*

(B) *on an annual basis, evaluate the needs of the nuclear energy community to implement traineeships for focused topical areas addressing mission-specific workforce needs.*

(3) AUTHORIZATION OF APPROPRIATIONS.—*There is authorized to be appropriated to the Secretary to carry out the subprogram under this subsection \$5,000,000 for each of fiscal years 2020 through 2024*

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Subtitle H—International Cooperation

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SEC. 986A. INTERNATIONAL ENERGY TRAINING.

(a) IN GENERAL.—The Secretary, in consultation with the Secretary of Commerce, the Secretary of the Interior, and Secretary of State, and the Federal Energy Regulatory Commission, shall coordinate training and outreach efforts for international commercial energy markets in countries with developing and restructuring economies.

(b) COMPONENTS.—The training and outreach efforts referred to in subsection (a) may include—

- (1) production-related fiscal regimes;
- (2) grid and network issues;
- (3) energy user and demand side response;
- (4) international trade of energy; and
- (5) international transportation of energy.

(c) AUTHORIZATION OF APPROPRIATIONS.—There is authorized to be appropriated to carry out this section \$1,500,000 for each of fiscal years 2007 through 2010.

SEC. 986B. INTERNATIONAL NUCLEAR ENERGY COOPERATION. —

(a) *IN GENERAL.*—The Secretary shall carry out a program to develop bilateral collaboration initiatives with a variety of countries through—

- (1) research and development agreements;
- (2) other relevant arrangements and action plan updates; and
- (3) maintaining existing multilateral cooperation commitments of—
 - (A) the International Framework for Nuclear Energy Cooperation;
 - (B) the Generation IV International Forum;
 - (C) the International Atomic Energy Agency; and
 - (D) any other international collaborative effort with respect to advanced nuclear reactor operations and safety.

(b) SUBPROGRAM. —

(1) *IN GENERAL.*—In carrying out the program under subsection (a), the Secretary shall establish a subprogram that shall—

- (A) support diplomatic, nonproliferation, climate, and international economic objectives for the safe, secure, and peaceful use of nuclear technology in countries developing nuclear energy programs, with a focus on countries that have increased civil nuclear cooperation with Russia and China; and

(B) be modeled after the International Military Education and Training program of the Department of State.

(2) *AUTHORIZATION OF APPROPRIATIONS.*—There is authorized to be appropriated to the Secretary to carry out the subprogram under this subsection \$5,500,000 for each of fiscal years 2020 through 2024.

(c) *REQUIREMENTS.*—The program under subsection (a) shall be carried out—

- (1) to facilitate, to the maximum extent practicable, workshops and expert-based exchanges to engage industry, stakeholders, and foreign governments regarding international civil nuclear issues, such as training, financing, safety, and options for multinational cooperation on used nuclear fuel disposal; and

(2) in coordination with—

- (A) the National Security Council;
- (B) the Secretary of State;
- (C) the Secretary of Commerce; and
- (D) the Nuclear Regulatory Commission.

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