

ciated with the objectives described in subparagraphs (A) through (F).

**(b) Definitions**

In this part:

**(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 reactors operating on December 27, 2020, including improvements such as—

- (i) additional inherent safety features;
- (ii) lower waste yields;
- (iii) improved fuel and material performance;
- (iv) increased tolerance to loss of fuel cooling;
- (v) enhanced reliability or improved resilience;
- (vi) increased proliferation resistance;
- (vii) increased thermal efficiency;
- (viii) reduced consumption of cooling water and other environmental impacts;
- (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 process heat; and
- (xi) operational flexibility to respond to changes in demand for electricity or process heat and to complement integration with intermittent renewable energy or energy storage; and

(B) a fusion reactor.

**(2) Commission**

The term “Commission” means the Nuclear Regulatory Commission.

**(3) Fast neutron**

The term “fast neutron” means a neutron with kinetic energy above 100 kiloelectron volts.

**(4) National Laboratory**

**(A) In general**

Except as provided in subparagraph (B), the term “National Laboratory” has the meaning given the term in section 15801 of this title.

**(B) Limitation**

With respect to the Lawrence Livermore National Laboratory, the Los Alamos National Laboratory, and the Sandia National Laboratories, the term “National Laboratory” means only the civilian activities of the laboratory.

**(5) Neutron flux**

The term “neutron flux” means the intensity of neutron radiation measured as a rate of flow of neutrons applied over an area.

**(6) Neutron source**

The term “neutron source” means a research machine that provides neutron irradiation services for—

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

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

(Pub. L. 109–58, title IX, §951, Aug. 8, 2005, 119 Stat. 884; Pub. L. 115–248, §2(a), Sept. 28, 2018, 132 Stat. 3154; Pub. L. 116–260, div. Z, title II, §2002, Dec. 27, 2020, 134 Stat. 2459.)

AMENDMENTS

2020—Subsec. (b)(1). Pub. L. 116–260 amended par. (1) generally. Prior to amendment, par. (1) defined the term “advanced nuclear reactor”.

2018—Pub. L. 115–248 amended section generally. Prior to amendment, section related to civilian nuclear energy research programs and authorizations of appropriations to carry out such programs.

**§ 16272. Reactor concepts research, development, demonstration, and commercial application**

**(a) Sustainability program for light water reactors**

**(1) In general**

The Secretary shall carry out a program of research, development, demonstration, and commercial application, including through the use of modeling and simulation, to support existing operating nuclear power plants which shall address technologies to modernize and improve, with respect to such plants—

- (A) reliability;
- (B) capacity;
- (C) component aging;
- (D) safety;
- (E) physical security and security costs;
- (F) plant lifetime;
- (G) operations and maintenance costs, including by utilizing risk-informed systems analysis;
- (H) the ability for plants to operate flexibly;
- (I) nuclear integrated energy system applications described in subsection (c);
- (J) efficiency;
- (K) environmental impacts; and
- (L) resilience.

**(2) Authorization of appropriations**

There are authorized to be appropriated to the Secretary to carry out the program under this subsection \$55,000,000 for each of fiscal years 2021 through 2025.

**(3) Report**

The Secretary shall submit annually a public report to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate documenting funds spent under the program that describes program activities, objectives, and outcomes, including those that could benefit the entirety of the existing reactor fleet, such as with respect to aging management and related sustainability concerns, and identifying funds awarded to private entities.

**(b) Advanced reactor technologies**

**(1) In general**

The Secretary shall carry out a program of research, development, demonstration, and

commercial application to support advanced reactor technologies.

**(2) Requirements**

In carrying out the program under this subsection, the Secretary shall—

(A) prioritize designs for advanced nuclear reactors that are proliferation resistant and passively safe, including designs that, compared to reactors operating on December 27, 2020—

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

(ii) have higher efficiency, lower cost, less environmental impacts, increased resilience, and improved safety;

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

(iv) use advanced instrumentation and monitoring systems;

(B) consult with the Nuclear Regulatory Commission on appropriate metrics to consider for the criteria specified in subparagraph (A);

(C) support research and development to resolve materials challenges relating to extreme environments, including environments that contain high levels of—

(i) radiation fluence;

(ii) temperature;

(iii) pressure; and

(iv) corrosion;

(D) support research and development to aid in the qualification of advanced fuels, including fabrication techniques;

(E) support activities that address near-term challenges in modeling and simulation to enable accelerated design of and licensing of advanced nuclear reactors, including the identification of tools and methodologies for validating such modeling and simulation efforts;

(F) develop technologies, including technologies to manage, reduce, or reuse nuclear waste;

(G) ensure that nuclear research infrastructure is maintained or constructed, including—

(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) advanced coolant testing facilities, including coolants such as lead, sodium, gas, and molten salt;

(H) improve scientific understanding of nonlight water coolant physics and chemistry;

(I) develop advanced sensors and control systems, including the identification of tools and methodologies for validating such sensors and systems;

(J) investigate advanced manufacturing and advanced construction techniques and materials to reduce the cost of advanced nuclear reactors, including the use of digital twins and of strategies to implement project and construction management best prac-

tices, and study the effects of radiation and corrosion on materials created with these techniques;

(K) consult with the Administrator of the National Nuclear Security Administration to integrate reactor safeguards and security into design;

(L) support efforts to reduce any technical barriers that would prevent commercial application of advanced nuclear energy systems; and

(M) develop various safety analyses and emergency preparedness and response methodologies.

**(3) Coordination**

The Secretary shall coordinate with individuals engaged in the private sector and individuals who are experts in nuclear nonproliferation, environmental and public health and safety, and economics to advance the development of various designs of advanced nuclear reactors. In carrying out this paragraph, the Secretary shall convene an advisory committee of such individuals and such committee shall submit annually a report to the relevant committees of Congress with respect to the progress of the program.

**(4) Authorization of appropriations**

There are authorized to be appropriated to the Secretary to carry out the program under this subsection \$55,000,000 for each of fiscal years 2021 through 2025.

**(c) Nuclear integrated energy systems research, development, demonstration, and commercial application program**

**(1) In general**

The Secretary shall carry out a program of research, development, demonstration, and commercial application to develop nuclear integrated energy systems, composed of 2 or more co-located or jointly operated subsystems of energy generation, energy storage, or other technologies and in which not less than 1 such subsystem is a nuclear energy system, to—

(A) reduce greenhouse gas emissions in both the power and nonpower sectors; and

(B) maximize energy production and efficiency.

**(2) Coordination**

In carrying out the program under paragraph (1), the Secretary shall coordinate with—

(A) relevant program offices within the Department of Energy;

(B) National Laboratories;

(C) institutions of higher education; and

(D) the private sector.

**(3) Focus areas**

The program under paragraph (1) may include research, development, demonstration, or commercial application of nuclear integrated energy systems with respect to—

(A) desalination technologies and processes;

(B) hydrogen or other liquid and gaseous fuel or chemical production;

- (C) heat for industrial processes;
- (D) district heating;
- (E) heat or electricity generation and storage;
- (F) carbon capture, use, utilization, and storage;
- (G) microgrid or island applications;
- (H) integrated systems modeling, analysis, and optimization, inclusive of different configurations of integrated energy systems; and
- (I) integrated design, planning, building, and operation of systems with existing infrastructure, including interconnection requirements with the electric grid, as appropriate.

**(4) Authorization of appropriations**

There are authorized to be appropriated to the Secretary to carry out the program under this subsection—

- (A) \$20,000,000 for fiscal year 2021;
- (B) \$30,000,000 for fiscal year 2022;
- (C) \$30,000,000 for fiscal year 2023;
- (D) \$40,000,000 for fiscal year 2024; and
- (E) \$40,000,000 for fiscal year 2025.

(Pub. L. 109–58, title IX, §952, Aug. 8, 2005, 119 Stat. 885; Pub. L. 115–248, §2(b)(1), Sept. 28, 2018, 132 Stat. 3155; Pub. L. 116–260, div. Z, title II, §2003(a), Dec. 27, 2020, 134 Stat. 2459.)

AMENDMENTS

2020—Pub. L. 116–260 amended section generally. Prior to amendment, section related to nuclear energy research programs.

2018—Subsecs. (c) to (e). Pub. L. 115–248 redesignated subsecs. (d) and (e) as (c) and (d), respectively, and struck out former subsec. (c) which related to establishment and administration of a Nuclear Power 2010 Program.

**§ 16273. Fuel cycle research, development, demonstration, and commercial application**

**(a) Used nuclear fuel research, development, demonstration, and commercial application**

**(1) In general**

The Secretary shall conduct an advanced fuel cycle research, development, demonstration, and commercial application program to improve fuel cycle performance, minimize environmental and public health and safety impacts, and support a variety of options for used nuclear fuel storage, use, and disposal, including advanced nuclear reactor and non-reactor concepts (such as radioisotope power systems), which may include—

- (A) dry cask storage;
- (B) consolidated interim storage;
- (C) deep geological storage and disposal, including mined repository, and other technologies;
- (D) used nuclear fuel transportation;
- (E) integrated waste management systems;
- (F) vitrification;
- (G) fuel recycling and transmutation technologies, including advanced reprocessing technologies such as electrochemical and molten salt technologies, and advanced redox extraction technologies;
- (H) advanced materials to be used in subparagraphs (A) through (G); and

- (I) other areas as determined by the Secretary.

**(2) Requirements**

In carrying out the program under this subsection, the Secretary shall—

- (A) ensure all activities and designs incorporate state of the art safeguards technologies and techniques to reduce risk of proliferation;
- (B) consult with the Administrator of the National Nuclear Security Administration to integrate safeguards and security by design;
- (C) consider the potential benefits and other impacts of those activities for civilian nuclear applications, environmental health and safety, and national security, including consideration of public consent; and
- (D) consider the economic viability of all activities and designs.

**(3) Authorization of appropriations**

There are authorized to be appropriated to the Secretary to carry out the program under this subsection \$60,000,000 for each of fiscal years 2021 through 2025.

**(b) Advanced fuels**

**(1) In general**

The Secretary shall conduct an advanced fuels research, development, demonstration, and commercial application program on next-generation light water reactor and advanced reactor fuels that demonstrate the potential for improved—

- (A) performance;
- (B) accident tolerance;
- (C) proliferation resistance;
- (D) use of resources;
- (E) environmental impact; and
- (F) economics.

**(2) Requirements**

In carrying out the program under this subsection, the Secretary shall focus on the development of advanced technology fuels, including fabrication techniques, that offer improved accident-tolerance and economic performance with the goal of initial commercial application by December 31, 2025.

**(3) Report**

Not later than 180 days December 27, 2020, the Secretary shall submit to the Committee on Science, Space, and Technology of the House of Representatives and the Committee on Energy and Natural Resources of the Senate a report that describes how the technologies and concepts studied under this program would impact reactor economics, the fuel cycle, operations, safety, proliferation, and the environment.

**(4) Authorization of appropriations**

There are authorized to be appropriated to the Secretary to carry out the program under this subsection \$125,000,000 for each of fiscal years 2021 through 2025.

(Pub. L. 109–58, title IX, §953, Aug. 8, 2005, 119 Stat. 886; Pub. L. 115–248, §2(c), Sept. 28, 2018, 132 Stat. 3155; Pub. L. 116–260, div. Z, title II, §2003(b), Dec. 27, 2020, 134 Stat. 2462.)