

118TH CONGRESS
2D SESSION

S. _____

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

Mr. DURBIN introduced the following bill; which was read twice and referred to the Committee on _____

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 2024”.

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 research with indus-
7 try, National Laboratories, institutions of higher
8 education, and other research institutions to facili-
9 tate the development and demonstration of quantum
10 information science, engineering, and technology pri-
11 orities, as determined by the Secretary of Energy,
12 including in the fields of—

13 “(A) quantum information theory;

14 “(B) quantum physics;

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

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

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

23 “(F) quantum sensing and detection;

24 “(G) materials science and engineering;

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

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

6 “(J) quantum chemistry;

7 “(K) quantum biology;

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

10 “(M) quantum security technologies;”;

11 (F) in paragraph (6) (as so redesign-
12 nated)—

13 (i) in subparagraph (E), by striking
14 “and” at the end;

15 (ii) by redesignating subparagraph
16 (F) as subparagraph (J); and

17 (iii) by inserting after subparagraph
18 (E) the following:

19 “(F) the Office of Electricity;

20 “(G) the Office of Cybersecurity, Energy
21 Security, and Emergency Response;

22 “(H) the Office of Fossil Energy and Car-
23 bon Management;

24 “(I) the Office of Technology Transitions;
25 and”; and

1 (G) in paragraph (7) (as so redesignated)—

2 (i) by striking “and” before “potential”; and

3 (ii) by inserting “, and other relevant stakeholders, as determined by the Secretary of Energy” before the period at the end; and

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

5 “(c) INDUSTRY OUTREACH.—In carrying out the program under subsection (a), the Secretary of Energy shall support the quantum technology industry and promote commercialization of applications of quantum technology relevant to the activities of the Department of Energy by—

6 “(1) educating—

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

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

9 “(2) accelerating the advancements of United States quantum computing, communications, networking, sensing, and security capabilities to protect and optimize the energy sector;

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

4 “(4) facilitating commercialization of quantum
5 technologies from National Laboratories and engag-
6 ing with the Quantum Economic Development Con-
7 sortium and other organizations, as applicable, to
8 transition component technologies that advance the
9 development of a quantum supply chain; and

10 “(5) to the extent practicable, ensuring industry
11 partner access, especially for small- and medium-
12 sized businesses, to specialized quantum instrumen-
13 tation, equipment, testbeds, and other infrastructure
14 to design, prototype, and test novel quantum hard-
15 ware and streamline user access to reduce costs and
16 other administrative burdens.

17 “(d) HIGH PERFORMANCE COMPUTING STRATEGIC
18 PLAN.—

19 “(1) IN GENERAL.—Not later than 1 year after
20 the date of enactment of this subsection, the Sec-
21 retary of Energy shall submit to Congress a 10-year
22 strategic plan to guide Federal programs in design-
23 ing, expanding, and procuring hybrid, energy-effi-
24 cient high-performance computing systems capable
25 of integrating with a diverse set of accelerators, in-

1 cluding quantum, artificial intelligence, and machine
2 learning accelerators, to enable the computing facili-
3 ties of the Department of Energy to advance na-
4 tional computing resources.

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

7 “(A) A conceptual plan to leverage capa-
8 bilities and infrastructure from the exascale
9 computing program, as the Secretary of Energy
10 determines necessary.

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

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

15 “(D) A plan to integrate cloud access of
16 commercially available quantum hardware and
17 software to complement on-premises high per-
18 formance computing systems and resources con-
19 sistent with the QUEST program established
20 under section 404.

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

23 “(1) IN GENERAL.—The Secretary of Energy
24 shall establish an early-stage research and develop-

1 ment program in quantum high-performance com-
2 puting—

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

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

8 “(2) ACTIVITIES.—The program established
9 under paragraph (1) shall—

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

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

15 “(3) FUNDING.—Of funds made available under
16 subsection (i)(1), the Secretary of Energy shall use
17 not more than \$20,000,000 for each of fiscal years
18 2025 through 2029 to carry out the activities under
19 this subsection.

20 “(f) SUPPLY CHAIN STUDY.—Not later than 180
21 days after the date of enactment of this subsection, the
22 Secretary of Energy shall conduct a study on quantum
23 science, engineering, and technology supply chain needs,
24 including—

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

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

8 “(g) TRAINEESHIP PROGRAM.—

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

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

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

19 “(2) FUNDING.—Of funds made available under
20 subsection (i)(1), the Secretary of Energy shall use
21 not more than \$5,000,000 for each of fiscal years
22 2025 through 2029 to carry out the activities under
23 this subsection.

24 “(h) COORDINATION OF ACTIVITIES.—In carrying
25 out this section, the Secretary of Energy shall, to the max-

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

11 “(i) FUNDING.—

12 “(1) IN GENERAL.—Of the funds authorized to
13 be appropriated to the Office of Science under sec-
14 tion 303(j) of the Department of Energy Research
15 and Innovation Act (42 U.S.C. 18641(j)), there is
16 authorized to be appropriated to the Secretary of
17 Energy not more than \$175,000,000 for each of fis-
18 cal years 2025 through 2029 to carry out activities
19 under this section.

20 “(2) RESTRICTIONS.—

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

1 other agreement with a Confucius Institute or
2 any successor of a Confucius Institute.

3 “(B) FOREIGN COUNTRIES AND ENTITIES
4 OF CONCERN.—

5 “(i) DEFINITIONS.—In this subpara-
6 graph:

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

10 “(aa) a covered nation (as
11 defined in section 4872(d) of title
12 10, United States Code); and

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

23 “(II) FOREIGN ENTITY OF CON-
24 CERN.—The term ‘foreign entity of

1 concern’ means a foreign entity
2 that—

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

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

15 “(cc) is owned by, controlled
16 by, or subject to the jurisdiction
17 or direction of a government of a
18 foreign country that is a covered
19 nation (as defined in section
20 4872(d) of title 10, United
21 States Code);

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

1 “(AA) chapter 37 of
2 title 18, United States Code
3 (commonly known as the
4 ‘Espionage Act’);

5 “(BB) section 951 or
6 1030 of title 18, United
7 States Code;

8 “(CC) chapter 90 of
9 title 18, United States Code
10 (commonly known as the
11 ‘Economic Espionage Act of
12 1996’);

13 “(DD) the Arms Ex-
14 port Control Act (22 U.S.C.
15 2751 et seq.);

16 “(EE) section 224,
17 225, 226, 227, or 236 of the
18 Atomic Energy Act of 1954
19 (42 U.S.C. 2274, 2275,
20 2276, 2277, 2284);

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

24 “(GG) the International
25 Emergency Economic Pow-

1 ers Act (50 U.S.C. 1701 et
2 seq.); or

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

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

19 **SEC. 3. DOE QUANTUM INSTRUMENTATION AND FOUNDRY**
20 **PROGRAM.**

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

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

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

6 “(1) Maintain United States leadership in
7 quantum information science, engineering, and tech-
8 nology.

9 “(2) Develop domestic quantum supply chains.

10 “(3) Provide resources for the broader scientific
11 community.

12 “(4) Support activities carried out under sec-
13 tions 401, 403, and 404.

14 “(b) PROGRAM COMPONENTS.—In carrying out the
15 program under subsection (a), the Secretary of Energy
16 shall—

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

25 “(2) leverage the capabilities of National Lab-
26 oratories and Nanoscale Science Research Centers,

1 including facilities and experts that research and de-
2 velop novel quantum materials and devices; and

3 “(3) consider the technologies and end-use ap-
4 plications identified by the Quantum Economic De-
5 velopment Consortium as having significant eco-
6 nomic potential.

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

14 “(d) FUNDING.—Of amounts appropriated or other-
15 wise made available to the Office of Science, the Secretary
16 of Energy shall use not more than \$50,000,000 for each
17 of fiscal years 2025 through 2029 to carry out this sec-
18 tion.”.

19 **SEC. 4. NATIONAL QUANTUM INFORMATION SCIENCE RE-**
20 **SEARCH CENTERS.**

21 Section 402 of the National Quantum Initiative Act
22 (15 U.S.C. 8852) is amended—

23 (1) in subsection (a)—

24 (A) in paragraph (1)—

25 (i) by striking “basic”; and

1 (ii) by striking “science and tech-
2 nology and to support research conducted
3 under section 401” and inserting “science,
4 engineering, and technology, expand capac-
5 ity for the domestic quantum workforce,
6 and support research conducted under sec-
7 tions 401, 403, and 404”; and

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

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

15 (3) in subsection (c)—

16 (A) by striking “basic”; and

17 (B) by inserting “, engineering, and tech-
18 nology, accelerating quantum workforce devel-
19 opment,” after “science”;

20 (4) in subsection (d)(1)—

21 (A) in subparagraph (C), by striking
22 “and” at the end;

23 (B) by redesignating subparagraph (D) as
24 subparagraph (E); and

1 (C) by inserting after subparagraph (C)
2 the following:

3 “(D) the Office of Technology Transitions;
4 and”;

5 (5) in subsection (e), by striking paragraph (2)
6 and inserting the following:

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

11 (6) in subsection (f), in the first sentence—

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

14 (B) by striking “2019 through 2023” and
15 inserting “2025 through 2029”.

16 **SEC. 5. DEPARTMENT OF ENERGY QUANTUM NETWORK IN-**
17 **FRASTRUCTURE RESEARCH AND DEVELOP-**
18 **MENT PROGRAM.**

19 Section 403 of the National Quantum Initiative Act
20 (15 U.S.C. 8853) is amended—

21 (1) in subsection (a)—

22 (A) in paragraph (4)—

23 (i) by inserting “, including” after
24 “networking”; and

25 (ii) by striking “and” at the end;

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

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

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

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

11 (2) in subsection (b)—

12 (A) in paragraph (1)—

13 (i) by redesignating subparagraphs
14 (C) and (D) as subparagraphs (D) and
15 (E), respectively; and

16 (ii) by inserting after subparagraph
17 (B) the following:

18 “(C) the Administrator of the National
19 Aeronautics and Space Administration;”;

20 (B) in paragraph (2)—

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

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

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

7 (iv) in subparagraph (G)—

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

10 (II) by striking “and” at the end;

11 (v) in subparagraph (H)—

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

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

19 (vi) by adding at the end the fol-
20 lowing:

21 “(I) development of quantum network and
22 entanglement distribution protocols or applica-
23 tions, including development of network stack
24 protocols and protocols enabling integration
25 with existing technologies or infrastructure; and

1 “(J) development of high-efficiency room-
2 temperature photon detectors for quantum
3 photonics applications, including quantum net-
4 working and communications;”;

5 (C) in paragraph (4)—

6 (i) by striking “basic”; and

7 (ii) by striking “material” and insert-
8 ing “materials”; and

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

11 (3) in subsection (d), by striking “basic re-
12 search” and inserting “research, development, and
13 demonstration”.

14 **SEC. 6. DEPARTMENT OF ENERGY QUANTUM USER EXPAN-**
15 **SION FOR SCIENCE AND TECHNOLOGY PRO-**
16 **GRAM.**

17 Section 404 of the National Quantum Initiative Act
18 (15 U.S.C. 8854) is amended—

19 (1) in subsection (a)—

20 (A) in the matter preceding paragraph (1),
21 by striking “and quantum computing clouds”
22 and inserting “, software, and cloud-based
23 quantum computing”;

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

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

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

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

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

9 (2) in subsection (b)—

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

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

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

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

18 “(7) partner with appropriate public- and pri-
19 vate-sector entities to develop training and education
20 opportunities on prototype and early-stage devices.”;

21 (3) in subsection (c)—

22 (A) by redesignating paragraphs (4)
23 through (8) as paragraphs (5) through (9), re-
24 spectively; and

1 (B) by inserting after paragraph (3) the
2 following:

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

5 (4) in subsection (e)—

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

8 (B) in paragraph (5), by striking the pe-
9 riod at the end and inserting “; and”; and

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

11 “(6) \$38,000,000 for fiscal year 2028.”.