

Union Calendar No. 349

117TH CONGRESS
2^D SESSION

H. R. 6291

[Report No. 117–452]

To provide for a comprehensive and integrative program to accelerate micro-electronics research and development at the Department of Energy, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

DECEMBER 14, 2021

Mr. TONKO (for himself and Mr. ELLZEY) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

AUGUST 19, 2022

Additional sponsors: Ms. STEVENS, Mr. GIMENEZ, and Ms. WILD

AUGUST 19, 2022

Reported with an amendment, committed to the Committee of the Whole House on the State of the Union, and ordered to be printed

[Strike out all after the enacting clause and insert the part printed in *italie*]

[For text of introduced bill, see copy of bill as introduced on December 14, 2021]

A BILL

To provide for a comprehensive and integrative program to accelerate microelectronics research and development 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 “Microelectronics Re-*
 5 *search for Energy Innovation Act” or the “Micro Act”.*

6 **SEC. 2. DEFINITIONS.**

7 *In this Act:*

8 (1) *DEPARTMENT.*—*The term “Department”*
 9 *means the Department of Energy.*

10 (2) *HISTORICALLY BLACK COLLEGE AND UNIVER-*
 11 *SITY.*—*The term “historically Black college and uni-*
 12 *versity” has the meaning given the term “part B in-*
 13 *stitution” in section 322 of the Higher Education Act*
 14 *of 1965 (20 U.S.C. 1061).*

15 (3) *INSTITUTION OF HIGHER EDUCATION.*—*The*
 16 *term “institution of higher education” has the mean-*
 17 *ing given the term in section 101(a) of the Higher*
 18 *Education Act of 1965 (20 U.S.C. 1001(a)).*

19 (4) *MINORITY SERVING INSTITUTION.*—*The term*
 20 *“minority serving institution” includes the entities*
 21 *described in any of the paragraphs (1) through (7) of*
 22 *section 371(a) of the Higher Education Act of 1965*
 23 *(20 U.S.C. 1067q(a)).*

24 (5) *NATIONAL LABORATORY.*—*The term “Na-*
 25 *tional Laboratory” has the meaning given the term in*

1 *section 2 of the Energy Policy Act of 2005 (42 U.S.C.*
2 *15801).*

3 (6) *SECRETARY.*—*The term “Secretary” means*
4 *the Secretary of Energy.*

5 (7) *SKILLED TECHNICAL WORKFORCE.*—*The*
6 *term “skilled technical workforce” has the meaning*
7 *given such term in section 4(b) of the Innovations in*
8 *Mentoring, Training, and Apprenticeships Act (42*
9 *U.S.C. 1862p).*

10 (8) *TRIBAL COLLEGE AND UNIVERSITY.*—*The*
11 *term “Tribal College and University” has the mean-*
12 *ing given in section 316 of the Higher Education Act*
13 *of 1965 (20 U.S.C. 1059c).*

14 **SEC. 3. FINDINGS.**

15 *Congress finds that—*

16 (1) *the coming end of Moore’s Law presents*
17 *major technological challenges and opportunities for*
18 *the United States and important implications for na-*
19 *tional security, economic competitiveness, and sci-*
20 *entific discovery;*

21 (2) *future progress and innovation in microelec-*
22 *tronics, and maintaining a robust domestic microelec-*
23 *tronics supply chain, will require an approach that*
24 *advances relevant materials science, electronic and*
25 *photonic device technologies, processing and pack-*

1 aging technologies, manufacturing technologies, cir-
2 cuit, chip, and system architecture, and software sys-
3 tem and algorithm development in a co-design fash-
4 ion;

5 (3) the National Laboratories possess unique
6 technical expertise and user facilities that are essen-
7 tial to overcoming foundational research challenges
8 relevant to the topics described in paragraph (2), and
9 translating and transferring research outcomes to in-
10 dustry; and

11 (4) the assets described in paragraph (3) will en-
12 able the Department to drive advances in microelec-
13 tronics that are essential to meeting future needs in
14 areas critical to its missions as well as the future
15 competitiveness of the domestic microelectronics in-
16 dustry, including high-performance computing,
17 emerging data-centric computing approaches, and en-
18 ergy-efficient computing; optical sensors, sources, and
19 wireless networks; and power electronics and elec-
20 tricity delivery systems.

21 **SEC. 4. MICROELECTRONICS RESEARCH PROGRAM.**

22 (a) *IN GENERAL.*—The Secretary shall carry out a
23 cross-cutting program of research, development, and dem-
24 onstration of microelectronics relevant to the mission of the
25 Department and in the service of the Nation’s global com-

1 *petitiveness in the field of microelectronics. In carrying out*
2 *this program, the Secretary shall coordinate across all rel-*
3 *evant programs and offices of the Department.*

4 *(b) RESEARCH AREAS.—In carrying out the program*
5 *under subsection (a), the Secretary shall award financial*
6 *assistance to eligible entities under subsection (c) to carry*
7 *out research projects in—*

8 *(1) foundational science areas, including—*

9 *(A) materials sciences, chemical sciences,*
10 *and plasma science synthesis, and fabrication;*

11 *(B) novel microelectronics devices, including*
12 *emerging memory and storage technologies;*

13 *(C) diverse computing architectures and*
14 *paradigms, including analog computing and*
15 *edge computing;*

16 *(D) data-driven modeling and simulation;*

17 *(E) integrated sensing, power harvesting,*
18 *and communications;*

19 *(F) component integration and subsystems;*

20 *(G) photonic integration; and*

21 *(H) development of co-design frameworks*
22 *for all stages of microelectronics design, develop-*
23 *ment, fabrication, and application;*

24 *(2) cybersecurity by design to result in trusted*
25 *and resilient microelectronics;*

1 (3) *methods for leveraging advanced simulation*
2 *and artificial intelligence to enhance co-design and*
3 *discovery in microelectronics;*

4 (4) *in consultation with the National Institute of*
5 *Standards and Technology, fabrication and proc-*
6 *essing science and metrology associated with micro-*
7 *electronics manufacturing, including lithography,*
8 *patterning, surface deposition, etching, and cleaning;*

9 (5) *approaches for optimizing system-level en-*
10 *ergy efficiency of advanced computing systems, the*
11 *electrical grid, power electronics, and other energy in-*
12 *frastructure;*

13 (6) *approaches for enhancing the durability and*
14 *lifetime of radiation-hardened electronics;*

15 (7) *enhancement of microelectronics security, in-*
16 *cluding the development of integrated devices, pack-*
17 *ages, and thermal management for severe environ-*
18 *ments and national security; and*

19 (8) *in coordination with other relevant initia-*
20 *tives at the Department, methods to improve the life-*
21 *time, maintenance, decommissioning, recycling, reuse,*
22 *and sustainability of microelectronics components*
23 *and systems, including technologies and strategies*
24 *that reduce the use of energy, water, critical mate-*

1 *rials, and other commodities that are determined to*
2 *be vulnerable to disruption.*

3 (c) *ELIGIBLE ENTITIES.—The entities eligible to re-*
4 *ceive financial assistance under this section include—*

5 (1) *an institution of higher education, including*
6 *historically Black colleges and universities, Tribal col-*
7 *leges and universities, and minority serving institu-*
8 *tions;*

9 (2) *a nonprofit research organization;*

10 (3) *a State research agency;*

11 (4) *a National Laboratory;*

12 (5) *a private commercial entity;*

13 (6) *a partnership or consortium of 2 or more en-*
14 *tities described in paragraphs (1) through (5); and*

15 (7) *any other entities the Secretary deems appro-*
16 *priate.*

17 (d) *TECHNOLOGY TRANSFER.—In carrying out the*
18 *program described in subsection (a), the Secretary, in co-*
19 *ordination with the Director of the Office of Technology*
20 *Transitions, and in consultation with the private sector,*
21 *shall support translational research and transfer of micro-*
22 *electronics technologies and identify emerging research and*
23 *development needs of industry and government for the ben-*
24 *efit of United States economic competitiveness.*

1 (e) *WORKFORCE DEVELOPMENT*.—In carrying out the
2 program under subsection (a), the Secretary shall sup-
3 port—

4 (1) *workforce development through the existing*
5 *authorities and mechanisms available to the Depart-*
6 *ment, including internships, fellowships, individual*
7 *investigator grants, and other activities the Secretary*
8 *deems appropriate; and*

9 (2) *education and outreach activities to dissemi-*
10 *nate information and promote understanding of*
11 *microelectronics and related fields among students at*
12 *K-12, undergraduate, and graduate levels. Such ac-*
13 *tivities may include educational programming with*
14 *an emphasis on experiential and project-based learn-*
15 *ing. The Secretary shall consult with the Director of*
16 *the National Science Foundation on activities carried*
17 *out this paragraph.*

18 (f) *OUTREACH*.—In carrying out activities under sub-
19 section (e), the Secretary shall ensure program outreach to
20 recruit applicants and engage participants from all regions
21 of the country, especially underserved communities and
22 groups historically underrepresented in STEM.

23 (g) *REPORT*.—Not less than 180 days after the enact-
24 ment of this Act, the Secretary shall submit to the Com-
25 mittee on Science, Space, and Technology of the House of

1 *Representatives, and the Committee on Energy and Natural*
 2 *Resources of the Senate, a report describing the goals, prior-*
 3 *ities, and anticipated outcomes of the program described in*
 4 *subsection (a).*

5 (h) *FUNDING.—There are authorized to be appro-*
 6 *priated to the Secretary to carry out the activities described*
 7 *in this section—*

8 (1) *\$75,000,000 for fiscal year 2022;*

9 (2) *\$100,000,000 for fiscal year 2023;*

10 (3) *\$100,000,000 for fiscal year 2024;*

11 (4) *\$100,000,000 for fiscal year 2025; and*

12 (5) *\$100,000,000 for fiscal year 2026.*

13 **SEC. 5. MICROELECTRONICS SCIENCE RESEARCH CENTERS.**

14 (a) *IN GENERAL.—In carrying out the program under*
 15 *section 4, the Secretary, acting through the Director of the*
 16 *Office of Science, shall establish up to four Microelectronics*
 17 *Science Research Centers (referred to in this section as*
 18 *“Centers”) to conduct mission-driven research to address*
 19 *foundational challenges in the design, development, charac-*
 20 *terization, prototyping, demonstration, and fabrication of*
 21 *microelectronics and to facilitate the translation of research*
 22 *results to industry.*

23 (b) *ACTIVITIES.—The activities of the Centers author-*
 24 *ized under this section shall include research, development,*
 25 *and demonstration activities for—*

1 (1) *accelerating the development of new micro-*
2 *electronics science and technology, including mate-*
3 *rials, devices, circuits, systems, architectures, fabrica-*
4 *tion tools, processes, diagnostics, modeling, synthesis,*
5 *and, in consultation with the National Institute of*
6 *Standards and Technology, metrology;*

7 (2) *advancing the sustainability and energy effi-*
8 *ciency of new microelectronics devices, packages, and*
9 *systems;*

10 (3) *application-driven co-design and prototyping*
11 *of novel devices to facilitate laboratory-to-fabrication*
12 *transition;*

13 (4) *advancing knowledge and experimental capa-*
14 *bilities in surface and materials science, plasma*
15 *science, and computational and theoretical methods,*
16 *including artificial intelligence, multi-scale co-design,*
17 *and advanced supercomputing capabilities to invent*
18 *and manufacture revolutionary microelectronic de-*
19 *vices;*

20 (5) *creating technology testbeds for prototyping*
21 *platforms for validation and verification of new capa-*
22 *bilities and sharing of ideas, intellectual property,*
23 *and the unique facilities of the Department;*

24 (6) *supporting development of cybersecurity ca-*
25 *pabilities for computing architectures that measur-*

ably improve safety and security, and that are adaptable for existing and future applications; and

(7) supporting long-term and short-term workforce development in microelectronics.

(c) REQUIREMENTS.—

(1) SELECTION AND DURATION.—The Director of the Office of Science shall select Centers on a competitive, merit-reviewed basis for a period of not more than 5 years, subject to the availability of appropriations, beginning on the date of establishment of that Center.

(2) APPLICATIONS.—An eligible applicant under this subsection shall submit to the Director of the Office of Science an application at such time, in such manner, and containing such information as the Director deems appropriate.

(3) ELIGIBLE APPLICANTS.—The Director of the Office of Science shall consider applications from—

(A) National Laboratories;

(B) institutions of higher education, including historically Black colleges and universities, Tribal colleges and universities, and minority serving institutions;

(C) private industry;

(D) research centers;

1 (E) consortia of 2 or more of the entities de-
2 scribed in subparagraphs (A) through (D); and
3 (F) any other entity that the Secretary of
4 Energy deems appropriate.

5 (4) *RENEWAL*.—After the end of either period de-
6 scribed in paragraph (1), the Director of the Office of
7 Science may renew support for the Center for a pe-
8 riod of not more than 5 years on a merit-reviewed
9 basis. For a Center in operation for 10 years after its
10 previous selection on a competitive, merit-reviewed
11 basis, the Director may renew support for the center
12 on a competitive, merit-reviewed basis for a period of
13 not more than 5 years, and may subsequently provide
14 an additional renewal on a merit-reviewed basis for
15 a period of not more than 5 years.

16 (5) *TERMINATION*.—Consistent with the existing
17 authorities of the Department, the Director of the Of-
18 fice of Science may terminate an underperforming
19 center for cause during the performance period.

20 (d) *TECHNOLOGY TRANSFER*.—The Director of the Of-
21 fice of Science, in coordination with the Director of the Of-
22 fice of Technology Transitions, shall implement partner-
23 ships with industry groups for the purpose of facilitating
24 the translation and transfer of research results produced by
25 the Centers.

1 (e) *COORDINATION.*—*The Secretary shall—*

2 (1) *establish a coordinating network to coordi-*
3 *nate cross-cutting research and foster communication*
4 *and collaboration among the Centers; and*

5 (2) *ensure the coordination, and avoid unneces-*
6 *sary duplication, of the activities of each Center with*
7 *the activities of—*

8 (A) *other research entities of the Depart-*
9 *ment, including—*

10 (i) *the Nanoscale Science Research*
11 *Centers;*

12 (ii) *the National Quantum Informa-*
13 *tion Science Research Centers;*

14 (iii) *the Energy Frontier Research*
15 *Centers;*

16 (iv) *the Energy Innovation Hubs;*

17 (v) *the National Laboratories; and*

18 (vi) *other offices of the Department;*

19 (B) *the National Semiconductor Technology*
20 *Center authorized in title XCIX of division H of*
21 *the William M. (Mac) Thornberry National De-*
22 *fense Authorization Act for Fiscal Year 2021*
23 *(Public Law 116–283);*

24 (C) *institutions of higher education;*

25 (D) *industry; and*

1 (E) research activities carried out by other
2 Federal agencies.

3 (f) *WORKFORCE DEVELOPMENT.*—Centers established
4 under this section shall support workforce development
5 through—

6 (1) incorporation of undergraduate students,
7 postdoctoral fellows, graduate students, and early ca-
8 reer researchers, as well as K-12 students through op-
9 portunities such as dual-enrollment programs and
10 work-based learning programs, as applicable;

11 (2) hand-on research and equipment training
12 programs;

13 (3) technical training and certificate programs
14 for the skilled technical workforce;

15 (4) facilitation of engagement between academic,
16 industry, and laboratory researchers; and

17 (5) public outreach activities, including to stu-
18 dents at K-12, undergraduate, and graduate levels.
19 Such activities may include educational program-
20 ming with an emphasis on experiential and project-
21 based learning.

22 (g) *OUTREACH.*—In carrying out activities under sub-
23 section (e), the Secretary shall ensure program outreach to
24 recruit applicants and engage participants from all regions

1 *of the country, especially underserved communities and*
2 *groups historically underrepresented in STEM.*

3 *(h) INTELLECTUAL PROPERTY.—The Secretary shall*
4 *ensure that the intellectual property and value proposition*
5 *created by the Centers are retained within the United*
6 *States.*

7 *(i) FUNDING.—The Secretary of Energy shall allocate*
8 *up to \$25,000,000 for each Center established under this*
9 *section for each of fiscal years 2022 through 2026, subject*
10 *to the availability of appropriations.*

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[Report No. 117-452]

A BILL

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