

119TH CONGRESS
2D SESSION

S. _____

To amend the Energy Independence and Security Act of 2007 to direct research, development, demonstration, and commercial application activities in support of next-generation geothermal systems in various conditions, and for other purposes.

IN THE SENATE OF THE UNITED STATES

Ms. CORTEZ MASTO (for herself and Ms. MURKOWSKI) introduced the following bill; which was read twice and referred to the Committee on

A BILL

To amend the Energy Independence and Security Act of 2007 to direct research, development, demonstration, and commercial application activities in support of next-generation geothermal systems in various conditions, 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 “Next-Generation Geo-
5 thermal Research and Development Act”.

1 **SEC. 2. GEOTHERMAL ENERGY.**

2 (a) EISA DEFINITIONS.—Section 612 of the Energy
3 Independence and Security Act of 2007 (42 U.S.C.
4 17191) is amended—

5 (1) by redesignating paragraphs (1) through
6 (8) as paragraphs (2), (3), (4), (5), (6), (7), (8),
7 and (12), respectively;

8 (2) by inserting before paragraph (2) (as so re-
9 designated) the following:

10 “(1) CLOSED-LOOP GEOTHERMAL SYSTEMS.—
11 The term ‘closed-loop geothermal systems’ means a
12 wellbore or subsurface circuit of wellbores containing
13 a fluid heated through contact with the borehole
14 wall.”; and

15 (3) by inserting after paragraph (8) (as so re-
16 designated) the following:

17 “(9) NEXT-GENERATION GEOTHERMAL SYS-
18 TEMS.—The term ‘next-generation geothermal sys-
19 tems’ means—

20 “(A) enhanced geothermal systems;

21 “(B) closed-loop geothermal systems; and

22 “(C) in supercritical conditions—

23 “(i) enhanced geothermal systems;

24 “(ii) closed-loop geothermal systems;

25 or

1 “(iii) other technologies, as deter-
2 mined by the Secretary.

3 “(10) SUPERCRITICAL CONDITIONS.—The term
4 ‘supercritical conditions’ means subsurface tempera-
5 ture conditions at or above the supercritical tem-
6 perature of the primary fluid present.

7 “(11) SUPERCRITICAL GEOTHERMAL.—The
8 term ‘supercritical geothermal’ means energy derived
9 from a subsurface geologic rock resource existing in-
10 situ at or above the supercritical temperature of the
11 primary fluid present.”.

12 (b) HYDROTHERMAL RESEARCH AND DEVELOPMENT
13 PROGRAMS.—Section 613(b)(1) of the Energy Independ-
14 ence and Security Act of 2007 (42 U.S.C. 17192(b)(1))
15 is amended by striking “advanced geologic tools to assist”
16 and inserting “advanced tools, including machine learning
17 algorithms, to assist”.

18 (c) GEOTHERMAL SYSTEMS RESEARCH AND DEVEL-
19 OPMENT.—Section 614 of the Energy Independence and
20 Security Act of 2007 (42 U.S.C. 17193) is amended—

21 (1) in subsection (d)(1), by striking “among the
22 Office of Fossil Energy, the Office of Energy Effi-
23 ciency and Renewable Energy,” and inserting
24 “across the Department”; and

25 (2) in subsection (h)—

1 (A) in paragraph (1), by inserting “and
2 publicly available subsurface data, including
3 data reported as part of fossil fuel and mining
4 operations,” after “geothermal drilling informa-
5 tion”; and

6 (B) in paragraph (2), by adding at the end
7 the following:

8 “(C) UPDATES.—The repository estab-
9 lished under paragraph (1) shall be periodically
10 updated in order to carry out the following:

11 “(i) Standardize data in a uniform
12 manner to the maximum extent practicable
13 and enable analysis across different
14 projects.

15 “(ii) Enhance the accessibility and
16 usability of data to increase analysis of
17 geothermal energy, including next-genera-
18 tion geothermal systems on regional, local,
19 and site-specific scales.

20 “(iii) Increase uses of data, including
21 data viewable by map and organization by
22 common attributes such as region.

23 “(iv) Make other improvements in
24 functionality and usability, as determined
25 by the Secretary.

1 and control points for deep heat mapping
2 and geothermal development.

3 “(E) REGIONAL DEEP DATA PROBES.—

4 “(i) IN GENERAL.—The Secretary
5 shall work with the Secretary of the Inte-
6 rior, who shall be responsible for commis-
7 sioning the drilling of deep exploration
8 boreholes deeper than 8 kilometers in
9 depth in representative geological provinces
10 in the United States to provide control
11 points for deep heat mapping and geo-
12 thermal development.

13 “(ii) REQUIREMENTS.—The resulting
14 data shall—

15 “(I) include an exploration of
16 heat, lithology, and subsurface stress
17 state; and

18 “(II) be shared publicly on the
19 drilling data repository.”.

20 (d) ENHANCED GEOTHERMAL SYSTEMS RESEARCH
21 AND DEVELOPMENT.—Section 615 of the Energy Inde-
22 pendence and Security Act of 2007 (42 U.S.C. 17194) is
23 amended—

24 (1) in the section heading, by striking “**RE-**
25 **SEARCH AND DEVELOPMENT**” and inserting

1 **“AND CLOSED-LOOP GEOTHERMAL SYSTEMS**
2 **RESEARCH, DEVELOPMENT, AND TESTING”**;

3 (2) by inserting “and closed-loop geothermal
4 systems” after “enhanced geothermal systems” each
5 place it appears;

6 (3) in subsection (b)—

7 (A) in the subsection heading, by inserting
8 “AND CLOSED-LOOP GEOTHERMAL SYSTEMS”
9 after “SYSTEMS”;

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

12 (C) in paragraph (12), by striking the pe-
13 riod at the end and inserting “; and”; and

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

15 “(13) the research topics described in para-
16 graphs (1) through (12) in supercritical condi-
17 tions.”;

18 (4) in subsection (c)—

19 (A) by inserting “systems and closed-loop
20 geothermal systems” after “enhanced geo-
21 thermal” each place it appears;

22 (B) by redesignating paragraph (7) as
23 paragraph (8); and

24 (C) by inserting after paragraph (6) the
25 following:

1 “(7) TESTING OF NEXT-GENERATION GEO-
2 THERMAL SYSTEMS IN SUPERCRITICAL CONDI-
3 TIONS.—Not later than 1 year after the date of en-
4 actment of the Next-Generation Geothermal Re-
5 search and Development Act, the Secretary shall
6 take such actions as may be necessary to ensure that
7 at least 1 FORGE site has the capabilities to in-
8 clude testing of next-generation geothermal systems
9 in supercritical conditions.”;

10 (5) in subsection (d)—

11 (A) in the subsection heading, by inserting
12 “AND CLOSED-LOOP GEOTHERMAL SYSTEMS”
13 after “SYSTEMS”; and

14 (B) in paragraph (2)(C), by inserting “and
15 closed-loop geothermal” after “enhanced geo-
16 thermal”; and

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

18 “(e) NEXT-GENERATION GEOTHERMAL RESEARCH
19 AND DEVELOPMENT PROGRAM.—

20 “(1) IN GENERAL.—Within the Geothermal
21 Technologies Office of the Department, the Sec-
22 retary shall support a program, to be called the
23 ‘Next-Generation Research and Development Pro-
24 gram’, for next-generation geothermal systems re-

1 search, development, demonstration, and commercial
2 application activities.

3 “(2) SUPERCRITICAL GEOTHERMAL.—

4 “(A) IN GENERAL.—The program de-
5 scribed in paragraph (1) shall include research
6 on supercritical geothermal, including on the
7 following topics in supercritical conditions:

8 “(i) Well completion.

9 “(ii) Reservoir creation and manage-
10 ment, including drilling tools, casing pro-
11 duction equipment, proppants, and pack-
12 ers.

13 “(iii) Materials development and
14 equipment design, including power produc-
15 tion, specific to supercritical geothermal
16 systems.

17 “(iv) Sensor development.

18 “(v) Water-rock geochemistry.

19 “(vi) Rock properties.

20 “(vii) Hard rock and deep drilling.

21 “(viii) Any other topics the Secretary
22 determines necessary.

23 “(B) MILESTONE-BASED GRANTS.—In car-
24 rying out supercritical geothermal research
25 under the program described in paragraph (1),

1 the Secretary shall award milestone-based
2 grants for deep drilling projects in unique
3 geodynamic settings at each of the following
4 milestones:

5 “(i) Tectonic crustal stress and frac-
6 ture characterization.

7 “(ii) Laboratory work.

8 “(iii) Drilling.

9 “(iv) Flow testing.

10 “(v) Power production.

11 “(C) ADMINISTRATION.—The Secretary
12 shall administer grants to institutions of higher
13 education and private sector entities to carry
14 out activities on the topics described in sub-
15 paragraphs (A) and (B) and, to the maximum
16 extent practicable, share data, results, and in-
17 formation publicly.

18 “(3) REPORT ON WATER USE.—

19 “(A) IN GENERAL.—Not later than 5 years
20 after the date of enactment of this subsection,
21 the Secretary shall submit to the Committee on
22 Natural Resources and the Committee on
23 Science, Space, and Technology of the House of
24 Representatives and the Committee on Energy
25 and Natural Resources of the Senate a report

1 on estimated water withdrawal and consump-
2 tion of next-generation geothermal systems.

3 “(B) REQUIREMENTS.—The report re-
4 quired under subparagraph (A) shall include an
5 analysis of—

6 “(i) the ability of next-generation geo-
7 thermal systems to use brackish and non-
8 potable water;

9 “(ii) the withdrawal and consumption
10 of water per megawatt hour of next-gen-
11 eration geothermal systems, as compared
12 to other power-generation technologies;
13 and

14 “(iii) technological and operational
15 improvements that could lead to decreases
16 in water withdrawal and consumption of
17 next-generation geothermal systems.

18 “(4) NEXT-GENERATION GEOTHERMAL CENTER
19 OF EXCELLENCE.—

20 “(A) ESTABLISHMENT.—The Secretary
21 shall award grants, through a competitive,
22 merit-reviewed process, to National Labora-
23 tories (as defined in section 2 of the Energy
24 Policy Act of 2005 (42 U.S.C. 15801)) (re-
25 ferred to in this paragraph as the ‘National

1 Laboratories’), multi-institutional collabora-
2 tions, public-private partnerships, State geologi-
3 cal surveys, or institutions of higher education
4 (or consortia thereof), for the following:

5 “(i) The continuation and expansion
6 of research, development, demonstration,
7 testing, and commercial application activi-
8 ties applicable to FORGE sites, including
9 activities in supercritical conditions.

10 “(ii) The establishment of a next-gen-
11 eration geothermal systems center of excel-
12 lence.

13 “(B) LOCATION.—In selecting National
14 Laboratories, multi-institutional collaborations,
15 public-private partnerships, or institutions of
16 higher education for the establishment of a cen-
17 ter of excellence under subparagraph (A), the
18 Secretary shall consider the following criteria:

19 “(i) Whether the institution hosts an
20 existing geothermal energy research and
21 development program.

22 “(ii) Whether the institution has prov-
23 en technical expertise to support geo-
24 thermal energy research.

1 States geothermal energy industry, includ-
2 ing a focus on next-generation geothermal
3 systems.

4 “(iii) Support workforce development
5 across the next-generation geothermal sys-
6 tems energy development lifecycle.

7 “(iv) Provide educational, technical,
8 and analytical assistance on next-genera-
9 tion geothermal systems to Federal agen-
10 cies, industry, and State, local, and Tribal
11 governments.

12 “(v) Collect and disseminate informa-
13 tion on best practices in all areas relating
14 to developing and managing geothermal
15 energy resources and energy systems, in-
16 cluding next-generation geothermal sys-
17 tems.

18 “(5) COMMERCIAL-READINESS INNOVATION
19 GRANTS.—

20 “(A) IN GENERAL.—The Secretary shall
21 award grants to accelerate the development,
22 testing, and implementation of innovative tech-
23 nologies identified by in-field operations as
24 areas for improving the performance of com-
25 mercial geothermal energy projects using en-

1 hanced geothermal systems and closed-loop geo-
2 thermal systems.

3 “(B) FOCUS AREAS.—Grants may be
4 awarded under this paragraph for innovative
5 technologies, including—

6 “(i) hardrock drilling equipment, com-
7 ponents, and systems, including bit design
8 and vibration control;

9 “(ii) reservoir characterization, well
10 design and spacing, and completions; and

11 “(iii) data acquisition and analysis,
12 including fiber optic sensing tools and
13 methodologies.

14 “(C) APPLICATIONS.—

15 “(i) IN GENERAL.—An entity seeking
16 a grant under this paragraph shall submit
17 to the Secretary an application at such
18 time, in such manner, and containing such
19 information as the Secretary may require.

20 “(ii) PRIORITIZATION.—In awarding
21 grants under this paragraph, the Secretary
22 shall give priority to—

23 “(I) applicants, especially for-
24 profit entities and public-private part-
25 nerships, with demonstrated success

1 relating to in-field development and
2 commercial operations for geothermal
3 energy projects;

4 “(II) projects with the greatest
5 ability to advance near-term commer-
6 cial deployment of enhanced geo-
7 thermal systems and closed-loop geo-
8 thermal systems; and

9 “(III) projects that advance the
10 commercialization of geothermal en-
11 ergy projects in diverse geological con-
12 ditions or supercritical conditions.

13 “(D) COST SHARING.—The Federal share
14 of the cost of a project carried out with a grant
15 under this paragraph shall be not more than 80
16 percent.

17 “(6) NEXT-GENERATION GEOTHERMAL SYS-
18 TEMS SURFACE FACILITY INNOVATION GRANTS.—

19 “(A) IN GENERAL.—The Secretary shall
20 award grants for innovation in the operation,
21 cost, and design of surface facility components
22 of next-generation geothermal systems.

23 “(B) FOCUS AREAS.—Grants may be
24 awarded under this paragraph for development

1 and testing of innovative technologies, includ-
2 ing—

3 “(i) improved organic Rankine cycle
4 generation efficiency, working fluids, and
5 performance at low and supercritical tem-
6 peratures;

7 “(ii) improved performance of air-
8 cooled condensers in warm ambient weath-
9 er conditions, and improved efficiency of
10 water-cooled condensers; and

11 “(iii) component and facility design,
12 including gathering lines, generation unit
13 standardization, and data collection and
14 monitoring.

15 “(C) APPLICATIONS.—

16 “(i) IN GENERAL.—An entity seeking
17 a grant under this paragraph shall submit
18 to the Secretary an application at such
19 time, in such manner, and containing such
20 information as the Secretary may require.

21 “(ii) PRIORITIZATION.—In awarding
22 grants under this paragraph, the Secretary
23 shall give priority to—

24 “(I) applicants, especially private
25 entities and public-private partner-

1 ships, with demonstrated success re-
2 lating to in-field operation of geo-
3 thermal energy technologies, including
4 manufacturing power generation and
5 industrial energy components;

6 “(II) projects with the greatest
7 ability to advance near-term commer-
8 cial deployment of geothermal energy
9 projects; and

10 “(III) projects that advance the
11 commercialization of geothermal en-
12 ergy projects in diverse geological con-
13 ditions or in supercritical conditions.

14 “(7) AUTHORIZATION OF APPROPRIATIONS.—
15 There are authorized to be appropriated to the Sec-
16 retary to carry out this subsection \$5,000,000 for
17 each of fiscal years 2027 through 2031.”.

18 (e) ORGANIZATION AND ADMINISTRATION OF PRO-
19 GRAMS.—Section 617 of the Energy Independence and Se-
20 curity Act of 2007 (42 U.S.C. 17196) is amended—

21 (1) in subsection (e), by striking “Committee
22 on Science and Technology” and inserting “Com-
23 mittee on Science, Space, and Technology”; and

24 (2) by striking subsection (f) and inserting the
25 following:

1 “(f) PROGRESS REPORTS.—Not later than 1 year
2 after the date of enactment of the Next-Generation Geo-
3 thermal Research and Development Act, and every 2 years
4 thereafter, the Secretary shall submit to the Committee
5 on Science, Space, and Technology of the House of Rep-
6 resentatives and the Committee on Energy and Natural
7 Resources of the Senate a report that contains the fol-
8 lowing:

9 “(1) A description of the maximum potential of
10 geothermal resources in the United States, including
11 the States of Alaska and Hawaii, using the geo-
12 thermal resource assessment under section 2501 of
13 the Energy Policy Act of 1992 (30 U.S.C. 1028) or
14 other such means, as the Secretary determines ap-
15 propriate, including a consideration of next-genera-
16 tion geothermal systems.

17 “(2) Information relating to the results of
18 projects undertaken under this section.

19 “(3) An assessment of the barriers to commer-
20 cialization of next-generation geothermal systems.

21 “(4) Such other information as the Secretary
22 considers appropriate.”.

23 (f) REAUTHORIZATION OF ADVANCED GEOTHERMAL
24 INNOVATION LEADERSHIP.—Section 623 of the Energy

1 Independence and Security Act of 2007 (42 U.S.C.
2 17202) is amended—

3 (1) by striking “There are authorized” and in-
4 serting the following:

5 “(a) IN GENERAL.—There are authorized”; and

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

7 “(b) PROGRAM CONTINUANCE.—In addition to
8 amounts provided under section 615(e), there are author-
9 ized to be appropriated to the Secretary to carry out the
10 programs under this subtitle such sums as are necessary
11 for each of fiscal years 2026 through 2031, to remain
12 available until expended.”.

13 (g) INTERNATIONAL GEOTHERMAL ENERGY DEVEL-
14 OPMENT.—Section 624(a) of the Energy Independence
15 and Security Act of 2007 (42 U.S.C. 17203(a)) is amend-
16 ed by striking “system resources” and inserting “systems
17 resources”.

18 (h) UPDATE TO GEOTHERMAL RESOURCE ASSESS-
19 MENT.—Section 2501 of the Energy Policy Act of 1992
20 (30 U.S.C. 1028) is amended—

21 (1) by striking “acting through the United
22 States Geological Survey” each place it appears and
23 inserting “acting through the Director of the United
24 States Geological Survey”;

25 (2) in subsection (c)—

1 (A) in the matter preceding paragraph (1),
2 by inserting “, subject to subsection (d), quad-
3 rennially” after “shall”;

4 (B) in paragraph (1)(D)(ii), by striking
5 “and” at the end;

6 (C) in paragraph (2)—

7 (i) by inserting “, State geological
8 surveys,” after “State officials”; and

9 (ii) by striking the period at the end
10 and inserting “; and”; and

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

12 “(3) by assessing regions of the United States
13 with significant potential for supercritical geo-
14 thermal (as defined in section 612 of the Energy
15 Independence and Security Act of 2007 (42 U.S.C.
16 17191)).”; and

17 (3) by striking subsection (d) and inserting the
18 following:

19 “(d) INITIAL ASSESSMENTS.—

20 “(1) IN GENERAL.—Not later than 2 years
21 after the date of enactment of the Next-Generation
22 Geothermal Research and Development Act, the Sec-
23 retary of the Interior, acting through the Director of
24 the United States Geological Survey (referred to in

1 this subsection as the ‘Director’), shall complete up-
2 dated assessments of—

3 “(A) conventional hydrothermal resources;

4 and

5 “(B) next-generation geothermal resources,
6 including enhanced geothermal systems.

7 “(2) METHODOLOGIES.—Not later than 5 years
8 after the date of enactment of the Next-Generation
9 Geothermal Research and Development Act, the Di-
10 rector shall develop methodologies for, and complete
11 an initial assessment of, next-generation geothermal
12 resources, including supercritical geothermal sys-
13 tems.

14 “(3) INTERIM PRODUCTS.—In carrying out
15 paragraphs (1) and (2), the Director may publish in-
16 terim datasets, analyses, or partial assessments prior
17 to the completion of a full assessment under those
18 paragraphs.

19 “(4) PRIORITIZATION.—To the extent prac-
20 ticable, the Director shall prioritize carrying out geo-
21 thermal resource assessments in a sustained effort
22 and manner consistent with the requirements of the
23 Advanced Geothermal Energy Research and Devel-
24 opment Act of 2007 (42 U.S.C. 17191 et seq.).

1 “(5) IMPLEMENTATION.—The completion of the
2 initial assessments required under paragraphs (1)
3 and (2) shall satisfy the first update required after
4 the date of enactment of the Next-Generation Geo-
5 thermal Research and Development Act under sub-
6 section (c).”.

7 (i) CLERICAL AMENDMENT.—The table of contents
8 of the Energy Independence and Security Act of 2007 (42
9 U.S.C. 17001 note; Public Law 110–140) is amended by
10 striking the item relating to section 615 and inserting the
11 following:

 “Sec. 615. Enhanced geothermal systems and closed-loop geothermal systems
 research, development, and testing.”.