Calendar No. 217

116TH CONGRESS
1st Session

SENATE

REPORT
116–114

NUCLEAR ENERGY LEADERSHIP ACT

SEPTEMBER 24, 2019.—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. 903]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 903) to direct the Secretary of Energy to establish advanced nuclear goals, provide for a versatile, reactor-based fast neutron source, make available high-assay, low-enriched uranium for research, development, and demonstration of advanced nuclear reactor concepts, and for other purposes, having considered the same, reports favorably thereon with an amendment (in the nature of a substitute) and recommends that the bill, as amended, do pass.

The amendment is 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 Leadership Act".

SEC. 2. AUTHORIZATION OF LONG-TERM POWER PURCHASE AGREEMENTS.

Section 501(b)(1) of title 40, United States Code, is amended by striking subparagraph (B) and inserting the following:

(B) PUBLIC UTILITY CONTRACTS.—

(i) TERM.—

(I) IN GENERAL.—A contract under this paragraph to purchase electricity from a public utility may be for a period of not more than 40 years.

(II) OTHER PUBLIC UTILITY SERVICES.—A contract under this paragraph for a public utility service other than a service described in subclause (I) may be for a period of not more than 10 years.

(ii) COSTS.—The cost of a contract under this paragraph for any fiscal year may be paid from the appropriations for that fiscal year.

SEC. 3. LONG-TERM NUCLEAR POWER PURCHASE AGREEMENT PILOT PROGRAM.

(a) IN GENERAL.—Subtitle B of title VI of the Energy Policy Act of 2005 (Public Law 109–58; 119 Stat. 782) is amended by adding at the end the following:

SEC. 640. LONG-TERM NUCLEAR POWER PURCHASE AGREEMENT PILOT PROGRAM.

(a) ESTABLISHMENT.—The Secretary shall establish a pilot program for a long-term nuclear power purchase agreement.

(b) REQUIREMENTS.—In developing the pilot program under this section, the Secretary shall—

(1) consult and coordinate with the heads of other Federal departments and agencies that may benefit from purchasing nuclear power for a period of longer than 10 years, including—

(A) the Secretary of Defense; and

(B) the Secretary of Homeland Security; and

(2) not later than December 31, 2023, enter into at least 1 agreement to purchase power from a commercial nuclear reactor that receives the first license for that reactor from the Nuclear Regulatory Commission after January 1, 2019.

(c) FACTORS FOR CONSIDERATION.—

(1) IN GENERAL.—In carrying out this section, the Secretary shall give special consideration to power purchase agreements for first-of-a-kind or early deployment nuclear technologies that can provide reliable and resilient power to high-value assets for national security purposes or other purposes as the Secretary determines to be in the national interest, especially in remote off-grid scenarios or grid-connected scenarios that can provide capabilities commonly known as 'islanding power capabilities' during an emergency scenario.

(2) EFFECT ON RATES.—An agreement to purchase power under this section may be at a rate that is higher than the average market rate, if the agreement fulfills an applicable consideration described in paragraph (1).

(b) TABLE OF CONTENTS.—The table of contents of the Energy Policy Act of 2005 (Public Law 109–58; 119 Stat. 594) is amended by inserting after the item relating to section 639 the following:

"Sec. 640. Long-term nuclear power purchase agreement pilot program.".

SEC. 4. ADVANCED NUCLEAR REACTOR RESEARCH AND DEVELOPMENT GOALS.

(a) IN GENERAL.—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. 959A. ADVANCED NUCLEAR REACTOR RESEARCH AND DEVELOPMENT GOALS.

(a) DEFINITIONS.—In this section:

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

(A) a nuclear fission reactor, including a prototype plant (as defined in sections 50.2 and 52.1 of title 10, Code of Federal Regulations (or successor regulations)), with significant improvements compared to the most recent generation of fission reactors, including improvements such as—

(i) additional inherent safety features;

(ii) lower waste yields;

(iii) improved fuel performance;

(iv) increased tolerance to loss of fuel cooling;

(v) enhanced reliability;

(vi) increased proliferation resistance;

(vii) increased thermal efficiency;

(viii) reduced consumption of cooling water;

(ix) the ability to integrate into electric applications and nonelectric applications;

(x) modular sizes to allow for deployment that corresponds with the demand for electricity; or

(xi) operational flexibility to respond to changes in demand for electricity and to complement integration with intermittent renewable energy; and

(B) a fusion reactor.

(2) DEMONSTRATION PROJECT.—The term 'demonstration project' means—

(A) an advanced nuclear reactor operated—

(i) as part of the power generation facilities of an electric utility system; or

(ii) in any other manner for the purpose of demonstrating the suitability for commercial application of the advanced nuclear reactor;

(B) the demonstration of privately funded experimental advanced nuclear reactors, funded in whole or in part by the private sector, at National Laboratories or other sites owned by the Department of Energy; and

(C) an advanced nuclear reactor demonstrated by the Secretary of Defense in cooperation with the Secretary of Energy.

(b) PURPOSE.—The purpose of this section is to direct the Secretary, as soon as practicable after the date of enactment of this section, to advance the research and development of domestic advanced, affordable, and clean nuclear energy by—

(1) demonstrating different advanced nuclear reactor technologies that could be used by the private sector to produce—

(A) emission-free power at a levelized cost of electricity of $60 per megawatt-hour or less;

(B) heat for community heating, industrial purposes, or synthetic fuel production;

(C) remote or off-grid energy supply; or

(D) backup or mission-critical power supplies;

(2) developing subgoals for nuclear energy research programs that would accomplish the goals of the demonstration projects carried out under subsection (c);

(3) identifying research areas that the private sector is unable or unwilling to undertake due to the cost of, or risks associated with, the research; and

(4) facilitating the access of the private sector

(A) to Federal research facilities and personnel; and

(B) to the results of research relating to civil nuclear technology funded by the Federal Government.

(c) DEMONSTRATION PROJECTS.—

(1) IN GENERAL.—The Secretary shall, to the maximum extent practicable—

(A) enter into agreements to complete not fewer than 2 demonstration projects by not later than December 31, 2025; and

(B) establish a program to enter into agreements to demonstrate not fewer than 2, and not more than 5, additional operational advanced reactor designs by not later than December 31, 2035.

(2) REQUIREMENTS.—In carrying out demonstration projects under paragraph (1), the Secretary shall—

(A) include diversity in designs for the advanced nuclear reactors demonstrated under this section, including designs using various—

(i) primary coolants;

(ii) fuel types and compositions; and

(iii) neutron spectra;

(B) seek to ensure that—

(i) the long-term cost of electricity or heat for each design to be demonstrated under this subsection is cost-competitive in the applicable market;

(ii) the selected projects can meet the deadline established in paragraph (1) to demonstrate first-of-a-kind advanced nuclear reactor technologies, for which additional information shall be considered, including—

(I) the technology readiness level of a proposed advanced nuclear reactor technology;

(II) the technical abilities and qualifications of teams desiring to demonstrate a proposed advanced nuclear reactor technology; and

(III) the capacity to meet cost-share requirements of the Department;

(C) ensure that each evaluation of candidate technologies for the demonstration projects is completed through an external review of proposed designs, which review shall—

(i) be conducted by a panel that includes not fewer than 1 representative of each of—

(I) an electric utility; and

(II) an entity that uses high-temperature process heat for manufacturing or industrial processing, such as a petrochemical company, a manufacturer of metals, or a manufacturer of concrete;

(ii) include a review of cost-competitiveness and other value streams, together with the technology readiness level, of each design to be demonstrated under this subsection; and

(iii) not be required for a demonstration project that is not federally funded;

(D) for federally funded demonstration projects, enter into cost-sharing agreements with private sector partners in accordance with section 988 for the conduct of activities relating to the research, development, and demonstration of private-sector advanced nuclear reactor designs under the program;

(E) work with private sector partners to identify potential sites, including Department-owned sites, for demonstrations, as appropriate;

(F) align specific activities carried out under demonstration projects carried out under this subsection with priorities identified through direct consultations between—

(i) the Department;

(ii) National Laboratories;

(iii) institutions of higher education;

(iv) traditional end-users (such as electric utilities);

(v) potential end-users of new technologies (such as users of high-temperature process heat for manufacturing processing, including petrochemical companies, manufacturers of metals, or manufacturers of concrete); and

(vi) developers of advanced nuclear reactor technology; and

(G) seek to ensure that the demonstration projects carried out under paragraph (1) do not cause any delay in a deployment of an advanced reactor by private industry and the Department of Energy that is underway as of the date of enactment of this section.

(3) ADDITIONAL REQUIREMENTS.—In carrying out demonstration projects under paragraph (1), the Secretary shall—

(A) identify candidate technologies that—

(i) are not developed sufficiently for demonstration within the initial required timeframe described in paragraph (1)(A); but

(ii) could be demonstrated within the timeframe described in paragraph (1)(B);

(B) identify technical challenges to the candidate technologies identified in subparagraph (A);

(C) support near-term research and development to address the highest-risk technical challenges to the successful demonstration of a selected advanced reactor technology, in accordance with—

(i) subparagraph (B); and

(ii) the research and development activities under section 958;

(D) establish such technology advisory working groups as the Secretary determines to be appropriate to advise the Secretary regarding the technical challenges identified under subparagraph (B) and the scope of research and development programs to address the challenges, in accordance with subparagraph (C), to be comprised of—

(i) private—sector advanced nuclear reactor technology developers;

(ii) technical experts with respect to the relevant technologies at institutions of higher education; and

(iii) technical experts at the National Laboratories.

(d) GOALS.—

(1) IN GENERAL.—The Secretary shall establish goals for research relating to advanced nuclear reactors facilitated by the Department that support the objectives of the program for demonstration projects established under subsection (c).

(2) COORDINATION.—In developing the goals under paragraph (1), the Secretary shall coordinate, on an ongoing basis, with members of private industry to advance the demonstration of various designs of advanced nuclear reactors.

(3) REQUIREMENTS.—In developing the goals under paragraph (1), the Secretary shall ensure that (A) research activities facilitated by the Department to meet the goals developed under this subsection are focused on key areas of nuclear research and deployment ranging from basic science to full-design development, safety evaluation, and licensing;

(B) research programs designed to meet the goals emphasize—

(i) resolving materials challenges relating to extreme environments, including extremely high levels of—

(I) radiation fluence;

(II) temperature;

(III) pressure; and

(IV) corrosion; and

(ii) qualification of advanced fuels;

(C) activities are carried out that address near-term challenges in modeling and simulation to enable accelerated design and licensing;

(D) related technologies, such as technologies to manage, reduce, or reuse nuclear waste, are developed;

(E) nuclear research infrastructure is maintained or constructed, such as—

(i) currently operational research reactors at the National Laboratories and institutions of higher education;

(ii) hot cell research facilities;

(iii) a versatile fast neutron source; and

(iv) a molten salt testing facility;

(F) basic knowledge of non-light water coolant physics and chemistry is improved;

(G) advanced sensors and control systems are developed; and

(H) advanced manufacturing and advanced construction techniques and materials are investigated to reduce the cost of advanced nuclear reactors.

(b) TABLE OF CONTENTS.—The table of contents of the Energy Policy Act of 2005 (Public Law 109–58; 119 Stat. 594) is amended—

(1) in the item relating to section 917, by striking "Efficiency";

(2) in the items relating to sections 957, 958, and 959, by inserting "Sec." before "9" each place it appears; and

(3) by inserting after the item relating to section 959 the following:

"Sec. 959A. Advanced nuclear reactor research and development goals.".

SEC. 5. NUCLEAR ENERGY STRATEGIC PLAN.

(a) IN GENERAL.—Subtitle E of title IX of the Energy Policy Act of 2005 (42 U.S.C. 16271 et seq.) (as amended by section 4(a)) is amended by adding at the end the following:

SEC. 959B. NUCLEAR ENERGY STRATEGIC PLAN.

(a) IN GENERAL.—Not later than 180 days after the date of enactment of this section, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committees on Energy and Commerce and Science, Space, and Technology of the House of Representatives a 10-year strategic plan for the Office of Nuclear Energy of the Department, in accordance with this section.

(b) REQUIREMENTS.—

(1) COMPONENTS.—The strategic plan under this section shall designate—

(A) programs that support the planned accomplishment of—

(i) the goals established under section 959A; and

(ii) the demonstration programs identified under subsection (c) of that section; and

(B) programs that—

(i) do not support the planned accomplishment of demonstration programs, or the goals, referred to in subparagraph (A); but

(ii) are important to the mission of the Office of Nuclear Energy, as determined by the Secretary.

(2) PROGRAM PLANNING.—In developing the strategic plan under this section, the Secretary shall specify expected timelines for, as applicable—

(A) the accomplishment of relevant objectives under current programs of the Department; or

(B) the commencement of new programs to accomplish those objectives.

(c) UPDATES.—Not less frequently than once every 2 years, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committees on Energy and Commerce and Science, Space, and Technology of the House of Representatives an updated 10-year strategic plan in accordance with subsection (b), which shall identify, and provide a justification for, any major deviation from a previous strategic plan submitted under this section.

(b) TABLE OF CONTENTS.—The table of contents of the Energy Policy Act of 2005 (Public Law 109–58; 119 Stat. 594) (as amended by section 4(b)(3)) is amended by inserting after the item relating to section 959A the following:

"Sec. 959B. Nuclear energy strategic plan.".

SEC. 6. VERSATILE, REACTOR-BASED FAST NEUTRON SOURCE.

Section 955(c)(1) of the Energy Policy Act of 2005 (42 U.S.C. 16275(c)(1)) is amended—

(1) in the paragraph heading, by striking "MISSION NEED" and inserting "AUTHORIZATION"; and

(2) in subparagraph (A), by striking "determine the mission need" and inserting "provide".

SEC. 7. ADVANCED NUCLEAR FUEL SECURITY PROGRAM.

(a) FINDINGS.—Congress finds that—

(1) the national security nuclear enterprise, which supports the nuclear weapons stockpile stewardship and naval reactors functions of the National Nuclear Security Administration, requires a domestic source of low- and high-enriched uranium in accordance with legal restrictions regarding foreign obligations relating to the beginning stage of the nuclear fuel cycle;

(2) many domestic advanced nuclear power industry participants require access to high-assay, low-enriched uranium fuel for

(A) initial fuel testing;
(B) operation of demonstration reactors; and
(C) commercial operation of advanced nuclear reactors;

(3) nuclear fuel supply technology originating in the United States is not required for use in civilian advanced reactor applications;

(4) as of the date of enactment of this Act, no domestic uranium enrichment or fuel fabrication capability is licensed for uranium fuel enriched to greater than 5 weight percent of the uranium-235 isotope;

(5) a healthy commercial nuclear fuel cycle capable of providing higher levels of enriched uranium would benefit—

(A) the relevant national security functions of the National Nuclear Security Administration; and

(B) the domestic advanced nuclear industry of the United States; and

(6) making limited quantities of high-assay, low-enriched uranium available from Department of Energy stockpiles of uranium would allow for initial fuel testing and demonstration of advanced nuclear reactor concepts, accelerating—

(A) the path to market of those concepts; and

(B) the development of—

(i) a market for advanced nuclear reactors; and

(ii) a resulting growing commercial nuclear fuel cycle capability.

(b) AMENDMENT.—

(1) IN GENERAL.—Subtitle E of title IX of the Energy Policy Act of 2005 (42 U.S.C. 16271 et seq.) (as amended by section 5(a)) is amended by adding at the end the following:

SEC. 960. ADVANCED NUCLEAR FUEL SECURITY PROGRAM.

(a) DEFINITIONS.—In this section:

(1) HALEU TRANSPORTATION PACKAGE.—The term "HALEU transportation package" means a transportation package that is suitable for transporting high-assay, low-enriched uranium.

(2) HIGH-ASSAY, LOW-ENRICHED URANIUM.—The term "high-assay, low-enriched uranium" means uranium with an assay greater than 5 weight percent, but less than 20 weight percent, of the uranium-235 isotope.

(3) HIGH-ENRICHED URANIUM.—The term "high-enriched uranium" means uranium with an assay of 20 weight percent or more of the uranium-235 isotope.

(b) HIGH-ASSAY, LOW-ENRICHED URANIUM PROGRAM FOR ADVANCED REACTORS.

(1) ESTABLISHMENT.—Not later than 1 year after the date of enactment of this section, the Secretary shall establish a program to make available high-assay, low-enriched uranium, through contracts for sale, resale, transfer, or lease, for use in commercial or noncommercial advanced nuclear reactors.

(2) NUCLEAR FUEL OWNERSHIP.—Each lease under this subsection shall include a provision establishing that the nuclear fuel that is the subject of the lease shall remain the property of the Department, including with respect to responsibility for the final disposition of all radioactive waste created by the irradiation, processing, or purification of any leased uranium.

(3) QUANTITY.—In carrying out the program under this subsection, the Secretary shall make available—

(A) by December 31, 2022, high-assay, low-enriched uranium containing not less than 2 metric tons of the uranium-235 isotope; and

(B) by December 31, 2025, high-assay, low-enriched uranium containing not less than 10 metric tons of the uranium-235 isotope (as determined including the quantities of the uranium-235 isotope made available before December 31, 2022).

(4) FACTORS FOR CONSIDERATION.—In carrying out the program under this subsection, the Secretary shall take into consideration—

(A) options for providing the high-assay, low-enriched uranium under this subsection from a stockpile of uranium owned by the Department (including the National Nuclear Security Administration), including—

(i) fuel that—

(I) directly meets the needs of an end-user; but

(II) has been previously used or fabricated for another purpose;

(ii) fuel that can meet the needs of an end-user after removing radioactive or other contaminants that resulted from a previous use or fabrication of the fuel for research, development, demonstration, or deployment activities of the Department (including activities of the National Nuclear Security Administration); and

(iii) fuel from a high-enriched uranium stockpile, which can be blended with lower-assay uranium to become high-assay, low-enriched uranium to meet the needs of an end-user; and

(B) requirements to support molybdenum-99 production under the American Medical Isotopes Production Act of 2012 (Public Law 112–239; 126 Stat. 2211).

(5) LIMITATION.—The Secretary shall not barter or otherwise sell or transfer uranium in any form in exchange for services relating to the final disposition of radioactive waste from uranium that is the subject of a lease under this subsection.

(6) SUNSET.—The program under this subsection shall terminate on the earlier of—

(A) January 1, 2035; and

(B) the date on which uranium enriched up to, but not equal to, 20 weight percent can be obtained in the commercial market from domestic suppliers.

(c) REPORT.—

(1) IN GENERAL.—Not later than 180 days after the date of enactment of this section, the Secretary shall submit to the appropriate committees of Congress a report that describes actions proposed to be carried out by the Secretary—

(A) under the program under subsection (b); or

(B) otherwise to enable the commercial use of high-assay, low-enriched uranium.

(2) COORDINATION AND STAKEHOLDER INPUT.—In developing the report under this subsection, the Secretary shall seek input from—

(A) the Nuclear Regulatory Commission;

(B) the National Laboratories;

(C) institutions of higher education;

(D) producers of medical isotopes;

(E) a diverse group of entities operating in the nuclear energy industry; and

(F) a diverse group of technology developers.

(3) COST AND SCHEDULE ESTIMATES.—The report under this subsection shall include estimated costs, budgets, and timeframes for enabling the use of high-assay, low-enriched uranium.

(4) REQUIRED EVALUATIONS.—The report under this subsection shall evaluate—

(A) the costs and actions required to establish and carry out the program under subsection (b), including with respect to—

(i) proposed preliminary terms for the sale, resale, transfer, and leasing of high-assay, low-enriched uranium (including guidelines defining the roles and responsibilities between the Department and the purchaser, transfer recipient, or lessee); and

(ii) the potential to coordinate with purchasers, transfer recipients, and lessees regarding—

(I) fuel fabrication; and

(II) fuel transport;

(B) the potential sources and fuel forms available to provide uranium for the program under subsection (b);

(C) options to coordinate the program under subsection (b) with the operation of the versatile, reactor-based fast neutron source under section 959A;

(D) the ability of the domestic uranium market to provide materials for advanced nuclear reactor fuel; and

(E) any associated legal, regulatory, and policy issues that should be addressed to enable—

(i) the program under subsection (b); and

(ii) the establishment of a domestic industry capable of providing high-assay, low-enriched uranium for commercial and noncommercial purposes, including with respect to the needs of—

(I) the Department;

(II) the Department of Defense; and

(III) the National Nuclear Security Administration.

(d) HALEU TRANSPORTATION PACKAGE RESEARCH PROGRAM.—

(1) IN GENERAL.—As soon as practicable after the date of enactment of this section, the Secretary shall establish a research, development, and demonstration program under which the Secretary shall provide grants, on a competitive basis, to establish the capability to transport high-assay, low-enriched uranium.

(2) REQUIREMENT.—The focus of the program under this subsection shall be to establish 1 or more HALEU transportation packages that can be certified by the Nuclear Regulatory Commission to transport high-assay, low-enriched uranium to the various facilities involved in producing or using nuclear fuel containing high-assay, low-enriched uranium, such as—

(A) enrichment facilities;
(B) fuel processing facilities;
(C) fuel fabrication facilities; and
(D) nuclear reactors..

(2) TABLE OF CONTENTS.—The table of contents of the Energy Policy Act of 2005 (Public Law 109–58; 119 Stat. 594) (as amended by section 5(b)) is amended by inserting after the item relating to section 959B the following:

"Sec. 960. Advanced nuclear fuel security program.".

SEC. 8. UNIVERSITY NUCLEAR LEADERSHIP PROGRAM.

(a) FINDINGS.—Congress finds that—

(1) NUCLEAR POWER PLANTS—

(A) generate billions of dollars in national economic activity through procurements throughout the United States; and

(B) provide tens of thousands of people in the United States with high-paying jobs, contributing substantially to the local economies of the communities in which the plants operate;

(2) the world market for the growth of commercial nuclear power was estimated by the Department of Commerce to be valued at up to $740,000,000,000 during the period of calendar years 2018 through 2028;

(3) the participation and leadership of the United States in the market described in paragraph (2) will

(A)(i) increase economic activity in the United States through robust nuclear exports, leading to the enhanced economic security of the United States; and

(ii) preserve and enhance the ability of the United States to positively influence international nuclear safety, security, and nonproliferation standards through commercial engagement with other nations; but

(B) require significant investment in United States-origin advanced nuclear technologies;

(4) in order to lead the world in the next generation of commercial nuclear power, the advanced nuclear industry in the United States should be positioned for accelerated growth, which requires public-private partnerships between industry entities and the Federal Government;

(5) success in achieving the goals described in this subsection will require a whole-government Federal approach that focuses on the shared needs and individual mission requirements of, at a minimum

(A) the Department of Energy;
(B) the National Nuclear Security Administration; and
(C) the Nuclear Regulatory Commission;

(6) advanced reactors present new challenges and opportunities in reactor design, safeguards, and regulation;

(7) the challenges referred to in paragraph (6)

(A) are directly relevant to the missions of

(i) the Office of Nuclear Energy of the Department of Energy;
(ii) the National Nuclear Security Administration; and
(iii) the Nuclear Regulatory Commission; and

(B) require a highly skilled workforce in order to be met; and

(8) nuclear science and engineering programs at institutions of higher education in the United States—

(A) annually award degrees in nuclear engineering and related fields to more than 600 undergraduate students, and 500 graduate students, who are critical to maintaining United States leadership in the development of advanced nuclear systems;

(B) perform cutting-edge research and technology development activities that have made fundamental contributions to advancing United States nuclear technology; and

(C) support workforce development critical to maintaining United States leadership in nuclear detection, nonproliferation, nuclear medicine, advanced manufacturing, and other non-energy areas.

(b) AMENDMENT.—Section 313 of the Energy and Water Development and Related Agencies Appropriations Act, 2009 (42 U.S.C. 16274a), is amended to read as follows:

SEC. 313. UNIVERSITY NUCLEAR LEADERSHIP PROGRAM.

(a) DEFINITIONS.—In this section:

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

(A) a nuclear fission reactor, including a prototype plant (as defined in sections 50.2 and 52.1 of title 10, Code of Federal Regulations (or successor regulations)), with significant improvements compared to the most recent generation of fission reactors, including improvements such as—

(i) additional inherent safety features;
(ii) lower waste yields;
(iii) improved fuel performance;
(iv) increased tolerance to loss of fuel cooling;
(v) enhanced reliability;
(vi) increased proliferation resistance;
(vii) increased thermal efficiency;
(viii) reduced consumption of cooling water;
(ix) the ability to integrate into electric applications and nonelectric applications;
(x) modular sizes to allow for deployment that corresponds with the demand for electricity; or
(xi) operational flexibility to respond to changes in demand for electricity and to complement integration with intermittent renewable energy; and

(B) a fusion reactor.

(2) INSTITUTION OF HIGHER EDUCATION.—The term 'institution of higher education' has the meaning given the term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)).

(3) PROGRAM.—The term 'Program' means the University Nuclear Leadership Program established under subsection (b).

(b) ESTABLISHMENT.—The Secretary of Energy, the Administrator of the National Nuclear Security Administration, and the Chairman of the Nuclear Regulatory Commission shall jointly establish a program, to be known as the 'University Nuclear Leadership Program'.

(c) USE OF FUNDS.—

(1) IN GENERAL.—Except as provided in paragraph (2), amounts made available to carry out the Program shall be used to provide financial assistance for scholarships, fellowships, and research and development projects at institutions of higher education in areas relevant to the programmatic mission of the applicable Federal agency providing the financial assistance with respect to research, development, demonstration, and deployment activities for technologies relevant to advanced nuclear reactors, including relevant fuel cycle technologies.

(2) EXCEPTION.—Notwithstanding paragraph (1), amounts made available to carry out the Program may be used to provide financial assistance for a scholarship, fellowship, or multiyear research and development project that does not align directly with a programmatic mission of the applicable Federal agency providing the financial assistance, if the activity for which assistance is provided would facilitate the maintenance of the discipline of nuclear science or nuclear engineering.

(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out the Program for fiscal year 2020 and each fiscal year thereafter—

(1) $30,000,000 to the Secretary of Energy, of which $15,000,000 shall be for use by the Administrator of the National Nuclear Security Administration; and

(2) $15,000,000 to the Nuclear Regulatory Commission.

PURPOSE

The purpose of S. 903 is to direct the Secretary of Energy to establish advanced nuclear goals, provide for a versatile, reactor-based fast neutron source, and make available high-assay, low-enriched uranium (HALEU) for research, development, and demonstration (RD&D) of advanced nuclear reactor concepts.

BACKGROUND AND NEED

Nuclear plants have operated safely and reliably since their initial commercial deployment in the 1950s in the U.S.—and currently represent about 60 percent of the United States' carbon free power and nearly 20 percent of all of the nation's electric power generation. Civil nuclear technology today heavily relies on light-water reactor technology developed in the 1950s for use by the U.S. Navy.

Because the U.S. had the most robust and advanced technology at the time, the U.S. was the undisputed international leader on proliferation safeguards, technology, materials, and global industry safety standards. Additionally, the nuclear science and engineering ecosystem developed within the U.S. to support the commercial and defense sectors was comprised of the world's best laboratory capabilities, university professors, and nuclear supply chain, which bolstered our national security enterprise, including the best-in class naval reactors on U.S. submarines and aircraft carriers.

These same experts were testing light-water technologies and other more exotic advanced reactor designs at sites that would become today's Department of Energy (DOE) national laboratories. At that time, the U.S. was investigating different types of coolants, fuels, and materials that promised increased reactor performance. However, many of the technologies and materials were not yet ready for full-scale commercial deployment.

Due to the economic challenges that face large light water reactors and interests to reduce carbon, innovators around the world have been working to commercialize advanced nuclear reactors. In doing so, they are revisiting data collected during the 1960s, but moving beyond initial tests to design the next-generation of reactors. While based on old concepts, the innovations rely on new ideas and employ state of the art computer engineering, physics, design tools, and materials.

The U.S. has ceded global nuclear leadership to China and Russia

The U.S. has since lost its position in global nuclear leadership, having been surpassed by China and Russia. These nations and other U.S. competitors continued to build new nuclear reactors through the 1990s and 2000s, within their borders and around the world. Since 1990, the U.S. has completed only one commercial reactor construction project, at the Tennessee Valley Authority's Watts Bar plant (although this reactor's construction was started in the 1980s and then put on hold for decades until completion in 2016).

The health of the U.S. nuclear sector will depend on not only its ability to deploy reactors domestically, but on its ability to meet global market needs. More than 1.3 billion people will require electricity to move out of poverty while simultaneously working to cut carbon emissions. The Chinese government has committed to construct 120 to 150 gigawatts-electric of nuclear by 2030 and India wishes to meet 25 percent of its electricity needs with nuclear energy by 2050. Access to the global nuclear market, which is estimated at over $75 billion in new investment annually, and ability to provide advanced nuclear technologies on a relevant timescale will determine the competitiveness of U.S.-based technologies.

In addition, the U.S. has prematurely shut down seven reactors since 2013, due to various issues, including economic competition from natural gas and subsidized renewables, anti-nuclear political pressure, and maintenance challenges. There are now 98 commercial reactors operating in the U.S. with only two new units currently under construction and an additional 12 units scheduled to be closed by 2025. Continued investment in material and fuel research is essential for maintaining the viability of the commercial reactor fleet.

The loss of U.S. nuclear leadership has broad impacts

The loss of leadership equates to adverse effects on U.S. clean energy generation, economic competitiveness, and national security. To reestablish global nuclear leadership, the U.S. must have a healthy nuclear ecosystem capable of designing and deploying the most advanced reactor concepts in the world at a competitive price.

At the Committee's February 28, 2019, hearing to examine global markets, Dr. Fatih Birol, the Executive Director of the International Energy Agency, testified as to the importance of nuclear energy within the U.S. energy generation mix, as well as American global leadership on nuclear issues. At the Committee's February 7, 2019, hearing on the status and outlook of energy innovation in the United States, multiple witnesses testified regarding the importance of advanced nuclear technologies as key components in a future generation mix that is clean, safe, reliable, flexible, and diverse.

Fortunately, there is a burgeoning community of advanced reactor innovators in the U.S., led by the private sector and supported by DOE and its national laboratories. A study by Third Way in 2016 identified 54 advanced reactor developers in the U.S. Three of these companies provided testimony to the Committee at a May 17, 2016, hearing on advanced nuclear technologies.

Micro-reactors can lower emissions, power remote communities, and further national security efforts

One of the most challenging sectors of the energy economy from which to lower carbon emissions is the diesel generation market. Powering small remote communities, military installations, and remote mineral development projects, as well as providing backup power for high-value assets, continuous manufacturing processes, hospitals, and other community services are all dominated by diesel generation, which is often high-cost and high-emissions. Recent studies have shown that a subset of advanced reactors, called micro-reactors, could provide power on the order of single megawatts, be immediately competitive with diesel power, and lower energy costs substantially.

As authorized by the John S. McCain National Defense Authorization Act of Fiscal Year 2019 (Public Law 115–232), the Department of Defense (DoD) and DOE are exploring potential micro-reactors that could provide reliable and resilient power to DoD bases and installations. This effort is building upon other work that has examined the usefulness of micro-reactors or small modular reactors for defense needs, including a Defense Science Board Report from 2016 and a study by Sandia National Laboratory for the U.S. Air Force.

Industrial applications

The industrial sector relies on process heat to manufacture iron and steel, forest products, advanced materials, cement, glass, and many other products. Process heat requires a high amount of energy in order to reach temperatures as high as 1500°C and is currently dependent on carbon-intensive technologies. The industrial sector represents around 20 percent of total direct U.S. greenhouse gas emissions and will require technological advances in nuclear energy to become a zero emission sector. Additionally, advanced

nuclear could also play a critical role in hydrogen production and seawater desalination processes.

Challenges facing commercial nuclear innovation

Despite the many anticipated benefits of advanced reactors, including micro-reactors, there are many challenges that stand in the way of commercial nuclear innovators based in the U.S. bringing technologies to market in a globally relevant timeframe.

The advanced nuclear industry needs access to testing capabilities that do not currently exist in the U.S., including neutron irradiation facilities with a fast-neutron spectrum, and access to high assay low-enriched uranium, which is not commercially available in the U.S. There is also the need to identify and develop a market for early first adopters of their technologies. Meanwhile, the advanced nuclear industry, DOE, the National Nuclear Security Agency, and the Nuclear Regulatory Commission all need qualified nuclear scientists and engineers who can research, develop, commercialize, regulate, and safeguard advanced nuclear reactor technologies. S. 903, the Nuclear Energy Leadership Act, would set new policies for DOE to facilitate public-private partnerships to meet these specific challenges and accelerate the path to market for multiple advanced nuclear reactor technologies.

Driven by the need for reliable carbon-free power, many nations are considering nuclear energy for their futures. According to an International Trade Commission Report, in 2016 the U.S. Department of Commerce estimated that the global nuclear market may be worth up to $740 billion over 10 years. Competitor nations will continue pursuing their own advanced reactor concepts, making the export of nuclear technologies a geostrategic national goal. Many companies in competitor nations are state-owned enterprises. The governments of China and Russia fully back their nationalized nuclear corporations when opportunities for export arise in the global marketplace.

U.S.-based companies can compete globally if they lead the world with the best technologies. S. 903 is intended to position U.S. innovators to successfully develop, demonstrate, and deploy their advanced reactor concepts and reestablish the U.S. as the global nuclear leader.

LEGISLATIVE HISTORY

S. 903 was introduced by Senator Murkowski, for herself and Senators Booker, Alexander, Manchin, Risch, Whitehouse, Crapo, Coons, Capito, Duckworth, Sullivan, Bennet, Graham, Portman, and Gardner, on March 27, 2019. Senators Braun, Cardin, Cramer, and Jones were added as cosponsors. The Senate Committee on Energy and Natural Resources held a hearing on S. 903 on April 30, 2019.

Similar legislation, H.R. 3306, was introduced in the House of Representatives by Representative Luria on June 18, 2019 and referred to the Science, Space and Technology Committee; the Energy and Commerce Committee; the Oversight and Reform Committee; and the Armed Services Committee.

In the 115th Congress, Senator Murkowski, for herself and Senators Booker, Risch, Crapo, Capito, Durbin, Whitehouse, Manchin, and Coons, introduced nearly identical legislation, S. 3422, on Sep-

tember 6, 2018. Senators Bennet and Duckworth were added as cosponsors. The Energy and Natural Resources Committee conducted a hearing on S. 3422 on November 29, 2018.

Related legislation, H.R. 5260, was introduced in the House of Representatives by Representative Higgins on May 22, 2018, and referred to the Science, Space and Technology Committee. H.R. 4378, related legislation, was introduced in the House of Representatives by Representative Weber on November 13, 2017, and was reported by the Science, Space and Technology Committee on February 13, 2018 (H. Rept. 115–557). The House passed H.R. 4378 by voice vote on February 2, 2018, and the measure was referred to the Committee on Energy and Natural Resources in the Senate.

The Committee on Energy and Natural Resources met in open business session on July 16, 2019, and ordered S. 903 favorably reported, as amended.

COMMITTEE RECOMMENDATION

The Committee on Energy and Natural Resources, in open business session on July 16, 2019, by a majority voice vote of a quorum present, recommends that the Senate pass S. 903, if amended as described herein. Senators Lee and Hirono asked to be recorded as voting no.

COMMITTEE AMENDMENT

During its consideration of S. 903, the Committee adopted an amendment in the nature of a substitute. The substitute amendment modifies section 640 of the Energy Policy Act of 2005 (EPAct 2005, Public Law 109–58), as added by section 3 of the bill, to clarify that only a reactor that receives its first license from the Nuclear Regulatory Commission after January 1, 2019, can qualify for the Commercial Nuclear power purchase agreement (PPA) pilot program. It also adds the word "nuclear" before "power purchase agreement" in section 640(a) for further clarification.

The substitute amendment modifies the definition of "Demonstration Project" in section 959A of EPAct 2005, as added by section 4 of the bill, to include the demonstration of privately funded experimental advanced reactors on DOE land and advanced reactors demonstrated by DOD in cooperation with DOE.

The substitute amendment modifies section 959A(c) to use the phrase "enter into agreements to complete" instead of "the Secretary of Energy shall demonstrate."

The substitute amendment adds a new section 959A(c)(2)(C)(iii) specifying that the external review is not required for reactors that are not Federally funded. The amendment further modifies section 959A(c)(2)(D) to clarify that cost-sharing provisions in section 988 of EPAct 2005 only apply to Federally-funded demonstration projects.

The substitute amendment adds a new section 959A(c)(2)(G) requiring that the Secretary of Energy seek to ensure demonstrations projects will not slow existing advanced reactor deployments underway at time of enactment.

The substitute amendment also adds a new finding to section 7 of the bill that nuclear fuel supply technology originating in the United States is not required for use in civilian advanced reactor

applications, and modifies the fourth finding in section 7 to clarify that no domestic uranium enrichment capability "is licensed" for HALEU instead of "exists."

The substitute amendment adds a new subsection (b)(4)(B) to section 960 of EPAct 2005, as added by section 6(b) of the bill, requiring the Secretary to consider the impact of the HALEU provision on DOE's requirements to support medical isotope production.

The substitute amendment adds a new subsection (c)(2)(D) to section 960 that adds medical isotope producers to the stakeholder list for the required report on options to provide HALEU for advanced reactor development.

The substitute amendment modifies the authorization of appropriations in section 313 of the 2009 Energy and Water Development and Related Agencies Appropriations Act (Public Law 111–8), as amended by section 8(b) of the bill, for the University Nuclear Leadership Program. The modification authorizes $45 million annually and is equally distributed between the Secretary of Energy, the National Nuclear Security Administration Administrator, and the Chairman of the Nuclear Regulatory Commission.

SECTION-BY-SECTION ANALYSIS

Section 1. Short title

Section 1 sets forth the short title of the bill.

Sec. 2. Authorization of long-term power purchase agreements

Section 2 amends 40 U.S.C. 501(b)(1)(B) to extend the maximum length of Federal power purchase agreements (PPAs) from 10 years to 40 years, and clarify that the contract costs for any fiscal year (FY) under the provision may be paid from the annual appropriations for that FY.

Sec. 3. Long-term nuclear power purchase agreement pilot program

Section 3 amends subtitle B of title VI of EPAct 2005 to add a new "Section 640. Long-Term Nuclear Power Purchase Agreement Pilot Program." The new section 640 directs the Secretary to establish a pilot program in which DOE will work with other relevant agencies to identify and enter into at least one federal PPA by December 31, 2023, from a new NRC-licensed nuclear power facility for a period longer than 10 years. Special consideration will be given to, and above market rates will be allowed for, first-of-a-kind or early deployment nuclear technologies that can provide reliable and resilient power to high-value assets for national security purposes or other national interest purposes, especially in remote off-grid scenarios or grid-connected scenarios that can provide emergency islanding power capabilities.

Sec. 4. Advanced nuclear research and development goals

Section 4 amends subtitle E of title IX of EPAct 2005 to add at the end a new "Section 959A. Advanced Nuclear Reactor Research and Development Goals." Subsection (a) of the new section 959A defines key terms. Subsection (b) requires the Secretary to advance the research and development of advanced reactor technologies. Subsection (c) directs the Secretary to enter into agreements to complete two or more advanced reactor technologies by December

31, 2025, and an additional two to five reactors by December 31, 2035; specifies requirements, including design diversity, special considerations, cost-effectiveness, and cost-share; and directs the Secretary to conduct R&D with the private sector. Subsection (d) directs the Secretary to establish goals for advanced nuclear reactor-related research that support the program's objectives, coordinate with private industry to advance design demonstrations, and ensure that research activities and programs meet certain requirements.

Sec. 5. Nuclear energy strategic plan

Section 5 amends subtitle E of title IX of EPAct 2005 to add at the end a new "Section 959B. Nuclear Energy Strategic Plan." The new section 959B requires the Secretary to develop a 10-year strategic plan for the Office of Nuclear Energy within 180 days after enactment of the act. The plan, which is to be provided to relevant Congressional committees, is required to identify those programs that directly support the goals developed under section 4, as well as those deemed important to DOE's mission. It also requires anticipated milestones for the success and sun-setting of current programs, while identifying future programs leading to a coherent and staged strategic plan. An update to the plan is required to be submitted to relevant Congressional committees every two years.

Sec. 6. Versatile, reactor-based fast neutron source

Section 6 amends section 955(c)(1) of EPAct 2005 to direct the Secretary to provide for a versatile, reactor-based fast neutron source, which shall operate as a national user facility.

Sec. 7. Advanced nuclear fuel security program

Section 7 sets forth Congressional findings and amends subtitle E of title IX of EPAct 2005 to add at the end a new "Section 960. Advanced Nuclear Fuel Security Program." Subsection (a) of the new section 960 defines key terms. Subsection (b)(1) directs the Secretary to establish a program, within one year of the date of enactment, to make available HALEU, through contracts for sale, resale, transfer, or lease, for use in commercial or noncommercial advanced nuclear reactors. Subsection (b)(2) requires the Department to retain ownership of the fuel and retain responsibility for disposing of radioactive waste. Subsection (b)(3) prescribes minimum quantities and date requirements for making HALEU available. Subsection (b)(4) prescribes factors the Secretary should take into consideration in carrying out the program under subsection (b), including providing HALEU from the Department's stockpile and requirements to support molybdenum-99 production. Subsection (b)(5) prohibits the Secretary from bartering or otherwise selling or transferring uranium in exchange for services relating to the disposal of radioactive waste from uranium leased under subsection (b). Subsection (b)(6) terminates the program on the earlier of January 1, 2035, or the date in which HALEU can be provided by the commercial market. Subsection (c) requires a comprehensive report to be provided to relevant Congressional committees within 180 days of the enactment. Subsection (d) requires the Secretary to conduct an R&D program for HALEU transportation.

Sec. 8. University nuclear leadership program

Section 8 sets forth Congressional findings and amends Section 313 of the 2009 Energy and Water Development and Related Agencies Appropriations Act (Public Law 111–8) to authorize the University Nuclear Leadership Program, to be administered jointly by the Secretary, the NNSA Administrator, and the NRC Chairman. The new program replaces the Integrated University Program which expires in 2019 and will provide financial assistance through scholarships, fellowships, and R&D projects at institutions of higher education in nuclear science and engineering, and related technical fields. This section authorizes $45 million annually for this program (the current funding level), to be split equally among the Secretary, NNSA Administrator, and the NRC.

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. 903. 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. 903, as ordered reported.

CONGRESSIONALLY DIRECTED SPENDING

S. 903, 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 Energy at the November 29, 2018, hearing on S. 3422, a similar bill to S. 903, follows:

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

> Nuclear energy is clean, reliable, and safe, but the nuclear power industry needs to continue to innovate.
>
> Advanced reactors, including small modular reactors, hold great promise as a clean, reliable, and secure power source for our nation. The Department recognizes that advanced reactors face challenges to ultimately achieving commercialization. In addition to early-stage research and development the Administration supports prioritized in-

vestments in nuclear energy research infrastructure to enable private sector innovation.

S. 3422 (MURKOWSKI–AK) NUCLEAR ENERGY LEADERSHIP ACT

The Nuclear Energy Leadership Act would enhance nuclear energy innovation, specifically related to advanced nuclear reactor technologies by providing goals for DOE to further accelerate the development of advanced reactor technologies, developing a program for making available the fuel required by these advanced reactors, and supporting the development of the high-skilled workforce needed to develop, regulate, and safeguard advanced reactors. This bill would also extend federal power purchase agreements (PPAs) from 10 years to 40 years, and require DOE to enter into at least one PPA from a commercial nuclear reactor by 2023.

DOE has reviewed this bill and has a few observations:

- The requirement to enter into at least one agreement to purchase power from a commercial nuclear reactor is achievable at Idaho National Laboratory if it is done through a phased agreement to include the Idaho Power Company. However, potential conflicts with state law may need to be addressed.
- The bill would authorize the Secretary to enter into one or more agreements to carry out no fewer than four (4) advanced nuclear reactor demonstration projects. This initiative would be dependent on the availability of appropriations to attain its objectives.
- This bill would direct the Department to construct a fast neutron-capable research facility. This is consistent with the Department's current plans to develop a Versatile Test Reactor.
- DOE acknowledges the need for a strategic plan and one is currently under development.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, changes in existing law made by the bill S. 903, as ordered 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 presented in roman):

TITLE 40—PUBLIC BUILDINGS, PROPERTY, AND WORKS

* * * * * * *

CHAPTER 5—PROPERTY MANAGEMENT

* * * * * * *

Subchapter 1—Procurement and Warehousing

§ 501. Services for executive agencies.

(a) AUTHORITY OF ADMINISTRATOR OF GENERAL SERVICES.—

(1) IN GENERAL.—The Administrator of General Services shall take action under this subchapter for an executive agency—

(A) to the extent that the Administrator of General Services determines that the action is advantageous to the Federal Government in terms of economy, efficiency, or service; and

(B) with due regard to the program activities of the agency.

(2) EXEMPTION FOR DEFENSE.—The Secretary of Defense may exempt the Department of Defense from an action taken by the Administrator of General Services under this subchapter, unless the President directs otherwise, whenever the Secretary determines that an exemption is in the best interests of national security.

(b) PROCUREMENT AND SUPPLY.—

(1) FUNCTIONS.—

(A) IN GENERAL.—The Administrator of General Services shall procure and supply personal property and nonpersonal services for executive agencies to use in the proper discharge of their responsibilities, and perform functions related to procurement and supply including contracting, inspection, storage, issue, property identification and classification, transportation and traffic management, management of public utility services, and repairing and converting.

[(B) PUBLIC UTILITY CONTRACTS.—A contract for public utility services may be made for a period of not more than 10 years.]

(B) PUBLIC UTILITY CONTRACTS.—

(i) TERM.—

(I) IN GENERAL.—A contract under this paragraph to purchase electricity from a public utility may be for a period of not more than 40 years.

(II) OTHER PUBLIC UTILITY SERVICES.—A contract under this paragraph for a public utility service other than a service described in subclause (I) may be for a period of not more than 10 years.

(ii) COSTS.—The cost of a contract under this paragraph for any fiscal year may be paid from the appropriations for that fiscal year..

* * * * * * *

THE ENERGY POLICY ACT OF 2005

Public Law 109–58

AN ACT To ensure jobs for our future with secure, affordable, and reliable energy

* * * * * * *

SECTION 1. SHORT TITLE; TABLE OF CONTENTS.

(a) SHORT TITLE.—This Act may be cited as the "Energy Policy Act of 2005".

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

* * * * * * *

TITLE VI—NUCLEAR MATTERS

* * * * * * *

Subtitle B—General Nuclear Matters

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TITLE IX—RESEARCH AND DEVELOPMENT

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Subtitle A—Energy Efficiency

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Subtitle E—Nuclear Energy

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TITLE VI—NUCLEAR MATTERS

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Subtitle B—General Nuclear Matters

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SEC. 640. LONG-TERM NUCLEAR POWER PURCHASE AGREEMENT PILOT PROGRAM.

(a) ESTABLISHMENT.—The Secretary shall establish a pilot program for a long-term nuclear power purchase agreement.

(b) REQUIREMENTS.—In developing the pilot program under this section, the Secretary shall—

(1) consult and coordinate with the heads of other Federal departments and agencies that may benefit from purchasing nuclear power for a period of longer than 10 years, including—

(A) the Secretary of Defense; and

(B) the Secretary of Homeland Security; and

(2) not later than December 31, 2023, enter into at least 1 agreement to purchase power from a commercial nuclear reactor that receives the first license for that reactor from the Nuclear Regulatory Commission after January 1, 2019.

(c) FACTORS FOR CONSIDERATION.—

(1) IN GENERAL.—In carrying out this section, the Secretary shall give special consideration to power purchase agreements for first-of-a-kind or early deployment nuclear technologies that can provide reliable and resilient power to high-value assets for national security purposes or other purposes as the Secretary determines to be in the national interest, especially in remote off-grid scenarios or grid-connected scenarios that can provide capabilities commonly known as 'islanding power capabilities' during an emergency scenario.

(2) EFFECT ON RATES.—An agreement to purchase power under this section may be at a rate that is higher than the average market rate, if the agreement fulfills an applicable consideration described in paragraph (1).

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TITLE IX—RESEARCH AND DEVELOPMENT

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Subtitle E—Nuclear Energy

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SEC. 955. DEPARTMENT OF ENERGY CIVILIAN NUCLEAR INFRASTRUCTURE AND FACILITIES.

* * * * * * *

(c) VERSATILE NEUTRON SOURCE.—

(1) ⟦MISSION NEED⟧ AUTHORIZATION.—(A) IN GENERAL.—Not later than December 31, 2017, the Secretary shall *provide* ⟦determine the mission need⟧ for a versatile reactor-based fast neutron source, which shall operate as a national user facility.

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SEC. 959A. ADVANCED NUCLEAR REACTOR RESEARCH AND DEVELOPMENT GOALS.

(a) DEFINITIONS.—In this section:

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

(A) a nuclear fission reactor, including a prototype plant (as defined in sections 50.2 and 52.1 of title 10, Code of Federal Regulations (or successor regulations)), with significant improvements compared to the most recent generation of fission reactors, including improvements such as—

(i) additional inherent safety features;

(ii) lower waste yields;
(iii) improved fuel performance;
(iv) increased tolerance to loss of fuel cooling;
(v) enhanced reliability;
(vi) increased proliferation resistance;
(vii) increased thermal efficiency;
(viii) reduced consumption of cooling water;
(ix) the ability to integrate into electric applications and nonelectric applications;
(x) modular sizes to allow for deployment that corresponds with the demand for electricity; or
(xi) operational flexibility to respond to changes in demand for electricity and to complement integration with intermittent renewable energy; and
(B) a fusion reactor.
(2) DEMONSTRATION PROJECT.—The term "demonstration project" means—
(A) an advanced nuclear reactor operated—
(i) as part of the power generation facilities of an electric utility system; or
(ii) in any other manner for the purpose of demonstrating the suitability for commercial application of the advanced nuclear reactor;
(B) the demonstration of privately funded experimental advanced nuclear reactors, funded in whole or in part by the private sector, at National Laboratories or other sites owned by the Department of Energy; and
(C) an advanced nuclear reactor demonstrated by the Secretary of Defense in cooperation with the Secretary of Energy.
(b) PURPOSE.—The purpose of this section is to direct the Secretary, as soon as practicable after the date of enactment of this section, to advance the research and development of domestic advanced, affordable, and clean nuclear energy by—
(1) demonstrating different advanced nuclear reactor technologies that could be used by the private sector to produce—
(A) emission-free power at a levelized cost of electricity of $60 per megawatt-hour or less;
(B) heat for community heating, industrial purposes, or synthetic fuel production;
(C) remote or off-grid energy supply; or
(D) backup or mission-critical power supplies;
(2) developing subgoals for nuclear energy research programs that would accomplish the goals of the demonstration projects carried out under subsection (c);
(3) identifying research areas that the private sector is unable or unwilling to undertake due to the cost of, or risks associated with, the research; and
(4) facilitating the access of the private sector—
(A) to Federal research facilities and personnel; and
(B) to the results of research relating to civil nuclear technology funded by the Federal Government.
(c) DEMONSTRATION PROJECTS.—
(1) IN GENERAL.—The Secretary shall, to the maximum extent practicable—

(A) enter into agreements to complete not fewer than 2 demonstration projects by not later than December 31, 2025; and

(B) establish a program to enter into agreements to demonstrate not fewer than 2, and not more than 5, additional operational advanced reactor designs by not later than December 31, 2035.

(2) REQUIREMENTS.—In carrying out demonstration projects under paragraph (1), the Secretary shall—

(A) include diversity in designs for the advanced nuclear reactors demonstrated under this section, including designs using various—

(i) primary coolants;

(ii) fuel types and compositions; and

(iii) neutron spectra;

(B) seek to ensure that—

(i) the long-term cost of electricity or heat for each design to be demonstrated under this subsection is cost-competitive in the applicable market;

(ii) the selected projects can meet the deadline established in paragraph (1) to demonstrate first-of-a-kind advanced nuclear reactor technologies, for which additional information shall be considered, including—

(I) the technology readiness level of a proposed advanced nuclear reactor technology;

(II) the technical abilities and qualifications of teams desiring to demonstrate a proposed advanced nuclear reactor technology; and

(III) the capacity to meet cost-share requirements of the Department;

(C) ensure that each evaluation of candidate technologies for the demonstration projects is completed through an external review of proposed designs, which review shall—

(i) be conducted by a panel that includes not fewer than 1 representative of each of—

(I) an electric utility; and

(II) an entity that uses high-temperature process heat for manufacturing or industrial processing, such as a petrochemical company, a manufacturer of metals, or a manufacturer of concrete;

(ii) include a review of cost-competitiveness and other value streams, together with the technology readiness level, of each design to be demonstrated under this subsection; and

(iii) not be required for a demonstration project that is not federally funded;

(D) for federally funded demonstration projects, enter into cost-sharing agreements with private sector partners in accordance with section 988 for the conduct of activities relating to the research, development, and demonstration of private-sector advanced nuclear reactor designs under the program;

(E) work with private sector partners to identify potential sites, including Department-owned sites, for demonstrations, as appropriate;

(F) align specific activities carried out under demonstration projects carried out under this subsection with priorities identified through direct consultations between

(i) the Department;

(ii) National Laboratories;

(iii) institutions of higher education;

(iv) traditional end-users (such as electric utilities);

(v) potential end-users of new technologies (such as users of high-temperature process heat for manufacturing processing, including petrochemical companies, manufacturers of metals, or manufacturers of concrete); and

(vi) developers of advanced nuclear reactor technology; and

(G) seek to ensure that the demonstration projects carried out under paragraph (1) do not cause any delay in a deployment of an advanced reactor by private industry and the Department of Energy that is underway as of the date of enactment of this section.

(3) ADDITIONAL REQUIREMENTS.—In carrying out demonstration projects under paragraph (1), the Secretary shall—

(A) identify candidate technologies that—

(i) are not developed sufficiently for demonstration within the initial required timeframe described in paragraph (1)(A); but

(ii) could be demonstrated within the timeframe described in paragraph (1)(B);

(B) identify technical challenges to the candidate technologies identified in subparagraph (A);

(C) support near-term research and development to address the highest-risk technical challenges to the successful demonstration of a selected advanced reactor technology, in accordance with—

(i) subparagraph (B); and

(ii) the research and development activities under section 958;

(D) establish such technology advisory working groups as the Secretary determines to be appropriate to advise the Secretary regarding the technical challenges identified under subparagraph (B) and the scope of research and development programs to address the challenges, in accordance with subparagraph (C), to be comprised of—

(i) private-sector advanced nuclear reactor technology developers;

(ii) technical experts with respect to the relevant technologies at institutions of higher education; and

(iii) technical experts at the National Laboratories.

(d) GOALS.—

(1) IN GENERAL.—The Secretary shall establish goals for research relating to advanced nuclear reactors facilitated by the Department that support the objectives of the program for demonstration projects established under subsection (c).

(2) COORDINATION.—In developing the goals under paragraph (1), the Secretary shall coordinate, on an ongoing basis, with

members of private industry to advance the demonstration of various designs of advanced nuclear reactors.

(3) REQUIREMENTS.—In developing the goals under paragraph (1), the Secretary shall ensure that—

(A) research activities facilitated by the Department to meet the goals developed under this subsection are focused on key areas of nuclear research and deployment ranging from basic science to full-design development, safety evaluation, and licensing;

(B) research programs designed to meet the goals emphasize—

(i) resolving materials challenges relating to extreme environments, including extremely high levels of—

(I) radiation fluence;

(II) temperature;

(III) pressure; and

(IV) corrosion; and

(ii) qualification of advanced fuels;

(C) activities are carried out that address near-term challenges in modeling and simulation to enable accelerated design and licensing;

(D) related technologies, such as technologies to manage, reduce, or reuse nuclear waste, are developed;

(E) nuclear research infrastructure is maintained or constructed, such as—

(i) currently operational research reactors at the National Laboratories and institutions of higher education;

(ii) hot cell research facilities;

(iii) a versatile fast neutron source; and

(iv) a molten salt testing facility;

(F) basic knowledge of non-light water coolant physics and chemistry is improved;

(G) advanced sensors and control systems are developed; and

(H) advanced manufacturing and advanced construction techniques and materials are investigated to reduce the cost of advanced nuclear reactors.

SEC. 959B. NUCLEAR ENERGY STRATEGIC PLAN.

(a) IN GENERAL.—Not later than 180 days after the date of enactment of this section, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committees on Energy and Commerce and Science, Space, and Technology of the House of Representatives a 10-year strategic plan for the Office of Nuclear Energy of the Department, in accordance with this section.

(b) REQUIREMENTS.—

(1) COMPONENTS.—The strategic plan under this section shall designate—

(A) programs that support the planned accomplishment of—

(i) the goals established under section 959A; and

(ii) the demonstration programs identified under subsection (c) of that section; and

(B) programs that—

(i) do not support the planned accomplishment of demonstration programs, or the goals, referred to in subparagraph (A); but

(ii) are important to the mission of the Office of Nuclear Energy, as determined by the Secretary.

(2) PROGRAM PLANNING.—In developing the strategic plan under this section, the Secretary shall specify expected timelines for, as applicable

(A) the accomplishment of relevant objectives under current programs of the Department; or

(B) the commencement of new programs to accomplish those objectives.

(c) UPDATES.—Not less frequently than once every 2 years, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committees on Energy and Commerce and Science, Space, and Technology of the House of Representatives an updated 10-year strategic plan in accordance with subsection (b), which shall identify, and provide a justification for, any major deviation from a previous strategic plan submitted under this section.

SEC. 960. ADVANCED NUCLEAR FUEL SECURITY PROGRAM.

(a) DEFINITIONS.—In this section:

(1) HALEU TRANSPORTATION PACKAGE.—The term 'HALEU transportation package' means a transportation package that is suitable for transporting high-assay, low-enriched uranium.

(2) HIGH-ASSAY, LOW-ENRICHED URANIUM.—The term 'high-assay, low-enriched uranium' means uranium with an assay greater than 5 weight percent, but less than 20 weight percent, of the uranium-235 isotope.

(3) HIGH-ENRICHED URANIUM.—The term 'high-enriched uranium' means uranium with an assay of 20 weight percent or more of the uranium-235 isotope.

(b) HIGH-ASSAY, LOW-ENRICHED URANIUM PROGRAM FOR ADVANCED REACTORS.—

(1) ESTABLISHMENT.—Not later than 1 year after the date of enactment of this section, the Secretary shall establish a program to make available high-assay, low-enriched uranium, through contracts for sale, resale, transfer, or lease, for use in commercial or noncommercial advanced nuclear reactors.

(2) NUCLEAR FUEL OWNERSHIP.—Each lease under this subsection shall include a provision establishing that the nuclear fuel that is the subject of the lease shall remain the property of the Department, including with respect to responsibility for the final disposition of all radioactive waste created by the irradiation, processing, or purification of any leased uranium.

(3) QUANTITY.—In carrying out the program under this subsection, the Secretary shall make available—

(A) by December 31, 2022, high-assay, low-enriched uranium containing not less than 2 metric tons of the uranium-235 isotope; and

(B) by December 31, 2025, high-assay, low-enriched uranium containing not less than 10 metric tons of the uranium-235 isotope (as determined including the quantities of the uranium-235 isotope made available before December 31, 2022).

(4) FACTORS FOR CONSIDERATION.—In carrying out the program under this subsection, the Secretary shall take into consideration—

(A) options for providing the high-assay, low-enriched uranium under this subsection from a stockpile of uranium owned by the Department (including the National Nuclear Security Administration), including—

(i) fuel that—

(I) directly meets the needs of an end-user; but

(II) has been previously used or fabricated for another purpose;

(ii) fuel that can meet the needs of an end-user after removing radioactive or other contaminants that resulted from a previous use or fabrication of the fuel for research, development, demonstration, or deployment activities of the Department (including activities of the National Nuclear Security Administration); and

(iii) fuel from a high-enriched uranium stockpile, which can be blended with lower-assay uranium to become high-assay, low-enriched uranium to meet the needs of an end-user; and

(B) requirements to support molybdenum-99 production under the American Medical Isotopes Production Act of 2012 (Public Law 112–239; 126 Stat. 2211).

(5) LIMITATION.—The Secretary shall not barter or otherwise sell or transfer uranium in any form in exchange for services relating to the final disposition of radioactive waste from uranium that is the subject of a lease under this subsection.

(6) SUNSET.—The program under this subsection shall terminate on the earlier of—

(A) January 1, 2035; and

(B) the date on which uranium enriched up to, but not equal to, 20 weight percent can be obtained in the commercial market from domestic suppliers.

(c) REPORT.—

(1) IN GENERAL.—Not later than 180 days after the date of enactment of this section, the Secretary shall submit to the appropriate committees of Congress a report that describes actions proposed to be carried out by the Secretary—

(A) under the program under subsection (b); or

(B) otherwise to enable the commercial use of high-assay, low-enriched uranium.

(2) COORDINATION AND STAKEHOLDER INPUT.—In developing the report under this subsection, the Secretary shall seek input from—

(A) the Nuclear Regulatory Commission;

(B) the National Laboratories;

(C) institutions of higher education;

(D) producers of medical isotopes;

(E) a diverse group of entities operating in the nuclear energy industry; and

(F) a diverse group of technology developers.

(3) COST AND SCHEDULE ESTIMATES.—The report under this subsection shall include estimated costs, budgets, and time-

frames for enabling the use of high-assay, low-enriched uranium.

(4) REQUIRED EVALUATIONS.—The report under this subsection shall evaluate—

(A) the costs and actions required to establish and carry out the program under subsection (b), including with respect to—

(i) proposed preliminary terms for the sale, resale, transfer, and leasing of high-assay, low-enriched uranium (including guidelines defining the roles and responsibilities between the Department and the purchaser, transfer recipient, or lessee); and

(ii) the potential to coordinate with purchasers, transfer recipients, and lessees regarding—

(I) fuel fabrication; and

(II) fuel transport;

(B) the potential sources and fuel forms available to provide uranium for the program under subsection (b);

(C) options to coordinate the program under subsection (b) with the operation of the versatile, reactor-based fast neutron source under section 959A;

(D) the ability of the domestic uranium market to provide materials for advanced nuclear reactor fuel; and

(E) any associated legal, regulatory, and policy issues that should be addressed to enable—

(i) the program under subsection (b); and

(ii) the establishment of a domestic industry capable of providing high-assay, low-enriched uranium for commercial and noncommercial purposes, including with respect to the needs of—

(I) the Department;

(II) the Department of Defense; and

(III) the National Nuclear Security Administration.

(d) HALEU TRANSPORTATION PACKAGE RESEARCH PROGRAM.—

(1) IN GENERAL.—As soon as practicable after the date of enactment of this section, the Secretary shall establish a research, development, and demonstration program under which the Secretary shall provide grants, on a competitive basis, to establish the capability to transport high-assay, low-enriched uranium.

(2) REQUIREMENT.—The focus of the program under this subsection shall be to establish 1 or more HALEU transportation packages that can be certified by the Nuclear Regulatory Commission to transport high-assay, low-enriched uranium to the various facilities involved in producing or using nuclear fuel containing high-assay, low-enriched uranium, such as—

(A) enrichment facilities;

(B) fuel processing facilities;

(C) fuel fabrication facilities; and

(D) nuclear reactors.

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OMNIBUS APPROPRIATIONS ACT, 2009

Public Law 111–8

AN ACT Making omnibus appropriations for the fiscal year ending September 30, 2009, and for other purposes

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DIVISION C—ENERGY AND WATER DEVELOPMENT AND RELATED AGENCIES APPROPRIATIONS ACT, 2009

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TITLE III—DEPARTMENT OF ENERGY

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General Provisions—Department of Energy

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[SEC. 313. INTEGRATED UNIVERSITY PROGRAM.

[(a) The Secretary of Energy, along with the Administrator of the National Nuclear Security Administration and the Chairman of the Nuclear Regulatory Commission, shall establish an Integrated University Program.

[(b) For the purposes of carrying out this section, $45,000,000 is authorized to be appropriated in each of fiscal years 2009 to 2019 as follows:

[(1) $15,000,000 for the Department of Energy;

[(2) $15,000,000 for the Nuclear Regulatory Commission; and

[(3) $15,000,000 for the National Nuclear Security Administration.

[(c) Of the amounts authorized to carry out this section, $10,000,000 shall be used by each organization to support university research and development in areas relevant to their respective organization's mission, and $5,000,000 shall be used by each organization to support a jointly implemented Nuclear Science and Engineering Grant Program that will support multiyear research projects that do not align with programmatic missions but are critical to maintaining the discipline of nuclear science and engineering.]

SEC. 313. UNIVERSITY NUCLEAR LEADERSHIP PROGRAM.

(a) DEFINITIONS.—In this section:

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

(A) a nuclear fission reactor, including a prototype plant (as defined in sections 50.2 and 52.1 of title 10, Code of Federal Regulations (or successor regulations)), with significant improvements compared to the most recent generation of fission reactors, including improvements such as—

(i) additional inherent safety features;

(ii) lower waste yields;

(iii) improved fuel performance;
(iv) increased tolerance to loss of fuel cooling;
(v) enhanced reliability;
(vi) increased proliferation resistance;
(vii) increased thermal efficiency;
(viii) reduced consumption of cooling water;
(ix) the ability to integrate into electric applications and nonelectric applications;
(x) modular sizes to allow for deployment that corresponds with the demand for electricity; or
(xi) operational flexibility to respond to changes in demand for electricity and to complement integration with intermittent renewable energy; and
(B) a fusion reactor.

(2) INSTITUTION OF HIGHER EDUCATION.—The term 'institution of higher education' has the meaning given the term in section 101(a) of the Higher Education Act of 1965 (20 U.S.C. 1001(a)).

(3) PROGRAM.—The term 'Program' means the University Nuclear Leadership Program established under subsection (b).

(b) ESTABLISHMENT.—The Secretary of Energy, the Administrator of the National Nuclear Security Administration, and the Chairman of the Nuclear Regulatory Commission shall jointly establish a program, to be known as the 'University Nuclear Leadership Program'.

(c) USE OF FUNDS.—

(1) IN GENERAL.—Except as provided in paragraph (2), amounts made available to carry out the Program shall be used to provide financial assistance for scholarships, fellowships, and research and development projects at institutions of higher education in areas relevant to the programmatic mission of the applicable Federal agency providing the financial assistance with respect to research, development, demonstration, and deployment activities for technologies relevant to advanced nuclear reactors, including relevant fuel cycle technologies.

(2) EXCEPTION.—Notwithstanding paragraph (1), amounts made available to carry out the Program may be used to provide financial assistance for a scholarship, fellowship, or multiyear research and development project that does not align directly with a programmatic mission of the applicable Federal agency providing the financial assistance, if the activity for which assistance is provided would facilitate the maintenance of the discipline of nuclear science or nuclear engineering.

(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out the Program for fiscal year 2020 and each fiscal year thereafter—

(1) $30,000,000 to the Secretary of Energy, of which $15,000,000 shall be for use by the Administrator of the National Nuclear Security Administration; and

(2) $15,000,000 to the Nuclear Regulatory Commission.

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