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2D SESSION

H. R. 4084

IN THE SENATE OF THE UNITED STATES

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Received

AN ACT

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

1 *Be it enacted by the Senate and House of Representa-*
2 *tives of the United States of America in Congress assembled,*

1 **SECTION 1. SHORT TITLE.**

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

4 **SEC. 2. NUCLEAR ENERGY.**

5 Section 951 of the Energy Policy Act of 2005 (42
6 U.S.C. 16271) is amended to read as follows:

7 **“SEC. 951. NUCLEAR ENERGY.**

8 “(a) MISSION.—The Secretary shall conduct pro-
9 grams of civilian nuclear research, development, dem-
10 onstration, and commercial application, including activi-
11 ties in this subtitle. Such programs shall take into consid-
12 eration the following objectives:

13 “(1) Providing research infrastructure to pro-
14 mote scientific progress and enable users from aca-
15 demia, the National Laboratories, and the private
16 sector to make scientific discoveries relevant for nu-
17 clear, chemical, and materials science engineering.

18 “(2) Maintaining National Laboratory and uni-
19 versity nuclear energy research and development
20 programs, including their infrastructure.

21 “(3) Providing the technical means to reduce
22 the likelihood of nuclear weapons proliferation and
23 increasing confidence margins for public safety of
24 nuclear energy systems.

25 “(4) Reducing the environmental impact of nu-
26 clear energy related activities.

1 “(5) Supporting technology transfer from the
2 National Laboratories to the private sector.

3 “(6) Enabling the private sector to partner with
4 the National Laboratories to demonstrate novel reac-
5 tor concepts for the purpose of resolving technical
6 uncertainty associated with the aforementioned ob-
7 jectives in this subsection.

8 “(b) DEFINITIONS.—In this subtitle:

9 “(1) ADVANCED FISSION REACTOR.—The term
10 ‘advanced fission reactor’ means a nuclear fission re-
11 actor with significant improvements over the most
12 recent generation of nuclear reactors, which may in-
13 clude inherent safety features, lower waste yields,
14 greater fuel utilization, superior reliability, resist-
15 ance to proliferation, and increased thermal effi-
16 ciency.

17 “(2) FAST NEUTRON.—The term ‘fast neutron’
18 means a neutron with kinetic energy above 100
19 kiloelectron volts.

20 “(3) NATIONAL LABORATORY.—The term ‘Na-
21 tional Laboratory’ has the meaning given that term
22 in paragraph (3) of section 2, except that with re-
23 spect to subparagraphs (G), (H), and (N) of such
24 paragraph, for purposes of this subtitle the term in-
25 cludes only the civilian activities thereof.

1 “(4) NEUTRON FLUX.—The term ‘neutron flux’
2 means the intensity of neutron radiation measured
3 as a rate of flow of neutrons applied over an area.

4 “(5) NEUTRON SOURCE.—The term ‘neutron
5 source’ means a research machine that provides neu-
6 tron irradiation services for research on materials
7 sciences and nuclear physics as well as testing of ad-
8 vanced materials, nuclear fuels, and other related
9 components for reactor systems.

10 “(c) SENSE OF CONGRESS.—It is the sense of the
11 Congress that nuclear energy, through fission or fusion,
12 represents the highest energy density of any known attain-
13 able source and yields zero air emissions. This energy
14 source is of national importance to scientific progress, na-
15 tional security, electricity generation, heat generation for
16 industrial applications, and space exploration. Considering
17 the inherent complexity and regulatory burden associated
18 with this area of science, the Department should focus its
19 civilian nuclear research and development activities to-
20 wards programs that enable the private sector, National
21 Laboratories, and universities to carry out such experi-
22 ments as are necessary to promote scientific progress and
23 enhance practical knowledge of nuclear engineering.”.

1 **SEC. 3. NUCLEAR ENERGY RESEARCH PROGRAMS.**

2 Section 952 of the Energy Policy Act of 2005 (42
3 U.S.C. 16272) is amended—

4 (1) by striking subsection (c); and

5 (2) by redesignating subsections (d) and (e) as
6 subsections (c) and (d), respectively.

7 **SEC. 4. ADVANCED FUEL CYCLE INITIATIVE.**

8 Section 953(a) of the Energy Policy Act of 2005 (42
9 U.S.C. 16273(a)) is amended by striking “, acting
10 through the Director of the Office of Nuclear Energy,
11 Science and Technology,”.

12 **SEC. 5. UNIVERSITY NUCLEAR SCIENCE AND ENGINEERING**
13 **SUPPORT.**

14 Section 954(d)(4) of the Energy Policy Act of 2005
15 (42 U.S.C. 16274(d)(4)) is amended by striking “as part
16 of a taking into consideration effort that emphasizes” and
17 inserting “that emphasize”.

18 **SEC. 6. DEPARTMENT OF ENERGY CIVILIAN NUCLEAR IN-**
19 **FRASTRUCTURE AND FACILITIES.**

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

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

23 (2) by adding at the end the following:

24 “(c) VERSATILE NEUTRON SOURCE.—

25 “(1) MISSION NEED.—Not later than December
26 31, 2016, the Secretary shall determine the mission

1 need for a versatile reactor-based fast neutron
2 source, which shall operate as a national user facil-
3 ity. During this process, the Secretary shall consult
4 with the private sector, universities, National Lab-
5 oratories, and relevant Federal agencies to ensure
6 that this user facility will meet the research needs
7 of the largest possible majority of prospective users.

8 “(2) ESTABLISHMENT.—Upon the determina-
9 tion of mission need made under paragraph (1), the
10 Secretary shall, as expeditiously as possible, provide
11 to the Committee on Science, Space, and Technology
12 of the House of Representatives and the Committee
13 on Energy and Natural Resources of the Senate a
14 detailed plan for the establishment of the user facil-
15 ity.

16 “(3) FACILITY REQUIREMENTS.—

17 “(A) CAPABILITIES.—The Secretary shall
18 ensure that this user facility will provide, at a
19 minimum, the following capabilities:

20 “(i) Fast neutron spectrum irradiation
21 capability.

22 “(ii) Capacity for upgrades to accom-
23 modate new or expanded research needs.

1 “(B) CONSIDERATIONS.—In carrying out
2 the plan provided under paragraph (2), the Sec-
3 retary shall consider the following:

4 “(i) Capabilities that support experi-
5 mental high-temperature testing.

6 “(ii) Providing a source of fast neu-
7 trons at a neutron flux, higher than that
8 at which current research facilities operate,
9 sufficient to enable research for an optimal
10 base of prospective users.

11 “(iii) Maximizing irradiation flexibility
12 and irradiation volume to accommodate as
13 many concurrent users as possible.

14 “(iv) Capabilities for irradiation with
15 neutrons of a lower energy spectrum.

16 “(v) Multiple loops for fuels and ma-
17 terials testing in different coolants.

18 “(vi) Additional pre-irradiation and
19 post-irradiation examination capabilities.

20 “(vii) Lifetime operating costs and
21 lifecycle costs.

22 “(4) REPORTING PROGRESS.—The Department
23 shall, in its annual budget requests, provide an ex-
24 planation for any delay in its progress and otherwise
25 make every effort to complete construction and ap-

1 prove the start of operations for this facility by De-
2 cember 31, 2025.

3 “(5) COORDINATION.—The Secretary shall le-
4 verage the best practices for management, construc-
5 tion, and operation of national user facilities from
6 the Office of Science.”.

7 **SEC. 7. SECURITY OF NUCLEAR FACILITIES.**

8 Section 956 of the Energy Policy Act of 2005 (42
9 U.S.C. 16276) is amended by striking “, acting through
10 the Director of the Office of Nuclear Energy, Science and
11 Technology,”.

12 **SEC. 8. HIGH-PERFORMANCE COMPUTATION AND SUP-**
13 **PORTIVE RESEARCH.**

14 Section 957 of the Energy Policy Act of 2005 (42
15 U.S.C. 16277) is amended to read as follows:

16 **“SEC. 957. HIGH-PERFORMANCE COMPUTATION AND SUP-**
17 **PORTIVE RESEARCH.**

18 “(a) MODELING AND SIMULATION.—The Secretary
19 shall carry out a program to enhance the Nation’s capa-
20 bilities to develop new reactor technologies through high-
21 performance computation modeling and simulation tech-
22 niques. This program shall coordinate with relevant Fed-
23 eral agencies through the National Strategic Computing
24 Initiative created under Executive Order No. 13702 (July

1 29, 2015) while taking into account the following objec-
2 tives:

3 “(1) Utilizing expertise from the private sector,
4 universities, and National Laboratories to develop
5 computational software and capabilities that pro-
6 spective users may access to accelerate research and
7 development of advanced fission reactor systems, nu-
8 clear fusion systems, and reactor systems for space
9 exploration.

10 “(2) Developing computational tools to simulate
11 and predict nuclear phenomena that may be vali-
12 dated through physical experimentation.

13 “(3) Increasing the utility of the Department’s
14 research infrastructure by coordinating with the Ad-
15 vanced Scientific Computing Research program
16 within the Office of Science.

17 “(4) Leveraging experience from the Energy In-
18 novation Hub for Modeling and Simulation.

19 “(5) Ensuring that new experimental and com-
20 putational tools are accessible to relevant research
21 communities.

22 “(b) SUPPORTIVE RESEARCH ACTIVITIES.—The Sec-
23 retary shall consider support for additional research activi-
24 ties to maximize the utility of its research facilities, includ-
25 ing physical processes to simulate degradation of materials

1 and behavior of fuel forms and for validation of computa-
2 tional tools.”.

3 **SEC. 9. ENABLING NUCLEAR ENERGY INNOVATION.**

4 Subtitle E of title IX of the Energy Policy Act of
5 2005 (42 U.S.C. 16271 et seq.) is amended by adding at
6 the end the following:

7 **“SEC. 958. ENABLING NUCLEAR ENERGY INNOVATION.**

8 “(a) NATIONAL REACTOR INNOVATION CENTER.—
9 The Secretary shall carry out a program to enable the
10 testing and demonstration of reactor concepts to be pro-
11 posed and funded by the private sector. The Secretary
12 shall leverage the technical expertise of relevant Federal
13 agencies and National Laboratories in order to minimize
14 the time required to enable construction and operation of
15 privately funded experimental reactors at National Lab-
16 oratories or other Department-owned sites while ensuring
17 reasonable safety for persons working within these sites.
18 Such reactors shall operate to meet the following objec-
19 tives:

20 “(1) Enabling physical validation of novel reac-
21 tor concepts.

22 “(2) Resolving technical uncertainty and in-
23 creasing practical knowledge relevant to safety, resil-
24 ience, security, and functionality of first-of-a-kind
25 reactor concepts.

1 “(3) General research and development to im-
2 prove nascent technologies.

3 “(b) REPORTING REQUIREMENT.—Not later than
4 180 days after the date of enactment of the Nuclear En-
5 ergy Innovation Capabilities Act, the Secretary, in con-
6 sultation with the National Laboratories, relevant Federal
7 agencies, and other stakeholders, shall transmit to the
8 Committee on Science, Space, and Technology of the
9 House of Representatives and the Committee on Energy
10 and Natural Resources of the Senate a report assessing
11 the Department’s capabilities to authorize, host, and over-
12 see privately funded fusion and advanced fission experi-
13 mental reactors as described under subsection (a). The re-
14 port shall address the following:

15 “(1) The Department’s safety review and over-
16 sight capabilities, including options to leverage ex-
17 pertise from the Nuclear Regulatory Commission
18 and National Laboratories.

19 “(2) Potential sites capable of hosting activities
20 described under subsection (a).

21 “(3) The efficacy of the Department’s available
22 contractual mechanisms to partner with the private
23 sector and Federal agencies, including cooperative
24 research and development agreements, strategic

1 partnership projects, and agreements for commer-
2 cializing technology.

3 “(4) Potential cost structures related to phys-
4 ical security, decommissioning, liability, and other
5 long-term project costs.

6 “(5) Other challenges or considerations identi-
7 fied by the Secretary.”.

8 **SEC. 10. BUDGET PLAN.**

9 (a) IN GENERAL.—Subtitle E of title IX of the En-
10 ergy Policy Act of 2005 (42 U.S.C. 16271 et seq.) is fur-
11 ther amended by adding at the end the following:

12 **“SEC. 959. BUDGET PLAN.**

13 “Not later than 12 months after the date of enact-
14 ment of the Nuclear Energy Innovation Capabilities Act,
15 the Department shall transmit to the Committee on
16 Science, Space, and Technology of the House of Rep-
17 resentatives and the Committee on Energy and Natural
18 Resources of the Senate 2 alternative 10-year budget
19 plans for civilian nuclear energy research and development
20 by the Department. The first shall assume constant an-
21 nual funding for 10 years at the appropriated level for
22 the Department’s civilian nuclear energy research and de-
23 velopment for fiscal year 2016. The second shall be an
24 unconstrained budget. The two plans shall include—

1 “(1) a prioritized list of the Department’s pro-
2 grams, projects, and activities to best support the
3 development of next generation nuclear energy tech-
4 nology;

5 “(2) realistic budget requirements for the De-
6 partment to implement sections 955(c), 957, and
7 958 of this Act; and

8 “(3) the Department’s justification for con-
9 tinuing or terminating existing civilian nuclear en-
10 ergy research and development programs.”.

11 (b) REPORT ON FUSION INNOVATION.—Not later
12 than 6 months after the date of enactment of this Act,
13 the Secretary of the Department of Energy shall transmit
14 to the Committee on Science, Space, and Technology of
15 the House of Representatives and the Committee on En-
16 ergy and Natural Resources of the Senate a report that
17 will identify engineering designs for innovative fusion en-
18 ergy systems that have the potential to demonstrate net
19 energy production not later than 15 years after the start
20 of construction. In this report, the Secretary will identify
21 budgetary requirements that would be necessary for the
22 Department to carry out a fusion innovation initiative to
23 accelerate research and development of these designs.

1 **SEC. 11. CONFORMING AMENDMENTS.**

2 The table of contents for the Energy Policy Act of
3 2005 is amended by striking the item relating to section
4 957 and inserting the following:

“957. High-performance computation and supportive research.

“958. Enabling nuclear energy innovation.

“959. Budget plan.”.

Passed the House of Representatives February 29,
2016.

Attest:

KAREN L. HAAS,

Clerk.