

119TH CONGRESS
1ST SESSION

S. 579

To amend the National Quantum Initiative Act to provide for a research, development, and demonstration program, and for other purposes.

IN THE SENATE OF THE UNITED STATES

FEBRUARY 13, 2025

Mr. DURBIN (for himself, Mr. DAINES, Mr. SCHUMER, Ms. MURKOWSKI, Mr. YOUNG, and Mr. PADILLA) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

A BILL

To amend the National Quantum Initiative Act to provide for a research, development, and demonstration program, 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 “Department of Energy
5 Quantum Leadership Act of 2025”.

6 **SEC. 2. DEPARTMENT OF ENERGY QUANTUM INFORMATION**
7 **SCIENCE RESEARCH PROGRAM.**

8 Section 401 of the National Quantum Initiative Act
9 (15 U.S.C. 8851) is amended—

1 (1) by striking subsection (a) and inserting the
2 following:

3 “(a) IN GENERAL.—The Secretary of Energy shall
4 carry out a research, development, and demonstration pro-
5 gram on quantum information science, engineering, and
6 technology.”;

7 (2) in subsection (b)—

8 (A) in paragraph (1), by inserting “, engi-
9 neering, and technology” after “science”;

10 (B) in paragraph (2), by inserting “, engi-
11 neering, and technology” after “science”;

12 (C) by striking paragraph (3) and insert-
13 ing the following:

14 “(3) provide research experiences and training
15 for additional undergraduate and graduate students
16 in quantum information science, engineering, and
17 technology, including in the fields specified in para-
18 graph (4);”;

19 (D) by redesignating paragraphs (3)
20 through (5) as paragraphs (5) through (7), re-
21 spectively;

22 (E) by inserting after paragraph (2) the
23 following:

24 “(3) operate National Quantum Information
25 Science Research Centers under section 402 to ac-

1 celerate and scale scientific and technical break-
 2 throughs in quantum information science, engineer-
 3 ing, and technology, and maintain state-of-the-art
 4 infrastructure for quantum researchers and industry
 5 partners;

6 “(4) conduct cooperative basic and applied re-
 7 search with industry, National Laboratories, institu-
 8 tions of higher education, and other research institu-
 9 tions to facilitate the development, demonstration,
 10 and commercial application of quantum information
 11 science, engineering, and technology priorities, as de-
 12 termined by the Secretary of Energy, including in
 13 the fields of—

14 “(A) quantum information theory;

15 “(B) quantum physics;

16 “(C) quantum computational science, in-
 17 cluding hardware and software, machine learn-
 18 ing, and data science;

19 “(D) applied mathematics and algorithm
 20 development;

21 “(E) quantum communications and net-
 22 working, including hardware and software for
 23 quantum communications and networking;

24 “(F) quantum sensing, imaging, and detec-
 25 tion;

1 “(G) materials science and engineering;

2 “(H) quantum modeling and simulation,
3 including molecular modeling;

4 “(I) near- and long-term application devel-
5 opment, as determined by the Secretary of En-
6 ergy;

7 “(J) quantum chemistry;

8 “(K) quantum biology;

9 “(L) superconductive and high-perform-
10 ance microelectronics; and

11 “(M) quantum security technologies;”;

12 (F) in paragraph (6) (as so redesignated),
13 in subparagraph (F), by striking “and” at the
14 end;

15 (G) in paragraph (7) (as so redesign-
16 nated)—

17 (i) by striking “and” before “poten-
18 tial”; and

19 (ii) by striking the period at the end
20 and inserting “, and other relevant stake-
21 holders, as determined by the Secretary of
22 Energy; and”; and

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

24 “(8) leverage the collective body of knowledge
25 and data, including experience and resources from

1 existing Federal research activities and commercially
2 available quantum computing hardware and soft-
3 ware, to the extent practicable.”; and

4 (3) by adding at the end the following:

5 “(c) INDUSTRY OUTREACH.—In carrying out the pro-
6 gram under subsection (a), the Secretary of Energy shall
7 engage with the quantum technology industry and pro-
8 mote commercialization of applications of quantum tech-
9 nology relevant to the activities of the Department of En-
10 ergy by—

11 “(1) educating—

12 “(A) the energy industry on near-term and
13 commercially available quantum technologies;
14 and

15 “(B) the quantum industry on potential
16 energy applications;

17 “(2) accelerating the advancements of United
18 States quantum computing, communications, net-
19 working, sensing, and security capabilities to protect
20 and optimize the energy sector;

21 “(3) advancing relevant domestic supply chains,
22 manufacturing capabilities, and associated simula-
23 tions or modeling capabilities;

24 “(4) facilitating commercialization of quantum
25 technologies from National Laboratories and engag-

ing with the Quantum Economic Development Consortium and other organizations, as applicable, to transition component technologies that advance the development of a quantum supply chain; and

“(5) to the extent practicable, ensuring industry partner access, especially for small- and medium-sized businesses, to specialized quantum instrumentation, equipment, testbeds, and other infrastructure to design, prototype, and test novel quantum hardware and streamline user access to reduce costs and other administrative burdens.

“(d) HIGH-PERFORMANCE COMPUTING STRATEGIC PLAN.—

“(1) IN GENERAL.—Not later than 1 year after the date of enactment of this subsection, the Secretary of Energy shall submit to Congress a 10-year strategic plan to guide Federal programs in designing, expanding, and procuring hybrid, energy-efficient high-performance computing systems capable of integrating with a diverse set of accelerators, including quantum, artificial intelligence, and machine learning accelerators, to enable the computing facilities of the Department of Energy to advance national computing resources.

“(2) CONTENTS.—The strategic plan under paragraph (1) shall include the following:

“(A) A conceptual plan to leverage capabilities and infrastructure from the exascale computing program, as the Secretary of Energy determines necessary.

“(B) A plan to minimize disruptions to the advanced scientific computing workforce.

“(C) A consideration of a diversity of quantum computing modalities.

“(D) A plan to integrate cloud access of commercially available quantum hardware and software to complement on-premises high-performance computing systems and resources consistent with the QUEST program established under section 404.

“(e) EARLY-STAGE QUANTUM HIGH-PERFORMANCE COMPUTING RESEARCH AND DEVELOPMENT PROGRAM.—

“(1) DEFINITION OF QUANTUM HIGH-PERFORMANCE COMPUTING.—In this subsection, the term ‘quantum high-performance computing’ means the use of classical high-performance computing systems with quantum processing units and hybrid quantum-classical algorithms to leverage the strength of computational architectures and solve complex problems.

1 “(2) PROGRAM.—The Secretary of Energy shall
2 establish an early-stage research and development
3 program in quantum high-performance computing—

4 “(A) to inform the 10-year strategic plan
5 described in subsection (d)(1); and

6 “(B) to build the necessary scientific com-
7 puting workforce to fulfill the objectives of that
8 plan.

9 “(3) ACTIVITIES.—The program established
10 under paragraph (2) shall—

11 “(A) support early-stage quantum super-
12 computing testbeds and prototypes; and

13 “(B) connect early-stage quantum high-
14 performance computing projects to the Centers
15 funded under this Act.

16 “(4) FUNDING.—Of funds made available under
17 subsection (i)(1), the Secretary of Energy shall use
18 not more than \$20,000,000 for each of fiscal years
19 2026 through 2030 to carry out the activities under
20 this subsection.

21 “(f) SUPPLY CHAIN STUDY.—Not later than 1 year
22 after the date of enactment of this subsection, the Sec-
23 retary of Energy, in consultation with the Secretary of
24 Commerce, shall conduct a study on quantum science, en-
25 gineering, and technology supply chain needs, including—

1 “(1) identifying hurdles to growth in the quan-
 2 tum industry by leveraging the expertise of relevant
 3 stakeholders in academia and industry, including the
 4 Quantum Economic Development Consortium; and

5 “(2) making recommendations on how to
 6 strengthen the domestic supply of materials and
 7 technologies necessary for the development of a ro-
 8 bust manufacturing base and workforce.

9 “(g) TRAINEESHIP PROGRAM.—

10 “(1) IN GENERAL.—The Secretary of Energy
 11 shall establish a university-led traineeship pro-
 12 gram—

13 “(A) to address workforce development
 14 needs in quantum information science, engi-
 15 neering, and technology; and

16 “(B) that will focus on supporting in-
 17 creased participation, workforce development,
 18 and research experiences for underrepresented
 19 undergraduate and graduate students.

20 “(2) FUNDING.—Of funds made available under
 21 subsection (i)(1), the Secretary of Energy shall use
 22 not more than \$5,000,000 for each of fiscal years
 23 2026 through 2030 to carry out the activities under
 24 this subsection.

1 “(h) COORDINATION OF ACTIVITIES.—In carrying
 2 out this section, the Secretary of Energy shall, to the max-
 3 imum extent practicable, coordinate with the Director of
 4 the National Science Foundation, the Director of the Na-
 5 tional Institute of Standards and Technology, the Admin-
 6 istrator of the National Aeronautics and Space Adminis-
 7 tration, the Director of the Defense Advanced Research
 8 Projects Agency, and the heads of other relevant Federal
 9 departments and agencies to ensure that programs and
 10 activities carried out under this section complement and
 11 do not duplicate existing efforts across the Federal govern-
 12 ment.

13 “(i) FUNDING.—

14 “(1) IN GENERAL.—Of amounts authorized to
 15 be appropriated for the Department of Energy, the
 16 Secretary of Energy shall use not more than
 17 \$175,000,000 for each of fiscal years 2026 through
 18 2030 to carry out activities under this section.

19 “(2) RESTRICTIONS.—

20 “(A) CONFUCIUS INSTITUTE.—None of the
 21 funds made available under this subsection may
 22 be obligated to or expended by an institution of
 23 higher education that maintains a contract or
 24 other agreement with a Confucius Institute or
 25 any successor of a Confucius Institute.

1 “(B) FOREIGN COUNTRIES AND ENTITIES
2 OF CONCERN.—

3 “(i) DEFINITIONS.—In this subpara-
4 graph:

5 “(I) FOREIGN COUNTRY OF CON-
6 CERN.—The term ‘foreign country of
7 concern’ means—

8 “(aa) a covered nation (as
9 defined in section 4872(d) of title
10 10, United States Code); and

11 “(bb) any other country that
12 the Secretary of Energy, in con-
13 sultation with the Secretary of
14 Defense, the Secretary of State,
15 and the Director of National In-
16 telligence, determines to be en-
17 gaged in conduct that is detri-
18 mental to the national security or
19 foreign policy of the United
20 States.

21 “(II) FOREIGN ENTITY OF CON-
22 CERN.—The term ‘foreign entity of
23 concern’ means a foreign entity
24 that—

1 “(aa) is designated as a for-
2 eign terrorist organization by the
3 Secretary of State under section
4 219(a) of the Immigration and
5 Nationality Act (8 U.S.C.
6 1189(a));

7 “(bb) is included on the list
8 of specially designated nationals
9 and blocked persons maintained
10 by the Office of Foreign Assets
11 Control of the Department of the
12 Treasury;

13 “(cc) is owned by, controlled
14 by, or subject to the jurisdiction
15 or direction of a government of a
16 foreign country that is a covered
17 nation (as defined in section
18 4872(d) of title 10, United
19 States Code);

20 “(dd) is alleged by the At-
21 torney General to have been in-
22 volved in activities for which a
23 conviction was obtained under—

24 “(AA) chapter 37 of
25 title 18, United States Code

1 (commonly known as the
2 ‘Espionage Act’);

3 “(BB) section 951 or
4 1030 of title 18, United
5 States Code;

6 “(CC) chapter 90 of
7 title 18, United States Code
8 (commonly known as the
9 ‘Economic Espionage Act of
10 1996’);

11 “(DD) the Arms Ex-
12 port Control Act (22 U.S.C.
13 2751 et seq.);

14 “(EE) section 224,
15 225, 226, 227, or 236 of the
16 Atomic Energy Act of 1954
17 (42 U.S.C. 2274, 2275,
18 2276, 2277, 2284);

19 “(FF) the Export Con-
20 trol Reform Act of 2018 (50
21 U.S.C. 4801 et seq.); or

22 “(GG) the International
23 Emergency Economic Pow-
24 ers Act (50 U.S.C. 1701 et
25 seq.); or

1 “(ee) is determined by the
2 Secretary of Energy, in consulta-
3 tion with the Secretary of De-
4 fense and the Director of Na-
5 tional Intelligence, to be engaged
6 in unauthorized conduct that is
7 detrimental to the national secu-
8 rity or foreign policy of the
9 United States.

10 “(ii) RESTRICTION.—None of the
11 funds made available under this subsection
12 may be obligated or expended to promote,
13 establish, or finance quantum research ac-
14 tivities between a United States entity and
15 a foreign country of concern or a foreign
16 entity of concern.”.

17 **SEC. 3. DOE QUANTUM INSTRUMENTATION AND FOUNDRY**
18 **PROGRAM.**

19 The National Quantum Initiative Act is amended by
20 inserting after section 401 (15 U.S.C. 8851) the following:

21 **“SEC. 401A. DEPARTMENT OF ENERGY QUANTUM INSTRU-**
22 **MENTATION AND FOUNDRY PROGRAM.**

23 “(a) IN GENERAL.—The Secretary of Energy shall
24 establish an instrumentation and infrastructure program
25 to carry out the following:

1 “(1) Maintain United States leadership in
2 quantum information science, engineering, and tech-
3 nology.

4 “(2) Develop domestic quantum supply chains.

5 “(3) Provide resources for the broader scientific
6 community.

7 “(4) Support activities carried out under sec-
8 tions 401, 402, 403, and 404.

9 “(b) PROGRAM COMPONENTS.—In carrying out the
10 program under subsection (a), the Secretary of Energy
11 shall—

12 “(1) develop, design, build, purchase, and com-
13 mercialize specialized equipment, laboratory infra-
14 structure, and state-of-the-art instrumentation to
15 advance quantum engineering research and the de-
16 velopment of quantum component technologies at a
17 scale sufficient to meet the needs of the scientific
18 community and enable commercialization of quan-
19 tum technology;

20 “(2) leverage the capabilities of National Lab-
21 oratories and Nanoscale Science Research Centers,
22 including facilities and experts that research and de-
23 velop novel quantum materials and devices; and

24 “(3) consider the technologies and end-use ap-
25 plications that have significant economic potential,

1 as determined by the Secretary, based on consulta-
2 tion with relevant stakeholders in academia and in-
3 dustry, including the Quantum Economic Develop-
4 ment Consortium.

5 “(c) QUANTUM FOUNDRIES.—In carrying out the
6 program under subsection (a), and in coordination with
7 institutions of higher education and industry, the Sec-
8 retary of Energy shall support the development of quan-
9 tum foundries focused on meeting the device, hardware,
10 software, and materials needs of the scientific community
11 and the quantum supply chain.

12 “(d) CONSULTATION.—In carrying out the program
13 under subsection (a), the Secretary of Energy shall consult
14 with the following entities to identify the instrumentation,
15 equipment, infrastructure, and materials needed to sup-
16 port the objectives of that program:

17 “(1) The National Institute of Standards and
18 Technology.

19 “(2) The National Science Foundation.

20 “(3) The National Aeronautics and Space Ad-
21 ministration.

22 “(4) Any other relevant Federal agency.

23 “(5) The National Laboratories.

24 “(6) National Quantum Information Science
25 Research Centers.

1 “(7) Industry stakeholders.

2 “(8) Institutions of higher education.

3 “(9) Any other research institution.

4 “(e) FUNDING.—Of amounts authorized to be appro-
 5 priated for the Department of Energy, the Secretary of
 6 Energy shall use not more than \$50,000,000 for each of
 7 fiscal years 2026 through 2030 to carry out this section.”.

8 **SEC. 4. NATIONAL QUANTUM INFORMATION SCIENCE RE-**
 9 **SEARCH CENTERS.**

10 Section 402 of the National Quantum Initiative Act
 11 (15 U.S.C. 8852) is amended—

12 (1) in subsection (a)—

13 (A) in paragraph (1)—

14 (i) by striking “basic”; and

15 (ii) by striking “science and tech-
 16 nology and to support research conducted
 17 under section 401” and inserting “science,
 18 engineering, and technology, expand capac-
 19 ity for the domestic quantum workforce,
 20 and support research conducted under sec-
 21 tions 401, 403, and 404”; and

22 (B) in paragraph (2)(C), by inserting
 23 “that may include 1 or more commercial enti-
 24 ties” after “collaborations”;

1 (2) in subsection (b), by inserting “and should
2 be inclusive of the variety of viable quantum tech-
3 nologies, as appropriate” before the period at the
4 end;

5 (3) in subsection (c)—

6 (A) by striking “basic”; and

7 (B) by inserting “, engineering, and tech-
8 nology, accelerating quantum workforce devel-
9 opment,” after “science”;

10 (4) in subsection (e), by striking paragraph (2)
11 and inserting the following:

12 “(2) RENEWAL.—Each Center established
13 under this section may be renewed for an additional
14 period of 5 years following a successful, merit-based
15 review and approval by the Director.”; and

16 (5) in subsection (f), in the first sentence—

17 (A) by striking “\$25,000,000” and insert-
18 ing “\$35,000,000”; and

19 (B) by striking “2019 through 2023” and
20 inserting “2026 through 2030”.

21 **SEC. 5. DEPARTMENT OF ENERGY QUANTUM NETWORK IN-**
22 **FRASTRUCTURE RESEARCH AND DEVELOP-**
23 **MENT PROGRAM.**

24 Section 403 of the National Quantum Initiative Act
25 (15 U.S.C. 8853) is amended—

1 (1) in subsection (a)—

2 (A) in paragraph (4)—

3 (i) by inserting “, including” after
4 “networking”; and

5 (ii) by striking “and” at the end;

6 (B) in paragraph (5), by striking the pe-
7 riod at the end and inserting a semicolon; and

8 (C) by adding at the end the following:

9 “(6) as applicable, leverage a diversity of mo-
10 dalities and commercially available quantum hard-
11 ware and software; and

12 “(7) develop education and training pathways
13 related to quantum network infrastructure invest-
14 ments, aligned with existing programmatic invest-
15 ments by the Department of Energy.”;

16 (2) in subsection (b)—

17 (A) in paragraph (1)—

18 (i) by redesignating subparagraphs
19 (C) and (D) as subparagraphs (D) and
20 (E), respectively; and

21 (ii) by inserting after subparagraph
22 (B) the following:

23 “(C) the Administrator of the National
24 Aeronautics and Space Administration and the

head of any other relevant Federal agency, as
determined by the Secretary;”;

(B) in paragraph (2)—

(i) in subparagraph (A), by inserting
“ground-to-space and” before “space-to-
ground”;

(ii) in subparagraph (E), by striking
“photon-based” and inserting “all applica-
ble modalities of”;

(iii) in subparagraph (F), by inserting
“, quantum sensors,” after “quantum re-
peaters”;

(iv) in subparagraph (G)—

(I) by inserting “data centers,”
after “repeaters,”; and

(II) by striking “and” at the end;

(v) in subparagraph (H)—

(I) by striking “the quantum
technology stack” and inserting
“quantum technology modality
stacks”; and

(II) by striking “National Lab-
oratories in” and inserting “National
Laboratories such as”; and

1 (vi) by adding at the end the fol-
 2 lowing:

3 “(I) development of quantum network and
 4 entanglement distribution protocols or applica-
 5 tions, including development of network stack
 6 protocols and protocols enabling integration
 7 with existing technologies or infrastructure; and

8 “(J) development of high-efficiency room-
 9 temperature photon detectors for quantum
 10 photonic applications, including quantum net-
 11 working and communications;”;

12 (C) in paragraph (4)—

13 (i) by striking “basic”; and

14 (ii) by striking “material” and insert-
 15 ing “materials”; and

16 (D) in paragraph (5), by striking “funda-
 17 mental”; and

18 (3) in subsection (d), by striking “basic re-
 19 search” and inserting “research, development, and
 20 demonstration”.

21 **SEC. 6. DEPARTMENT OF ENERGY QUANTUM USER EXPAN-**
 22 **SION FOR SCIENCE AND TECHNOLOGY PRO-**
 23 **GRAM.**

24 Section 404 of the National Quantum Initiative Act
 25 (15 U.S.C. 8854) is amended—

1 (1) in subsection (a)—

2 (A) in the matter preceding paragraph (1),
3 by striking “and quantum computing clouds”
4 and inserting “, software, and cloud-based
5 quantum computing”;

6 (B) in paragraph (3), by striking “and” at
7 the end;

8 (C) in paragraph (4), by striking the pe-
9 riod at the end and inserting a semicolon; and

10 (D) by adding at the end the following:

11 “(5) to enable development of software and ap-
12 plications, including estimation of resources needed
13 to scale applications; and

14 “(6) to develop near-term quantum applications
15 to solve public and private sector problems.”;

16 (2) in subsection (b)—

17 (A) in paragraph (4), by striking “and” at
18 the end;

19 (B) in paragraph (5), by striking the pe-
20 riod at the end and inserting a semicolon; and

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

22 “(6) enable users to develop algorithms, soft-
23 ware tools, simulators, and applications for quantum
24 systems using cloud-based quantum computers; and

1 “(7) partner with appropriate public- and pri-
 2 vate-sector entities to develop training and education
 3 opportunities on prototype and early-stage devices to
 4 support commercial applications.”;

5 (3) in subsection (c)—

6 (A) by redesignating paragraphs (4)
 7 through (8) as paragraphs (5) through (9), re-
 8 spectively; and

9 (B) by inserting after paragraph (3) the
 10 following:

11 “(4) the National Oceanic and Atmospheric Ad-
 12 ministration;”; and

13 (4) in subsection (e)—

14 (A) in paragraph (4), by striking “and” at
 15 the end;

16 (B) in paragraph (5), by striking the pe-
 17 riod at the end and inserting a semicolon; and

18 (C) by adding at the end the following:

19 “(6) \$38,000,000 for fiscal year 2028;

20 “(7) \$39,900,000 for fiscal year 2029; and

21 “(8) \$41,895,000 for fiscal year 2030.”.

○