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(Original Signature of Member)

116TH CONGRESS  
2D SESSION

**H. R.** \_\_\_\_\_

To establish and support advanced nuclear energy research and development programs at the Department of Energy, and for other purposes.

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IN THE HOUSE OF REPRESENTATIVES

Mr. GALLAGHER introduced the following bill; which was referred to the Committee on \_\_\_\_\_  
\_\_\_\_\_

**A BILL**

To establish and support advanced nuclear energy research and development programs at the Department of Energy, and for other purposes.

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

3       **SECTION 1. SHORT TITLE.**

4       This Act may be cited as the “Nuclear Energy Reac-  
5       tor Demonstration Act”.

6       **SEC. 2. TABLE OF CONTENTS.**

Sec. 1. Short title.

Sec. 2. Table of contents.

Sec. 3. Advanced nuclear reactor research and development goals.

Sec. 4. Advanced fuels development.

1   **SEC. 3. ADVANCED NUCLEAR REACTOR RESEARCH AND DE-**  
2                           **VELOPMENT GOALS.**

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

6   **“SEC. 959A. ADVANCED NUCLEAR REACTOR RESEARCH**  
7                           **AND DEVELOPMENT GOALS.**

8           “(a) DEFINITIONS.—In this section:

9                   “(1) ADVANCED NUCLEAR REACTOR.—The  
10   term ‘advanced nuclear reactor’ means—

11                           “(A) a nuclear fission reactor, including a  
12                   prototype plant (as defined in sections 50.2 and  
13                   52.1 of title 10, Code of Federal Regulations  
14                   (or successor regulations)), with significant im-  
15                   provements compared to the most recent gen-  
16                   eration of fission reactors, including improve-  
17                   ments such as—

18                                   “(i) additional inherent safety fea-  
19                   tures;

20                                   “(ii) lower waste yields;

21                                   “(iii) improved fuel performance;

22                                   “(iv) increased tolerance to loss of  
23                   fuel cooling;

24                                   “(v) enhanced reliability;

25                                   “(vi) increased proliferation resist-  
26                   ance;

- 1 “(vii) increased thermal efficiency;
- 2 “(viii) reduced consumption of cooling
- 3 water;
- 4 “(ix) the ability to integrate into elec-
- 5 tric applications and nonelectric applica-
- 6 tions;
- 7 “(x) modular sizes to allow for deploy-
- 8 ment that corresponds with the demand
- 9 for electricity; or
- 10 “(xi) operational flexibility to respond
- 11 to changes in demand for electricity and to
- 12 complement integration with intermittent
- 13 renewable energy; and
- 14 “(B) a fusion reactor.
- 15 “(2) DEMONSTRATION PROJECT.—The term
- 16 ‘demonstration project’ means—
- 17 “(A) an advanced nuclear reactor oper-
- 18 ated—
- 19 “(i) as part of the power generation
- 20 facilities of an electric utility system; or
- 21 “(ii) in any other manner for the pur-
- 22 pose of demonstrating the suitability for
- 23 commercial application of the advanced nu-
- 24 clear reactor;

1 “(B) the demonstration of privately funded  
2 experimental advanced nuclear reactors, funded  
3 in whole or in part by the private sector, at Na-  
4 tional Laboratories or other sites owned by the  
5 Department of Energy; and

6 “(C) an advanced nuclear reactor dem-  
7 onstrated by the Secretary of Defense in co-  
8 operation with the Secretary of Energy.

9 “(b) PURPOSE.—The purpose of this section is to di-  
10 rect the Secretary, as soon as practicable after the date  
11 of enactment of this section, to advance the research and  
12 development of domestic advanced, affordable, and clean  
13 nuclear energy by—

14 “(1) demonstrating different advanced nuclear  
15 reactor technologies that could be used by the pri-  
16 vate sector to produce—

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

19 “(B) heat for community heating, indus-  
20 trial purposes, or synthetic fuel production;

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

22 “(D) backup or mission-critical power sup-  
23 plies;

24 “(2) developing subgoals for nuclear energy re-  
25 search programs that would accomplish the goals of

1 the demonstration projects carried out under sub-  
2 section (c);

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

6 “(4) facilitating the access of the private sec-  
7 tor—

8 “(A) to Federal research facilities and per-  
9 sonnel; and

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

13 “(c) DEMONSTRATION PROJECTS.—

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

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

19 “(B) establish a program to enter into  
20 agreements to demonstrate not fewer than 2,  
21 and not more than 5, additional operational ad-  
22 vanced reactor designs by not later than De-  
23 cember 31, 2035.

1           “(2) REQUIREMENTS.—In carrying out dem-  
2           onstration projects under paragraph (1), the Sec-  
3           retary shall—

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

7                           “(i) primary coolants;

8                           “(ii) fuel types and compositions; and

9                           “(iii) neutron spectra;

10           “(B) seek to ensure that—

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

15                   “(ii) the selected projects can meet  
16           the deadline established in paragraph (1)  
17           to demonstrate first-of-a-kind advanced  
18           nuclear reactor technologies, for which ad-  
19           ditional information shall be considered, in-  
20           cluding—

21                           “(I) the technology readiness  
22           level of a proposed advanced nuclear  
23           reactor technology;

24                           “(II) the technical abilities and  
25           qualifications of teams desiring to

1 demonstrate a proposed advanced nu-  
2 clear reactor technology; and

3 “(III) the capacity to meet cost-  
4 share requirements of the Depart-  
5 ment;

6 “(C) ensure that each evaluation of can-  
7 didate technologies for the demonstration  
8 projects is completed through an external re-  
9 view of proposed designs, which review shall—

10 “(i) be conducted by a panel that in-  
11 cludes not fewer than 1 representative of  
12 each of—

13 “(I) an electric utility; and

14 “(II) an entity that uses high-  
15 temperature process heat for manu-  
16 facturing or industrial processing,  
17 such as a petrochemical company, a  
18 manufacturer of metals, or a manu-  
19 facturer of concrete;

20 “(ii) include a review of cost-competi-  
21 tiveness and other value streams, together  
22 with the technology readiness level, of each  
23 design to be demonstrated under this sub-  
24 section; and

1 “(iii) not be required for a demonstra-  
2 tion project that is not federally funded;

3 “(D) for federally funded demonstration  
4 projects, enter into cost-sharing agreements  
5 with private sector partners in accordance with  
6 section 988 for the conduct of activities relating  
7 to the research, development, and demonstra-  
8 tion of private-sector advanced nuclear reactor  
9 designs under the program;

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

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

17 “(i) the Department;

18 “(ii) relevant Federal agencies as de-  
19 termined by the Secretary;

20 “(iii) National Laboratories;

21 “(iv) institutions of higher education;

22 “(v) traditional end-users (such as  
23 electric utilities);

24 “(vi) potential end-users of new tech-  
25 nologies (such as users of high- tempera-



1           ture process heat for manufacturing proc-  
2           essing, including petrochemical companies,  
3           manufacturers of metals, or manufacturers  
4           of concrete); and

5           “(vii) developers of advanced nuclear  
6           reactor technology; and

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

13          “(3) **ADDITIONAL REQUIREMENTS.**—In car-  
14          rying out demonstration projects under paragraph  
15          (1), the Secretary shall—

16               “(A) identify candidate technologies that—

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

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

23               “(B) identify technical challenges to the  
24               candidate technologies identified in subpara-  
25               graph (A);

1           “(C) support near-term research and devel-  
2           opment to address the highest-risk technical  
3           challenges to the successful demonstration of a  
4           selected advanced reactor technology, in accord-  
5           ance with—

6                   “(i) subparagraph (B); and

7                   “(ii) the research and development ac-  
8                   tivities under section 958; and

9           “(D) establish such technology advisory  
10          working groups as the Secretary determines to  
11          be appropriate to advise the Secretary regard-  
12          ing the technical challenges identified under  
13          subparagraph (B) and the scope of research  
14          and development programs to address the chal-  
15          lenges, in accordance with subparagraph (C), to  
16          be comprised of—

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

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

22                   “(iii) technical experts at the National  
23                   Laboratories.

24          “(d) GOALS.—

1           “(1) IN GENERAL.—The Secretary shall estab-  
2       lish goals for research relating to advanced nuclear  
3       reactors facilitated by the Department that support  
4       the objectives of the program for demonstration  
5       projects established under subsection (c).

6           “(2) COORDINATION.—In developing the goals  
7       under paragraph (1), the Secretary shall coordinate,  
8       on an ongoing basis, with members of private indus-  
9       try to advance the demonstration of various designs  
10      of advanced nuclear reactors.

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

14           “(A) research activities facilitated by the  
15      Department to meet the goals developed under  
16      this subsection are focused on key areas of nu-  
17      clear research and deployment ranging from  
18      basic science to full-design development, safety  
19      evaluation, and licensing;

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

22           “(i) resolving materials challenges re-  
23      lating to extreme environments, including  
24      extremely high levels of—

25           “(I) radiation fluence;

1 “(II) temperature;

2 “(III) pressure; and

3 “(IV) corrosion; and

4 “(ii) qualification of advanced fuels;

5 “(C) activities are carried out that address

6 near-term challenges in modeling and simula-

7 tion to enable accelerated design and licensing;

8 “(D) related technologies, such as tech-

9 nologies to manage, reduce, or reuse nuclear

10 waste, are developed;

11 “(E) nuclear research infrastructure is

12 maintained or constructed, such as—

13 “(i) currently operational research re-

14 actors at the National Laboratories and in-

15 stitutions of higher education;

16 “(ii) hot cell research facilities;

17 “(iii) a versatile fast neutron source;

18 and

19 “(iv) a molten salt testing facility;

20 “(F) basic knowledge of non-light water

21 coolant physics and chemistry is improved;

22 “(G) advanced sensors and control systems

23 are developed; and

24 “(H) advanced manufacturing and ad-

25 vanced construction techniques and materials

1 are investigated to reduce the cost of advanced  
2 nuclear reactors.”.

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

6 (1) in the item relating to section 917, by strik-  
7 ing “Efficiency”;

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

11 (3) by inserting after the item relating to sec-  
12 tion 959 the following:

“Sec. 959A. Advanced nuclear reactor research and development goals.”.

13 **SEC. 4. ADVANCED FUELS DEVELOPMENT.**

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

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

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

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

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

1 (C) by striking “the Generation IV”;

2 (3) by inserting after paragraph (1) (as so re-  
3 designated) the following:

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

9 (4) by inserting after paragraph (5) (as so re-  
10 designated) the following:

11 “(6) AUTHORIZATION OF APPROPRIATIONS.—  
12 From within funds authorized to be appropriated to  
13 the Department of Energy’s Office of Nuclear En-  
14 ergy, the Secretary may use to carry out the pro-  
15 gram under this subsection, \$40,000,000 for each of  
16 fiscal years 2021 through 2025.”;

17 (5) by inserting before paragraph (1) (as so re-  
18 designated) the following:

19 “(a) MATERIAL RECOVERY AND WASTE FORM DE-  
20 VELOPMENT.—”; and

21 (6) by adding at the end the following:

22 “(b) ADVANCED FUELS.—

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

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

3 “(i) performance; and

4 “(ii) accident tolerance; and

5 “(B) innovative advanced reactor fuels that  
6 demonstrate improved—

7 “(i) proliferation resistance; and

8 “(ii) use of resources.

9 “(2) REQUIREMENTS.—In carrying out the pro-  
10 gram under this subsection, the Secretary shall—

11 “(A) focus on the development of accident-  
12 tolerant fuel and cladding concepts that are ca-  
13 pable of achieving initial commercialization by  
14 December 31, 2025;

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

19 “(C) support a healthy nuclear fuel cycle  
20 capable of providing higher levels of enriched  
21 uranium for domestic advanced nuclear develop-  
22 ment and for national security applications;

23 “(D) subject to paragraph (3), publish the  
24 results of the studies conducted under subpara-  
25 graph (B); and

1                   “(E) cooperate with institutions of higher  
2                   education through the Nuclear Energy Univer-  
3                   sity and Integrated Research Projects programs  
4                   of the Department.

5                   “(3) SENSITIVE INFORMATION.—The Secretary  
6                   shall not publish any information under paragraph  
7                   (2)(C) that is detrimental to national security, as de-  
8                   termined by the Secretary.

9                   “(4) AUTHORIZATION OF APPROPRIATIONS.—  
10                  From within funds authorized to be appropriated to  
11                  the Department of Energy’s Office of Nuclear En-  
12                  ergy, the Secretary may use to carry out the pro-  
13                  gram under this subsection \$120,000,000 for each  
14                  of fiscal years 2021 through 2025.”.