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[Report No. 116–115]

To amend the fossil energy research and development provisions of the Energy Policy Act of 2005 to enhance fossil fuel technology, and for other purposes.

IN THE SENATE OF THE UNITED STATES

APRIL 11, 2019

Mr. MANCHIN (for himself, Ms. MURKOWSKI, Mrs. CAPITO, Mr. CRAMER, Mr. DAINES, Mr. JONES, Mr. ALEXANDER, Mr. HOEVEN, and Mr. COONS) introduced the following bill; which was read twice and referred to the Committee on Energy and Natural Resources

SEPTEMBER 24, 2019

Reported by Ms. MURKOWSKI, with an amendment

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

A BILL

To amend the fossil energy research and development provisions of the Energy Policy Act of 2005 to enhance fossil fuel technology, 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,*

1 **SECTION 1. SHORT TITLE.**

2 This Act may be cited as the “Enhancing Fossil Fuel
3 Energy Carbon Technology Act of 2019”.

4 **SEC. 2. ESTABLISHMENT OF COAL AND NATURAL GAS**
5 **TECHNOLOGY PROGRAM.**

6 (a) **IN GENERAL.**—The Energy Policy Act of 2005
7 is amended by striking section 962 (42 U.S.C. 16292) and
8 inserting the following:

9 **“SEC. 962. COAL AND NATURAL GAS TECHNOLOGY PRO-**
10 **GRAM.**

11 **“(a) DEFINITIONS.**—In this section:

12 **“(1) LARGE-SCALE PILOT PROJECT.**—The term
13 ‘large-scale pilot project’ means a pilot project
14 that—

15 **“(A)** represents the scale of technology de-
16 velopment beyond laboratory development and
17 bench scale testing; but not yet advanced to the
18 point of being tested under real operational con-
19 ditions at commercial scale;

20 **“(B)** represents the scale of technology
21 necessary to gain the operational data needed
22 to understand the technical and performance
23 risks of the technology before the application of
24 that technology at commercial scale or in com-
25 mercial-scale demonstration; and

26 **“(C)** is large enough—

1 “(i) to validate scaling factors; and

2 “(ii) to demonstrate the interaction
3 between major components so that control
4 philosophies for a new process can be de-
5 veloped and enable the technology to ad-
6 vance from large-scale pilot plant applica-
7 tion to commercial-scale demonstration or
8 application.

9 “(2) NET-NEGATIVE CARBON DIOXIDE EMIS-
10 SIONS TECHNOLOGY.—The term ‘net-negative car-
11 bon dioxide emissions technology’ means tech-
12 nology—

13 “(A) for thermochemical co-conversion of
14 coal and biomass fuels that—

15 “(i) uses a carbon capture system;
16 and

17 “(ii) with carbon dioxide removal, the
18 Secretary determines can provide elec-
19 tricity, fuels, or chemicals with net-nega-
20 tive carbon dioxide emissions from produc-
21 tion and consumption of the end products,
22 while removing atmospheric carbon dioxide;
23 and

24 “(B) through which each use of coal will
25 be combined with the use of a regionally indige-

nous form of biomass energy, provided on a renewable basis, that is sufficient in quantity to allow for net-negative emissions of carbon dioxide (in combination with a carbon capture system), while avoiding impacts on food production activities.

~~“(3) PROGRAM.—The term ‘program’ means the program established under subsection (b)(1).~~

~~“(4) TRANSFORMATIONAL TECHNOLOGY.—~~

~~“(A) IN GENERAL.—The term ‘transformational technology’ means a power generation technology that represents a significant change in the methods used to convert energy that will enable a step change in performance, efficiency, and cost of electricity as compared to the technology in existence on the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019.~~

~~“(B) INCLUSIONS.—The term ‘transformational technology’ includes a broad range of technology improvements, including—~~

~~“(i) thermodynamic improvements in energy conversion and heat transfer, including—~~

1 “(I) advanced combustion sys-
2 tems, including oxygen combustion
3 systems and chemical looping; and

4 “(II) the replacement of steam
5 cycles with supercritical carbon diox-
6 ide cycles;

7 “(ii) improvements in steam or carbon
8 dioxide turbine technology;

9 “(iii) improvements in carbon capture,
10 utilization, and storage systems technology;

11 “(iv) improvements in small-scale and
12 modular coal-fired technologies with re-
13 duced carbon output or carbon capture
14 that can support incremental power gen-
15 eration capacity additions;

16 “(v) fuel cell technologies for low-cost,
17 high-efficiency, fuel-flexible modular power
18 systems;

19 “(vi) advanced gasification systems;

20 “(vii) thermal cycling technologies;
21 and

22 “(viii) any other technology the Sec-
23 retary recognizes as transformational tech-
24 nology.

1 “(b) COAL AND NATURAL GAS TECHNOLOGY PRO-
2 GRAM.—

3 “(1) IN GENERAL.—The Secretary shall estab-
4 lish a coal and natural gas technology program to
5 ensure the continued use of the abundant domestic
6 coal and natural gas resources of the United States
7 through the development of technologies that will
8 significantly improve the efficiency, effectiveness,
9 costs, and environmental performance of coal and
10 natural gas use.

11 “(2) REQUIREMENTS.—The program shall in-
12 clude—

13 “(A) a research and development program;

14 “(B) large-scale pilot projects;

15 “(C) demonstration projects; and

16 “(D) a front-end engineering and design
17 program.

18 “(3) PROGRAM GOALS AND OBJECTIVES.—In
19 consultation with the interested entities described in
20 paragraph (5)(C), the Secretary shall develop goals
21 and objectives for the program to be applied to the
22 technologies developed within the program, taking
23 into consideration the following:

24 “(A) Increasing the performance of coal
25 and natural gas plants, including by—

1 “(i) ensuring reliable, low-cost power
2 from new and existing coal and natural gas
3 plants;

4 “(ii) achieving high conversion effi-
5 ciencies;

6 “(iii) addressing emissions of carbon
7 dioxide through high-efficiency platforms;

8 “(iv) developing small-scale and mod-
9 ular technologies to support incremental
10 capacity additions and load following gen-
11 eration, in addition to large-scale genera-
12 tion technologies;

13 “(v) supporting dispatchable oper-
14 ations for new and existing applications of
15 coal and natural gas generation; and

16 “(vi) accelerating the development of
17 technologies that have transformational en-
18 ergy conversion characteristics.

19 “(B) Using carbon capture, utilization, and
20 sequestration technologies to decrease the car-
21 bon dioxide emissions, and the environmental
22 impact from carbon dioxide emissions, from new
23 and existing coal and natural gas plants, includ-
24 ing by—

1 “(i) accelerating the development of
2 technologies to capture carbon dioxide
3 emissions from new and existing coal and
4 natural gas plants;

5 “(ii) accelerating the development of
6 technologies to capture carbon dioxide
7 emissions from industrial facilities, includ-
8 ing—

9 “(I) nontraditional fuel manufac-
10 turing facilities, including ethanol or
11 other biofuel production plants; and

12 “(II) energy-intensive manufac-
13 turing facilities that produce carbon
14 dioxide as a byproduct of operations;

15 “(iii) supporting sites for safe geologi-
16 cal storage of large volumes of anthropo-
17 genic sources of carbon dioxide and the de-
18 velopment of the infrastructure needed to
19 support a carbon dioxide utilization and
20 storage industry;

21 “(iv) improving the conversion, utili-
22 zation, and storage of carbon dioxide pro-
23 duced from fossil fuels and other anthropo-
24 genic sources of carbon dioxide;

1 “(v) lowering greenhouse gas emis-
 2 sions for all fossil fuel production, genera-
 3 tion, delivery, and use, to the maximum ex-
 4 tent practicable;

5 “(vi) developing carbon utilization
 6 technologies, products, and methods, in-
 7 cluding carbon use and reuse for commer-
 8 cial application; and

9 “(vii) developing net-negative carbon
 10 dioxide emissions technologies.

11 “(C) Decreasing the non-carbon dioxide
 12 relevant environmental impacts of coal and nat-
 13 ural gas production, including by—

14 “(i) further reducing non-carbon diox-
 15 ide air emissions; and

16 “(ii) reducing the use, and managing
 17 the discharge, of water in power plant op-
 18 erations.

19 “(D) Examining methods of converting
 20 coal and natural gas to other valuable products
 21 and commodities in addition to electricity.

22 “(4) CROSS-CUTTING DIRECTION FOR CARBON
 23 CAPTURE, UTILIZATION, AND SEQUESTRATION AC-
 24 TIVITIES.—The carbon capture, utilization, and se-

1 ~~questration~~ activities described in paragraph (3)(B)
 2 shall be—

3 ~~“(A) cross-cutting in nature; and~~

4 ~~“(B) carried out by the Assistant Sec-~~
 5 ~~retary for Fossil Energy, in coordination with~~
 6 ~~the heads of other relevant offices of the De-~~
 7 ~~partment, including the Director of the Office~~
 8 ~~of Science and the Assistant Secretary for En-~~
 9 ~~ergy Efficiency and Renewable Energy.~~

10 ~~“(5) CONSULTATIONS REQUIRED.—In carrying~~
 11 ~~out the program, the Secretary shall—~~

12 ~~“(A) undertake international collabora-~~
 13 ~~tions, taking into consideration the rec-~~
 14 ~~ommendations of the National Coal Council;~~

15 ~~“(B) use existing authorities to encourage~~
 16 ~~international cooperation; and~~

17 ~~“(C) consult with interested entities, in-~~
 18 ~~cluding—~~

19 ~~“(i) coal and natural gas producers;~~

20 ~~“(ii) industries that use coal and nat-~~
 21 ~~ural gas;~~

22 ~~“(iii) organizations that promote coal,~~
 23 ~~advanced coal, and natural gas tech-~~
 24 ~~nologies;~~

25 ~~“(iv) environmental organizations;~~

1 ~~“(v) organizations representing work-~~
 2 ~~ers; and~~

3 ~~“(vi) organizations representing con-~~
 4 ~~sumers.~~

5 ~~“(e) REPORT.—~~

6 ~~“(1) IN GENERAL.—Not later than 18 months~~
 7 ~~after the date of enactment of the Enhancing Fossil~~
 8 ~~Fuel Energy Carbon Technology Act of 2019, the~~
 9 ~~Secretary shall submit to Congress a report describ-~~
 10 ~~ing the program goals and objectives adopted under~~
 11 ~~subsection (b)(3).~~

12 ~~“(2) UPDATE.—Not less frequently than once~~
 13 ~~every 2 years after the initial report is submitted~~
 14 ~~under paragraph (1), the Secretary shall submit to~~
 15 ~~Congress a report describing the progress made to-~~
 16 ~~wards achieving the program goals and objectives~~
 17 ~~adopted under subsection (b)(3).~~

18 ~~“(d) FUNDING.—~~

19 ~~“(1) AUTHORIZATION OF APPROPRIATIONS.—~~

20 ~~There are authorized to be appropriated to the Sec-~~
 21 ~~retary to carry out this section, to remain available~~
 22 ~~until expended—~~

23 ~~“(A) for activities under the research and~~
 24 ~~development program component described in~~
 25 ~~subsection (b)(2)(A)—~~

1 “(i) ~~\$230,000,000~~ for each of fiscal
2 years ~~2020~~ and ~~2021~~; and

3 “(ii) ~~\$150,000,000~~ for each of fiscal
4 years ~~2022~~ through ~~2024~~;

5 “(B) subject to paragraph (2), for activi-
6 ties under the large-scale pilot projects program
7 component described in subsection (b)(2)(B)—

8 “(i) ~~\$347,000,000~~ for each of fiscal
9 years ~~2020~~ and ~~2021~~;

10 “(ii) ~~\$272,000,000~~ for each of fiscal
11 years ~~2022~~ and ~~2023~~; and

12 “(iii) ~~\$250,000,000~~ for fiscal year
13 ~~2024~~;

14 “(C) for activities under the demonstration
15 projects program component described in sub-
16 section (b)(2)(C)—

17 “(i) ~~\$100,000,000~~ for each of fiscal
18 years ~~2020~~ and ~~2021~~; and

19 “(ii) ~~\$500,000,000~~ for each of fiscal
20 years ~~2022~~ through ~~2024~~; and

21 “(D) for activities under the front-end en-
22 gineering and design program described in sub-
23 section (b)(2)(D), ~~\$50,000,000~~ for each of fis-
24 cal years ~~2020~~ through ~~2023~~.

1 ~~“(2) COST SHARING FOR LARGE-SCALE PILOT~~
 2 ~~PROJECTS.—Activities under subsection (b)(2)(B)~~
 3 ~~shall be subject to the cost-sharing requirements of~~
 4 ~~section 988(b).”.~~

5 ~~(b) TECHNICAL AMENDMENT.—The table of contents~~
 6 ~~for the Energy Policy Act of 2005 (Public Law 109–58;~~
 7 ~~119 Stat. 600) is amended by striking the item relating~~
 8 ~~to section 962 and inserting the following:~~

~~“Sec. 962. Coal and natural gas technology program.”.~~

9 ~~**SEC. 3. CARBON STORAGE VALIDATION AND TESTING.**~~

10 ~~(a) IN GENERAL.—The Energy Policy Act of 2005~~
 11 ~~is amended by striking section 963 (42 U.S.C. 16293)~~
 12 ~~and inserting the following:~~

13 ~~**“SEC. 963. CARBON STORAGE VALIDATION AND TESTING.**~~

14 ~~“(a) DEFINITIONS.—In this section:~~

15 ~~“(1) ELECTRIC GENERATION UNIT.—The term~~
 16 ~~‘electric generation unit’ means an electric genera-~~
 17 ~~tion unit that—~~

18 ~~“(A) uses coal- or natural gas-based gen-~~
 19 ~~eration technology; and~~

20 ~~“(B) is capable of capturing carbon dioxide~~
 21 ~~emissions from the unit.~~

22 ~~“(2) LARGE-SCALE CARBON SEQUESTRATION.—~~
 23 ~~The term ‘large-scale carbon sequestration’ means a~~
 24 ~~scale that demonstrates the ability to inject into geo-~~
 25 ~~logic formations and sequester several million metric~~

1 tons of carbon dioxide for not less than a 10-year
2 period.

3 ~~“(3) PROGRAM.—~~The term ‘program’ means
4 the program established under subsection (b)(1).

5 ~~“(b) CARBON STORAGE PROGRAM.—~~

6 ~~“(1) IN GENERAL.—~~The Secretary shall estab-
7 lish a program of research, development, and dem-
8 onstration for carbon storage.

9 ~~“(2) PROGRAM ACTIVITIES.—~~Activities under
10 the program shall include—

11 ~~“(A) in coordination with relevant Federal~~
12 agencies, developing and maintaining mapping
13 tools and resources that assess the capacity of
14 geologic storage formation in the United States;

15 ~~“(B) developing monitoring tools, modeling~~
16 of geologic formations, and analyses—

17 ~~“(i) to predict and verify carbon diox-~~
18 ide containment; and

19 ~~“(ii) to account for sequestered car-~~
20 bon dioxide in geologic storage sites;

21 ~~“(C) researching—~~

22 ~~“(i) potential environmental, safety,~~
23 and health impacts in the event of a leak
24 into the atmosphere or to an aquifer; and

1 “(ii) any corresponding mitigation ac-
2 tions or responses to limit harmful con-
3 sequences of such a leak;

4 “(D) evaluating the interactions of carbon
5 dioxide with formation solids and fluids, includ-
6 ing the propensity of injections to induce seis-
7 mic activity;

8 “(E) assessing and ensuring the safety of
9 operations relating to geologic sequestration of
10 carbon dioxide;

11 “(F) determining the fate of carbon diox-
12 ide concurrent with and following injection into
13 geologic formations; and

14 “(G) supporting cost and business model
15 assessments to examine the economic viability
16 of technologies and systems developed under the
17 program.

18 “(3) GEOLOGIC SETTINGS.—In carrying out re-
19 search activities under this subsection, the Secretary
20 shall consider a variety of candidate geologic set-
21 tings, including—

22 “(A) operating oil and gas fields;

23 “(B) depleted oil and gas fields;

24 “(C) residual oil zones;

1 “(D) unconventional reservoirs and rock
2 types;

3 “(E) unmineable coal seams;

4 “(F) saline formations in both sedimentary
5 and basaltic geologies;

6 “(G) geologic systems that may be used as
7 engineered reservoirs to extract economical
8 quantities of brine from geothermal resources of
9 low permeability or porosity; and

10 “(H) geologic systems containing in situ
11 carbon dioxide mineralization formations.

12 “(c) ~~LARGE-SCALE CARBON SEQUESTRATION DEM-~~
13 ~~ONSTRATION PROGRAM.—~~

14 “(1) ~~IN GENERAL.—~~The Secretary shall estab-
15 lish a demonstration program under which the Sec-
16 retary shall provide funding for demonstration
17 projects to collect and validate information on the
18 cost and feasibility of commercial deployment of
19 large-scale carbon sequestration technologies.

20 “(2) ~~EXISTING REGIONAL CARBON SEQUESTRATION PARTNERSHIPS.—~~In carrying out paragraph
21 (1), the Secretary may provide additional funding to
22 regional carbon sequestration partnerships that are
23 carrying out or have completed a large-scale carbon
24 sequestration demonstration project under this sec-
25

tion (as in effect on the day before the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019) for additional work on that project.

“(3) DEMONSTRATION COMPONENTS.—Each demonstration project carried out under this subsection shall include longitudinal tests involving carbon dioxide injection and monitoring, mitigation, and verification operations.

“(4) CLEARINGHOUSE.—The National Energy Technology Laboratory shall act as a clearinghouse of shared information and resources for—

“(A) existing or completed demonstration projects receiving additional funding under paragraph (2); and

“(B) any new demonstration projects funded under this subsection.

“(5) REPORT.—Not later than 1 year after the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Secretary shall submit to the Committee on Energy and Natural Resources of the Senate and the Committee on Science, Space, and Technology of the House of Representatives a report that—

1 “(A) assesses the progress of all regional
2 carbon sequestration partnerships carrying out
3 a demonstration project under this subsection;

4 “(B) identifies the remaining challenges in
5 achieving large-scale carbon sequestration that
6 is reliable and safe for the environment and
7 public health; and

8 “(C) creates a roadmap for carbon storage
9 research and development activities of the De-
10 partment through 2025, with the goal of reduc-
11 ing economic and policy barriers to commercial
12 carbon sequestration.

13 “(d) INTEGRATED STORAGE PROGRAM.—

14 “(1) IN GENERAL.—The Secretary may estab-
15 lish a program to transition large-scale carbon se-
16 questration demonstration projects under subsection
17 (c) into integrated commercial storage complexes.

18 “(2) GOALS AND OBJECTIVES.—The goals and
19 objectives of the program described in paragraph (1)
20 shall be—

21 “(A) to identify geologic storage sites that
22 are able to accept large volumes of carbon diox-
23 ide acceptable for commercial contracts;

1 ~~“(B) to understand the technical and com-~~
 2 ~~mercial viability of carbon dioxide geologic stor-~~
 3 ~~age sites; and~~

4 ~~“(C) to carry out any other activities nec-~~
 5 ~~essary to transition the large-scale carbon se-~~
 6 ~~questration demonstration projects under sub-~~
 7 ~~section (c) into integrated commercial storage~~
 8 ~~complexes.~~

9 ~~“(e) COST SHARING.—Activities carried out under~~
 10 ~~this section shall be subject to the cost-sharing require-~~
 11 ~~ments of section 988.~~

12 ~~“(f) REPORT ON CARBON DIOXIDE CAPTURE CON-~~
 13 ~~TRACTING AUTHORITY.—~~

14 ~~“(1) REPORT.—Not later than 180 days after~~
 15 ~~the date of enactment of the Enhancing Fossil Fuel~~
 16 ~~Energy Carbon Technology Act of 2019, the Sec-~~
 17 ~~retary shall submit to the Committee on Energy and~~
 18 ~~Natural Resources of the Senate and the Committee~~
 19 ~~on Science, Space, and Technology of the House of~~
 20 ~~Representatives a report that—~~

21 ~~“(A) describes the costs and benefits of en-~~
 22 ~~tering into long-term binding contracts on be-~~
 23 ~~half of the Federal Government with qualified~~
 24 ~~parties to provide support for capturing carbon~~
 25 ~~dioxide from electricity generated at an electric~~

generation unit or carbon dioxide captured from
 an electric generation unit and sold to a purchaser for—

“(i) the recovery of crude oil; or

“(ii) other purposes for which a commercial market exists;

“(B) contains an analysis of how the Department would establish, implement, and maintain a contracting program described in subparagraph (A); and

“(C) outlines options for how contracts may be structured, and regulations that would be necessary, to implement a contracting program described in subparagraph (A).

“(g) ~~AUTHORIZATION OF APPROPRIATIONS.~~—There are authorized to be appropriated to the Secretary to carry out this section—

“(1) \$105,000,000 for fiscal year 2020;

“(2) \$110,250,000 for fiscal year 2021;

“(3) \$115,763,000 for fiscal year 2022;

“(4) \$121,551,000 for fiscal year 2023; and

“(5) \$127,628,000 for fiscal year 2024.”.

(b) ~~TECHNICAL AMENDMENT.~~—The table of contents for the Energy Policy Act of 2005 (Public Law 109–58; 119 Stat. 600; 121 Stat. 1708) is amended by striking

1 the item relating to section 963 and inserting the fol-
 2 lowing:

“Sec. 963. Carbon storage validation and testing.”.

3 **SEC. 4. CARBON UTILIZATION PROGRAM.**

4 (a) CARBON UTILIZATION PROGRAM.—

5 (1) IN GENERAL.—Subtitle F of title IX of the
 6 Energy Policy Act of 2005 (42 U.S.C. 16291 et
 7 seq.) is amended by adding at the end the following:

8 **“SEC. 969. CARBON UTILIZATION PROGRAM.**

9 “(a) IN GENERAL.—The Secretary shall establish a
 10 program of research, development, and demonstration for
 11 carbon utilization—

12 “(1) to assess and monitor—

13 “(A) potential changes in lifecycle carbon
 14 dioxide and other greenhouse gas emissions;
 15 and

16 “(B) other environmental safety indicators
 17 of new technologies, practices, processes, or
 18 methods used in enhanced hydrocarbon recovery
 19 as part of the activities authorized under sec-
 20 tion 963;

21 “(2) to identify and assess novel uses for car-
 22 bon, including the conversion of carbon dioxide for
 23 commercial and industrial products, such as—

24 “(A) chemicals;

25 “(B) plastics;

1 “(C) building materials;

2 “(D) fuels;

3 “(E) cement;

4 “(F) products of coal use in power systems
5 or other applications; or

6 “(G) other products with demonstrated
7 market value;

8 “(3) to identify and assess carbon capture tech-
9 nologies for industrial systems; and

10 “(4) to identify and assess alternative uses for
11 coal, including products derived from carbon engi-
12 neering, carbon fiber, and coal conversion methods.

13 “(b) AUTHORIZATION OF APPROPRIATIONS.—There
14 are authorized to be appropriated to the Secretary to carry
15 out this section—

16 “(1) \$25,000,000 for fiscal year 2020;

17 “(2) \$26,250,000 for fiscal year 2021;

18 “(3) \$27,562,500 for fiscal year 2022;

19 “(4) \$28,940,625 for fiscal year 2023; and

20 “(5) \$30,387,656 for fiscal year 2024.”.

21 “(2) TECHNICAL AMENDMENT.—The table of
22 contents for the Energy Policy Act of 2005 (Public
23 Law 109–58; 119 Stat. 600) is amended by adding
24 at the end of the items relating to subtitle F of title
25 IX the following:

“Sec. 969. Carbon utilization program.”.

1 (b) STUDY.—

2 (1) IN GENERAL.—The Secretary of Energy
3 shall enter into an agreement with the National
4 Academies of Sciences, Engineering, and Medicine
5 under which the National Academies of Sciences,
6 Engineering, and Medicine shall conduct a study to
7 assess any barriers and opportunities relating to
8 commercializing carbon dioxide in the United States.

9 (2) REQUIREMENTS.—The study under para-
10 graph (1) shall—

11 (A) analyze challenges to commercializing
12 carbon dioxide, including—

13 (i) expanding carbon dioxide pipeline
14 capacity;

15 (ii) mitigating environmental impacts;

16 (iii) access to capital;

17 (iv) geographic barriers; and

18 (v) regional economic challenges and
19 opportunities;

20 (B) identify potential markets, industries,
21 or sectors that may benefit from greater access
22 to commercial carbon dioxide;

23 (C) assess—

24 (i) the state of infrastructure as of
25 the date of the study; and

1 (ii) any necessary updates to infra-
2 structure to allow for the integration of
3 safe and reliable carbon dioxide transpor-
4 tation, use, and storage;

5 (D) describe the economic, climate, and en-
6 vironmental impacts of any well-integrated na-
7 tional carbon dioxide pipeline system, including
8 suggestions for policies that could—

9 (i) improve the economic impact of
10 the system; and

11 (ii) mitigate impacts of the system;

12 (E) assess the global status and progress
13 of chemical and biological carbon utilization
14 technologies in practice as of the date of the
15 study that utilize anthropogenic carbon, includ-
16 ing carbon dioxide, carbon monoxide, methane,
17 and biogas, from power generation, biofuels
18 production, and other industrial processes;

19 (F) identify emerging technologies and ap-
20 proaches for carbon utilization that show prom-
21 ise for scale-up, demonstration, deployment,
22 and commercialization;

23 (G) analyze the factors associated with
24 making carbon utilization technologies viable at
25 a commercial scale, including carbon waste

1 stream availability, economics, market capacity,
 2 energy, and lifecycle requirements;

3 (H)(i) assess the major technical chal-
 4 lenges associated with increasing the commer-
 5 cial viability of carbon reuse technologies; and

6 (ii) identify the research and development
 7 questions that will address the challenges de-
 8 scribed in clause (i);

9 (I)(i) assess research efforts being carried
 10 out as of the date of the study, including basic,
 11 applied, engineering, and computational re-
 12 search efforts, that are addressing the chal-
 13 lenges described in subparagraph (H)(i); and

14 (ii) identify gaps in the research efforts
 15 under clause (i); and

16 (J) develop a comprehensive research agen-
 17 da that addresses long- and short-term research
 18 needs and opportunities.

19 (3) DEADLINE.—Not later than 180 days after
 20 the date of enactment of this Act, the National
 21 Academies of Sciences, Engineering, and Medicine
 22 shall submit to the Secretary of Energy a report de-
 23 scribing the results of the study under paragraph
 24 (1).

1 **SEC. 5. CARBON REMOVAL.**

2 (a) IN GENERAL.—Subtitle F of title IX of the En-
 3 ergy Policy Act of 2005 (42 U.S.C. 16291 et seq.) (as
 4 amended by section 4(a)(1)) is amended by adding at the
 5 end the following:

6 **“SEC. 969A. CARBON REMOVAL.**

7 “(a) ESTABLISHMENT.—The Secretary, in coordina-
 8 tion with the heads of appropriate Federal agencies, in-
 9 cluding the Secretary of Agriculture, shall establish a re-
 10 search, development, and demonstration program (re-
 11 ferred to in this section as the ‘program’) to test, validate,
 12 or improve technologies and strategies to remove carbon
 13 dioxide from the atmosphere on a large scale.

14 “(b) CROSS-CUTTING DIRECTION.—The Secretary
 15 shall ensure that the program—

16 “(1) is cross-cutting in nature; and

17 “(2) includes the coordinated participation of
 18 the Office of Fossil Energy, the Office of Science,
 19 and the Office of Energy Efficiency and Renewable
 20 Energy.

21 “(c) PROGRAM ACTIVITIES.—The program may in-
 22 clude research, development, and demonstration activities
 23 relating to—

24 “(1) direct air capture and storage technologies;

25 “(2) bioenergy with carbon capture and seques-
 26 tration;

1 ~~“(3) enhanced geological weathering;~~
 2 ~~“(4) agricultural and grazing practices;~~
 3 ~~“(5) forest management and afforestation; and~~
 4 ~~“(6) planned or managed carbon sinks, includ-~~
 5 ~~ing natural and artificial.~~

6 ~~“(d) REQUIREMENTS.—In developing and identifying~~
 7 ~~carbon removal technologies and strategies under the pro-~~
 8 ~~gram, the Secretary shall consider—~~

9 ~~“(1) land use changes, including impacts on~~
 10 ~~natural and managed ecosystems;~~
 11 ~~“(2) ocean acidification;~~
 12 ~~“(3) net greenhouse gas emissions;~~
 13 ~~“(4) commercial viability;~~
 14 ~~“(5) potential for near-term impact;~~
 15 ~~“(6) potential for carbon reductions on a~~
 16 ~~gigaton scale; and~~
 17 ~~“(7) economic cobenefits.~~

18 ~~“(e) AIR CAPTURE TECHNOLOGY PRIZE COMPETI-~~
 19 ~~TION.—~~

20 ~~“(1) DEFINITIONS.—In this subsection:~~

21 ~~“(A) DILUTE MEDIA.—The term ‘dilute~~
 22 ~~media’ means media in which the concentration~~
 23 ~~of carbon dioxide is less than 1 percent by vol-~~
 24 ~~ume.~~

1 “(B) PRIZE COMPETITION.—The term
2 ‘prize competition’ means the competitive tech-
3 nology prize competition established under
4 paragraph (2).

5 “(2) ESTABLISHMENT.—Not later than 1 year
6 after the date of enactment of the Enhancing Fossil
7 Fuel Energy Carbon Technology Act of 2019, the
8 Secretary, in consultation with the Administrator of
9 the Environmental Protection Agency, shall establish
10 as part of the program a competitive technology
11 prize competition to award prizes for carbon dioxide
12 capture from dilute media.

13 “(3) REQUIREMENTS.—In carrying out this
14 subsection, the Secretary, in accordance with section
15 24 of the Stevenson-Wydler Technology Innovation
16 Act of 1980 (15 U.S.C. 3719), shall develop require-
17 ments for—

18 “(A) the prize competition process; and

19 “(B) monitoring and verification proce-
20 dures for projects selected to receive a prize
21 under the prize competition.

22 “(4) ELIGIBLE PROJECTS.—To be eligible to be
23 awarded a prize under the prize competition, a
24 project shall—

1 “(A) meet minimum performance stand-
2 ards set by the Secretary;

3 “(B) meet minimum levels set by the Sec-
4 retary for the capture of carbon dioxide from
5 dilute media; and

6 “(C) demonstrate in the application of the
7 project for a prize—

8 “(i) a design for a promising carbon
9 capture technology that will—

10 “(I) be operated on a demonstra-
11 tion scale; and

12 “(II) have the potential to
13 achieve significant reduction in the
14 level of carbon dioxide in the atmos-
15 phere;

16 “(ii) a successful bench-scale dem-
17 onstration of a carbon capture technology;
18 or

19 “(iii) an operational carbon capture
20 technology on a commercial scale.

21 “(f) INTRAAGENCY COORDINATION.—The direct air
22 capture activities carried out under subsections (c)(1) and
23 (e) shall be carried out in coordination with, and
24 leveraging lessons learned from, the coal and natural gas
25 technology program established under section 962(b)(1).

1 “(g) ACCOUNTING.—The Secretary shall collaborate
 2 with the Administrator of the Environmental Protection
 3 Agency and the heads of other relevant Federal agencies
 4 to develop and improve accounting frameworks and tools
 5 to accurately measure carbon removal and sequestration
 6 methods and technologies across the Federal Government.

7 “(h) AUTHORIZATION OF APPROPRIATIONS.—There
 8 are authorized to be appropriated to the Secretary to carry
 9 out this section—

10 “(1) \$45,000,000 for fiscal year 2020, of which
 11 \$15,000,000 shall be used to carry out subsection
 12 (e);

13 “(2) \$31,500,000 for fiscal year 2021;

14 “(3) \$33,075,000 for fiscal year 2022;

15 “(4) \$34,729,000 for fiscal year 2023; and

16 “(5) \$36,465,000 for fiscal year 2024.”.

17 (b) TECHNICAL AMENDMENT.—The table of contents
 18 for the Energy Policy Act of 2005 (Public Law 109–58;
 19 119 Stat. 600) (as amended by section 4(a)(2)) is amend-
 20 ed by adding at the end of the items relating to subtitle
 21 F of title IX the following:

“Sec. 969A. Carbon removal.”.

22 **SEC. 6. FOSSIL ENERGY.**

23 Section 961(a) of the Energy Policy Act of 2005 (42
 24 U.S.C. 16291(a)) is amended—

1 (1) in paragraph (6), by inserting “, including
 2 technology development to reduce emissions of car-
 3 bon dioxide and associated emissions of heavy metals
 4 within coal combustion residues and gas streams re-
 5 sulting from fossil fuel use and production” before
 6 the period at the end; and

7 (2) by striking paragraph (7) and inserting the
 8 following:

9 “(7) Increasing the export of emissions control
 10 technologies from the United States for fossil en-
 11 ergy-related equipment, technology, and services.

12 “(8) Developing carbon removal and utilization
 13 technologies, products, and methods that result in
 14 net reductions in greenhouse gas emissions, includ-
 15 ing direct air capture and storage, and carbon use
 16 and reuse for commercial application.

17 “(9) Improving the conversion, use, and storage
 18 of carbon dioxide produced from fossil fuels.”.

19 **SECTION 1. SHORT TITLE.**

20 *This Act may be cited as the “Enhancing Fossil Fuel*
 21 *Energy Carbon Technology Act of 2019” or the “EFFECT*
 22 *Act of 2019”.*

1 **SEC. 2. ESTABLISHMENT OF COAL AND NATURAL GAS**
 2 **TECHNOLOGY PROGRAM.**

3 (a) *IN GENERAL.*—*The Energy Policy Act of 2005 is*
 4 *amended by striking section 962 (42 U.S.C. 16292) and in-*
 5 *serting the following:*

6 **“SEC. 962. COAL AND NATURAL GAS TECHNOLOGY PRO-**
 7 **GRAM.**

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

9 “(1) *LARGE-SCALE PILOT PROJECT.*—*The term*
 10 *‘large-scale pilot project’ means a pilot project that—*

11 “(A) *represents the scale of technology devel-*
 12 *opment beyond laboratory development and*
 13 *bench scale testing, but not yet advanced to the*
 14 *point of being tested under real operational con-*
 15 *ditions at commercial scale;*

16 “(B) *represents the scale of technology nec-*
 17 *essary to gain the operational data needed to un-*
 18 *derstand the technical and performance risks of*
 19 *the technology before the application of that tech-*
 20 *nology at commercial scale or in commercial-*
 21 *scale demonstration; and*

22 “(C) *is large enough—*

23 “(i) *to validate scaling factors; and*

24 “(ii) *to demonstrate the interaction be-*
 25 *tween major components so that control*
 26 *philosophies for a new process can be devel-*

1 *oped and enable the technology to advance*
 2 *from large-scale pilot plant application to*
 3 *commercial-scale demonstration or applica-*
 4 *tion.*

5 *“(2) NET-NEGATIVE CARBON DIOXIDE EMISSIONS*
 6 *TECHNOLOGY.—The term ‘net-negative carbon dioxide*
 7 *emissions technology’ means technology—*

8 *“(A) for thermochemical co-conversion of*
 9 *coal and biomass fuels that—*

10 *“(i) uses a carbon capture system; and*

11 *“(ii) with carbon dioxide removal, the*
 12 *Secretary determines can provide elec-*
 13 *tricity, fuels, or chemicals with net-negative*
 14 *carbon dioxide emissions from production*
 15 *and consumption of the end products, while*
 16 *removing atmospheric carbon dioxide; and*

17 *“(B) through which each use of coal will be*
 18 *combined with the use of biomass energy, pro-*
 19 *vided on a renewable basis, that is sufficient in*
 20 *quantity to allow for net-negative emissions of*
 21 *carbon dioxide (in combination with a carbon*
 22 *capture system), while avoiding impacts on food*
 23 *production activities.*

24 *“(3) PROGRAM.—The term ‘program’ means the*
 25 *program established under subsection (b)(1).*

1 “(4) *TRANSFORMATIONAL TECHNOLOGY*.—

2 “(A) *IN GENERAL*.—*The term ‘trans-*
 3 *formational technology’ means a power genera-*
 4 *tion technology that represents a significant*
 5 *change in the methods used to convert energy*
 6 *that will enable a step change in performance,*
 7 *efficiency, and cost of electricity as compared to*
 8 *the technology in existence on the date of enact-*
 9 *ment of the Enhancing Fossil Fuel Energy Car-*
 10 *bon Technology Act of 2019.*

11 “(B) *INCLUSIONS*.—*The term ‘trans-*
 12 *formational technology’ includes a broad range*
 13 *of technology improvements, including—*

14 “(i) *thermodynamic improvements in*
 15 *energy conversion and heat transfer, includ-*
 16 *ing—*

17 “(I) *advanced combustion sys-*
 18 *tems, including oxygen combustion sys-*
 19 *tems and chemical looping; and*

20 “(II) *the replacement of steam cy-*
 21 *cles with supercritical carbon dioxide*
 22 *cycles;*

23 “(ii) *improvements in steam or carbon*
 24 *dioxide turbine technology;*

- 1 “(iii) improvements in carbon capture,
 2 utilization, and storage systems technology;
 3 “(iv) improvements in small-scale and
 4 modular coal-fired technologies with reduced
 5 carbon output or carbon capture that can
 6 support incremental power generation ca-
 7 pacity additions;
 8 “(v) fuel cell technologies for low-cost,
 9 high-efficiency modular power systems;
 10 “(vi) advanced gasification systems;
 11 “(vii) thermal cycling technologies; and
 12 “(viii) any other technology the Sec-
 13 retary recognizes as transformational tech-
 14 nology.

15 “(b) COAL AND NATURAL GAS TECHNOLOGY PRO-
 16 GRAM.—

17 “(1) IN GENERAL.—The Secretary shall establish
 18 a coal and natural gas technology program to ensure
 19 the continued use of the abundant domestic coal and
 20 natural gas resources of the United States through the
 21 development of transformational technologies that will
 22 significantly improve the efficiency, effectiveness,
 23 costs, and environmental performance of coal and
 24 natural gas use.

1 “(2) *REQUIREMENTS.*—*The program shall in-*
2 *clude—*

3 “(A) *a research and development program;*

4 “(B) *large-scale pilot projects;*

5 “(C) *demonstration projects; and*

6 “(D) *a front-end engineering and design*
7 *program.*

8 “(3) *PROGRAM GOALS AND OBJECTIVES.*—*In*
9 *consultation with the interested entities described in*
10 *paragraph (5)(C), the Secretary shall develop goals*
11 *and objectives for the program to be applied to the*
12 *transformational technologies developed within the*
13 *program, taking into consideration the following:*

14 “(A) *Increasing the performance of coal and*
15 *natural gas plants, including by—*

16 “(i) *ensuring reliable, low-cost power*
17 *from new and existing coal and natural gas*
18 *plants;*

19 “(ii) *achieving high conversion effi-*
20 *ciencies;*

21 “(iii) *addressing emissions of carbon*
22 *dioxide through high-efficiency platforms;*

23 “(iv) *developing small-scale and mod-*
24 *ular technologies to support incremental ca-*
25 *capacity additions and load following genera-*

1 *tion, in addition to large-scale generation*
 2 *technologies;*

3 *“(v) supporting dispatchable oper-*
 4 *ations for new and existing applications of*
 5 *coal and natural gas generation; and*

6 *“(vi) accelerating the development of*
 7 *technologies that have transformational en-*
 8 *ergy conversion characteristics.*

9 *“(B) Using carbon capture, utilization, and*
 10 *sequestration technologies to decrease the carbon*
 11 *dioxide emissions, and the environmental impact*
 12 *from carbon dioxide emissions, from new and ex-*
 13 *isting coal and natural gas plants, including*
 14 *by—*

15 *“(i) accelerating the development, de-*
 16 *ployment, and commercialization of tech-*
 17 *nologies to capture and sequester carbon di-*
 18 *oxide emissions from new and existing coal*
 19 *and natural gas plants;*

20 *“(ii) supporting sites for safe geological*
 21 *storage of large volumes of anthropogenic*
 22 *sources of carbon dioxide and the develop-*
 23 *ment of the infrastructure needed to support*
 24 *a carbon dioxide utilization and storage in-*
 25 *dustry;*

1 “(iii) improving the conversion, utili-
 2 zation, and storage of carbon dioxide pro-
 3 duced from fossil fuels and other anthropo-
 4 genic sources of carbon dioxide;

5 “(iv) lowering greenhouse gas emis-
 6 sions for all fossil fuel production, genera-
 7 tion, delivery, and use, to the maximum ex-
 8 tent practicable;

9 “(v) developing carbon utilization tech-
 10 nologies, products, and methods, including
 11 carbon use and reuse for commercial appli-
 12 cation; and

13 “(vi) developing net-negative carbon
 14 dioxide emissions technologies.

15 “(C) Decreasing the non-carbon dioxide rel-
 16 evant environmental impacts of coal and natural
 17 gas production, including by—

18 “(i) further reducing non-carbon diox-
 19 ide air emissions; and

20 “(ii) reducing the use, and managing
 21 the discharge, of water in power plant oper-
 22 ations.

23 “(D) Accelerating the development of tech-
 24 nologies to capture carbon dioxide emissions
 25 from industrial facilities, including—

1 “(i) nontraditional fuel manufacturing
 2 facilities, including ethanol or other biofuel
 3 production plants or hydrogen production
 4 plants; and

5 “(ii) energy-intensive manufacturing
 6 facilities that produce carbon dioxide as a
 7 byproduct of operations.

8 “(E) Examining methods of converting coal
 9 and natural gas to other valuable products and
 10 commodities in addition to electricity, including
 11 hydrogen.

12 “(4) CROSS-CUTTING DIRECTION FOR CARBON
 13 CAPTURE, UTILIZATION, AND SEQUESTRATION ACTIVI-
 14 TIES.—The carbon capture, utilization, and seques-
 15 tration activities described in paragraph (3)(B) shall
 16 be—

17 “(A) cross-cutting in nature; and

18 “(B) carried out by the Assistant Secretary
 19 for Fossil Energy, in coordination with the heads
 20 of other relevant offices of the Department, in-
 21 cluding the Director of the Office of Science and
 22 the Assistant Secretary for Energy Efficiency
 23 and Renewable Energy.

24 “(5) CONSULTATIONS REQUIRED.—In carrying
 25 out the program, the Secretary shall—

1 “(A) undertake international collaborations,
 2 taking into consideration the recommendations
 3 of the National Coal Council;

4 “(B) use existing authorities to encourage
 5 international cooperation; and

6 “(C) consult with interested entities, includ-
 7 ing—

8 “(i) coal and natural gas producers;

9 “(ii) industries that use coal and nat-
 10 ural gas;

11 “(iii) organizations that promote coal,
 12 advanced coal, and natural gas technologies;

13 “(iv) environmental organizations;

14 “(v) organizations representing work-
 15 ers; and

16 “(vi) organizations representing con-
 17 sumers.

18 “(c) *REPORT*.—

19 “(1) *IN GENERAL*.—Not later than 18 months
 20 after the date of enactment of the Enhancing Fossil
 21 Fuel Energy Carbon Technology Act of 2019, the Sec-
 22 retary shall submit to Congress a report describing
 23 the program goals and objectives adopted under sub-
 24 section (b)(3).

1 “(2) *UPDATE.*—Not less frequently than once
 2 *every 2 years after the initial report is submitted*
 3 *under paragraph (1), the Secretary shall submit to*
 4 *Congress a report describing the progress made to-*
 5 *wards achieving the program goals and objectives*
 6 *adopted under subsection (b)(3).*

7 “(d) *FUNDING.*—

8 “(1) *AUTHORIZATION OF APPROPRIATIONS.*—
 9 *There are authorized to be appropriated to the Sec-*
 10 *retary to carry out this section, to remain available*
 11 *until expended—*

12 “(A) *for activities under the research and*
 13 *development program component described in*
 14 *subsection (b)(2)(A)—*

15 “(i) *\$230,000,000 for each of fiscal*
 16 *years 2020 and 2021; and*

17 “(ii) *\$150,000,000 for each of fiscal*
 18 *years 2022 through 2024;*

19 “(B) *subject to paragraph (2), for activities*
 20 *under the large-scale pilot projects program com-*
 21 *ponent described in subsection (b)(2)(B)—*

22 “(i) *\$347,000,000 for each of fiscal*
 23 *years 2020 and 2021;*

24 “(ii) *\$272,000,000 for each of fiscal*
 25 *years 2022 and 2023; and*

1 “(iii) \$250,000,000 for fiscal year
2 2024;

3 “(C) for activities under the demonstration
4 projects program component described in sub-
5 section (b)(2)(C)—

6 “(i) \$100,000,000 for each of fiscal
7 years 2020 and 2021; and

8 “(ii) \$500,000,000 for each of fiscal
9 years 2022 through 2024; and

10 “(D) for activities under the front-end engi-
11 neering and design program described in sub-
12 section (b)(2)(D), \$50,000,000 for each of fiscal
13 years 2020 through 2023.

14 “(2) COST SHARING FOR LARGE-SCALE PILOT
15 PROJECTS.—Activities under subsection (b)(2)(B)
16 shall be subject to the cost-sharing requirements of sec-
17 tion 988(b).”.

18 (b) TECHNICAL AMENDMENT.—The table of contents
19 for the Energy Policy Act of 2005 (Public Law 109–58; 119
20 Stat. 600) is amended by striking the item relating to sec-
21 tion 962 and inserting the following:

 “Sec. 962. Coal and natural gas technology program.”.

22 **SEC. 3. CARBON STORAGE VALIDATION AND TESTING.**

23 (a) IN GENERAL.—The Energy Policy Act of 2005 is
24 amended by striking section 963 (42 U.S. C. 16293) and
25 inserting the following:

1 **“SEC. 963. CARBON STORAGE VALIDATION AND TESTING.**

2 “(a) *DEFINITIONS.—In this section:*

3 “(1) *ELECTRIC GENERATION UNIT.—The term*
 4 *‘electric generation unit’ means an electric generation*
 5 *unit that—*

6 “(A) *uses coal- or natural gas-based genera-*
 7 *tion technology; and*

8 “(B) *is capable of capturing carbon dioxide*
 9 *emissions from the unit.*

10 “(2) *LARGE-SCALE CARBON SEQUESTRATION.—*
 11 *The term ‘large-scale carbon sequestration’ means a*
 12 *scale that demonstrates the ability to inject into geo-*
 13 *logic formations and sequester several million metric*
 14 *tons of carbon dioxide for not less than a 10-year pe-*
 15 *riod.*

16 “(3) *PROGRAM.—The term ‘program’ means the*
 17 *program established under subsection (b)(1).*

18 “(b) *CARBON STORAGE PROGRAM.—*

19 “(1) *IN GENERAL.—The Secretary shall establish*
 20 *a program of research, development, and demonstra-*
 21 *tion for carbon storage.*

22 “(2) *PROGRAM ACTIVITIES.—Activities under the*
 23 *program shall include—*

24 “(A) *in coordination with relevant Federal*
 25 *agencies, developing and maintaining mapping*

1 *tools and resources that assess the capacity of*
2 *geologic storage formation in the United States;*

3 *“(B) developing monitoring tools, modeling*
4 *of geologic formations, and analyses—*

5 *“(i) to predict carbon dioxide contain-*
6 *ment; and*

7 *“(ii) to account for sequestered carbon*
8 *dioxide in geologic storage sites;*

9 *“(C) researching—*

10 *“(i) potential environmental, safety,*
11 *and health impacts in the event of a leak*
12 *into the atmosphere or to an aquifer; and*

13 *“(ii) any corresponding mitigation ac-*
14 *tions or responses to limit harmful con-*
15 *sequences of such a leak;*

16 *“(D) evaluating the interactions of carbon*
17 *dioxide with formation solids and fluids, includ-*
18 *ing the propensity of injections to induce seismic*
19 *activity;*

20 *“(E) assessing and ensuring the safety of*
21 *operations relating to geologic sequestration of*
22 *carbon dioxide;*

23 *“(F) determining the fate of carbon dioxide*
24 *concurrent with and following injection into geo-*
25 *logic formations; and*

1 “(G) *supporting cost and business model as-*
 2 *sessments to examine the economic viability of*
 3 *technologies and systems developed under the*
 4 *program.*

5 “(3) *GEOLOGIC SETTINGS.—In carrying out re-*
 6 *search activities under this subsection, the Secretary*
 7 *shall consider a variety of candidate onshore and off-*
 8 *shore geologic settings, including—*

9 “(A) *operating oil and gas fields;*

10 “(B) *depleted oil and gas fields;*

11 “(C) *residual oil zones;*

12 “(D) *unconventional reservoirs and rock*
 13 *types;*

14 “(E) *unmineable coal seams;*

15 “(F) *saline formations in both sedimentary*
 16 *and basaltic geologies;*

17 “(G) *geologic systems that may be used as*
 18 *engineered reservoirs to extract economical quan-*
 19 *tities of brine from geothermal resources of low*
 20 *permeability or porosity; and*

21 “(H) *geologic systems containing in situ*
 22 *carbon dioxide mineralization formations.*

23 “(c) *LARGE-SCALE CARBON SEQUESTRATION DEM-*
 24 *ONSTRATION PROGRAM.—*

1 “(1) *IN GENERAL.*—*The Secretary shall establish*
 2 *a demonstration program under which the Secretary*
 3 *shall provide funding for demonstration projects to*
 4 *collect and validate information on the cost and feasi-*
 5 *bility of commercial deployment of large-scale carbon*
 6 *sequestration technologies.*

7 “(2) *EXISTING REGIONAL CARBON SEQUESTRA-*
 8 *TION PARTNERSHIPS.*—*In carrying out paragraph*
 9 *(1), the Secretary may provide additional funding to*
 10 *regional carbon sequestration partnerships that are*
 11 *carrying out or have completed a large-scale carbon*
 12 *sequestration demonstration project under this section*
 13 *(as in effect on the day before the date of enactment*
 14 *of the Enhancing Fossil Fuel Energy Carbon Tech-*
 15 *nology Act of 2019) for additional work on that*
 16 *project.*

17 “(3) *DEMONSTRATION COMPONENTS.*—*Each dem-*
 18 *onstration project carried out under this subsection*
 19 *shall include longitudinal tests involving carbon diox-*
 20 *ide injection and monitoring, mitigation, and*
 21 *verification operations.*

22 “(4) *CLEARINGHOUSE.*—*The National Energy*
 23 *Technology Laboratory shall act as a clearinghouse of*
 24 *shared information and resources for—*

1 “(A) existing or completed demonstration
2 projects receiving additional funding under
3 paragraph (2); and

4 “(B) any new demonstration projects fund-
5 ed under this subsection.

6 “(5) *REPORT*.—Not later than 1 year after the
7 date of enactment of the Enhancing Fossil Fuel En-
8 ergy Carbon Technology Act of 2019, the Secretary
9 shall submit to the Committee on Energy and Natural
10 Resources of the Senate and the Committee on
11 Science, Space, and Technology of the House of Rep-
12 resentatives a report that—

13 “(A) assesses the progress of all regional
14 carbon sequestration partnerships carrying out a
15 demonstration project under this subsection;

16 “(B) identifies the remaining challenges in
17 achieving large-scale carbon sequestration that is
18 reliable and safe for the environment and public
19 health; and

20 “(C) creates a roadmap for carbon storage
21 research and development activities of the De-
22 partment through 2025, with the goal of reduc-
23 ing economic and policy barriers to commercial
24 carbon sequestration.

25 “(d) *INTEGRATED STORAGE PROGRAM*.—

1 “(1) *IN GENERAL.*—*The Secretary may establish*
 2 *a program to transition large-scale carbon sequestra-*
 3 *tion demonstration projects under subsection (c) into*
 4 *integrated commercial storage complexes.*

5 “(2) *GOALS AND OBJECTIVES.*—*The goals and*
 6 *objectives of the program described in paragraph (1)*
 7 *shall be—*

8 “(A) *to identify geologic storage sites that*
 9 *are able to accept large volumes of carbon diox-*
 10 *ide acceptable for commercial contracts;*

11 “(B) *to understand the technical and com-*
 12 *mercial viability of carbon dioxide geologic stor-*
 13 *age sites; and*

14 “(C) *to carry out any other activities nec-*
 15 *essary to transition the large-scale carbon seques-*
 16 *tration demonstration projects under subsection*
 17 *(c) into integrated commercial storage complexes.*

18 “(e) *COST SHARING.*—*Activities carried out under this*
 19 *section shall be subject to the cost-sharing requirements of*
 20 *section 988.*

21 “(f) *REPORT ON CARBON DIOXIDE CAPTURE CON-*
 22 *TRACTING AUTHORITY.*—

23 “(1) *REPORT.*—*Not later than 180 days after the*
 24 *date of enactment of the Enhancing Fossil Fuel En-*
 25 *ergy Carbon Technology Act of 2019, the Secretary*

1 *shall submit to the Committee on Energy and Natural*
2 *Resources of the Senate and the Committee on*
3 *Science, Space, and Technology of the House of Rep-*
4 *resentatives a report that—*

5 “(A) *describes the costs and benefits of en-*
6 *tering into long-term binding contracts on behalf*
7 *of the Federal Government with qualified parties*
8 *to provide support for capturing carbon dioxide*
9 *from electricity generated at an electric genera-*
10 *tion unit or carbon dioxide captured from an*
11 *electric generation unit and sold to a purchaser*
12 *for—*

13 “(i) *the recovery of crude oil; or*

14 “(ii) *other purposes for which a com-*
15 *mercial market exists;*

16 “(B) *contains an analysis of how the De-*
17 *partment would establish, implement, and main-*
18 *tain a contracting program described in sub-*
19 *paragraph (A); and*

20 “(C) *outlines options for how contracts may*
21 *be structured, and regulations that would be nec-*
22 *essary, to implement a contracting program de-*
23 *scribed in subparagraph (A).*

1 “(g) *AUTHORIZATION OF APPROPRIATIONS.*—*There*
 2 *are authorized to be appropriated to the Secretary to carry*
 3 *out this section—*

4 “(1) \$105,000,000 for fiscal year 2020;

5 “(2) \$110,250,000 for fiscal year 2021;

6 “(3) \$115,763,000 for fiscal year 2022;

7 “(4) \$121,551,000 for fiscal year 2023; and

8 “(5) \$127,628,000 for fiscal year 2024.”.

9 (b) *TECHNICAL AMENDMENT.*—*The table of contents*
 10 *for the Energy Policy Act of 2005 (Public Law 109–58; 119*
 11 *Stat. 600; 121 Stat. 1708) is amended by striking the item*
 12 *relating to section 963 and inserting the following:*

“Sec. 963. *Carbon storage validation and testing.*”.

13 **SEC. 4. CARBON UTILIZATION PROGRAM.**

14 (a) *CARBON UTILIZATION PROGRAM.*—

15 (1) *IN GENERAL.*—*Subtitle F of title IX of the*
 16 *Energy Policy Act of 2005 (42 U.S.C. 16291 et seq.)*
 17 *is amended by adding at the end the following:*

18 **“SEC. 969. CARBON UTILIZATION PROGRAM.**

19 “(a) *IN GENERAL.*—*The Secretary shall establish a*
 20 *program of research, development, and demonstration for*
 21 *carbon utilization—*

22 “(1) *to assess and monitor—*

23 “(A) *potential changes in lifecycle carbon*
 24 *dioxide and other greenhouse gas emissions; and*

1 “(B) other environmental safety indicators
 2 of new technologies, practices, processes, or meth-
 3 ods used in enhanced hydrocarbon recovery as
 4 part of the activities authorized under section
 5 963;

6 “(2) to identify and assess novel uses for carbon,
 7 including the conversion of carbon oxides for commer-
 8 cial and industrial products, such as—

9 “(A) chemicals;

10 “(B) plastics;

11 “(C) building materials;

12 “(D) fuels;

13 “(E) cement;

14 “(F) products of coal use in power systems
 15 or other applications; or

16 “(G) other products with demonstrated
 17 market value;

18 “(3) to identify and assess carbon capture tech-
 19 nologies for industrial systems; and

20 “(4) to identify and assess alternative uses for
 21 coal, including products derived from carbon engi-
 22 neering, carbon fiber, and coal conversion methods.

23 “(b) *AUTHORIZATION OF APPROPRIATIONS.*—There
 24 are authorized to be appropriated to the Secretary to carry
 25 out this section—

- 1 “(1) \$25,000,000 for fiscal year 2020;
 2 “(2) \$26,250,000 for fiscal year 2021;
 3 “(3) \$27,562,500 for fiscal year 2022;
 4 “(4) \$28,940,625 for fiscal year 2023; and
 5 “(5) \$30,387,656 for fiscal year 2024.”.

6 (2) *TECHNICAL AMENDMENT.*—*The table of con-*
 7 *tents for the Energy Policy Act of 2005 (Public Law*
 8 *109–58; 119 Stat. 600) is amended by adding at the*
 9 *end of the items relating to subtitle F of title IX the*
 10 *following:*

 “*Sec. 969. Carbon utilization program.*”.

11 (b) *STUDY.*—

12 (1) *IN GENERAL.*—*The Secretary of Energy shall*
 13 *enter into an agreement with the National Academies*
 14 *of Sciences, Engineering, and Medicine under which*
 15 *the National Academies of Sciences, Engineering, and*
 16 *Medicine shall conduct a study to assess any barriers*
 17 *and opportunities relating to commercializing carbon*
 18 *dioxide in the United States.*

19 (2) *REQUIREMENTS.*—*The study under para-*
 20 *graph (1) shall—*

21 (A) *analyze challenges to commercializing*
 22 *carbon dioxide, including—*

23 (i) *expanding carbon dioxide pipeline*
 24 *capacity;*

25 (ii) *mitigating environmental impacts;*

1 (iii) access to capital;

2 (iv) geographic barriers; and

3 (v) regional economic challenges and
4 opportunities;

5 (B) identify potential markets, industries,
6 or sectors that may benefit from greater access to
7 commercial carbon dioxide;

8 (C) assess—

9 (i) the state of infrastructure as of the
10 date of the study; and

11 (ii) any necessary updates to infra-
12 structure to allow for the integration of safe
13 and reliable carbon dioxide transportation,
14 use, and storage;

15 (D) describe the economic, climate, and en-
16 vironmental impacts of any well-integrated na-
17 tional carbon dioxide pipeline system, including
18 suggestions for policies that could—

19 (i) improve the economic impact of the
20 system; and

21 (ii) mitigate impacts of the system;

22 (E) assess the global status and progress of
23 chemical and biological carbon utilization tech-
24 nologies in practice as of the date of the study
25 that utilize anthropogenic carbon, including car-

1 *bon dioxide, carbon monoxide, methane, and*
 2 *biogas, from power generation, biofuels produc-*
 3 *tion, and other industrial processes;*

4 *(F) identify emerging technologies and ap-*
 5 *proaches for carbon utilization that show prom-*
 6 *ise for scale-up, demonstration, deployment, and*
 7 *commercialization;*

8 *(G) analyze the factors associated with*
 9 *making carbon utilization technologies viable at*
 10 *a commercial scale, including carbon waste*
 11 *stream availability, economics, market capacity,*
 12 *energy, and lifecycle requirements;*

13 *(H)(i) assess the major technical challenges*
 14 *associated with increasing the commercial viabil-*
 15 *ity of carbon reuse technologies; and*

16 *(ii) identify the research and development*
 17 *questions that will address the challenges de-*
 18 *scribed in clause (i);*

19 *(I)(i) assess research efforts being carried*
 20 *out as of the date of the study, including basic,*
 21 *applied, engineering, and computational re-*
 22 *search efforts, that are addressing the challenges*
 23 *described in subparagraph (H)(i); and*

24 *(ii) identify gaps in the research efforts*
 25 *under clause (i);*

1 *(J) develop a comprehensive research agen-*
 2 *da that addresses long- and short-term research*
 3 *needs and opportunities; and*

4 *(K)(i) identify appropriate Federal agencies*
 5 *with capabilities to support small business enti-*
 6 *ties; and*

7 *(ii) determine what assistance the Federal*
 8 *agencies identified under clause (i) could provide*
 9 *to small business entities to further the develop-*
 10 *ment and commercial deployment of carbon di-*
 11 *oxide-based products.*

12 *(3) DEADLINE.—Not later than 180 days after*
 13 *the date of enactment of this Act, the National Acad-*
 14 *emies of Sciences, Engineering, and Medicine shall*
 15 *submit to the Secretary of Energy a report describing*
 16 *the results of the study under paragraph (1).*

17 **SEC. 5. CARBON REMOVAL.**

18 *(a) IN GENERAL.—Subtitle F of title IX of the Energy*
 19 *Policy Act of 2005 (42 U.S.C. 16291 et seq.) (as amended*
 20 *by section 4(a)(1)) is amended by adding at the end the*
 21 *following:*

22 **“SEC. 969A. CARBON REMOVAL.**

23 *“(a) ESTABLISHMENT.—The Secretary, in coordina-*
 24 *tion with the heads of appropriate Federal agencies, includ-*
 25 *ing the Secretary of Agriculture, shall establish a research,*

1 *development, and demonstration program (referred to in*
 2 *this section as the ‘program’) to test, validate, or improve*
 3 *technologies and strategies to remove carbon dioxide from*
 4 *the atmosphere on a large scale.*

5 “(b) *CROSS-CUTTING DIRECTION.*—*The Secretary shall*
 6 *ensure that the program—*

7 “(1) *is cross-cutting in nature; and*

8 “(2) *includes the coordinated participation of the*
 9 *Office of Fossil Energy, the Office of Science, and the*
 10 *Office of Energy Efficiency and Renewable Energy.*

11 “(c) *PROGRAM ACTIVITIES.*—*The program may in-*
 12 *clude research, development, and demonstration activities*
 13 *relating to—*

14 “(1) *direct air capture and storage technologies;*

15 “(2) *bioenergy with carbon capture and seques-*
 16 *tration;*

17 “(3) *enhanced geological weathering;*

18 “(4) *agricultural and grazing practices;*

19 “(5) *forest management and afforestation; and*

20 “(6) *planned or managed carbon sinks, includ-*
 21 *ing natural and artificial.*

22 “(d) *REQUIREMENTS.*—*In developing and identifying*
 23 *carbon removal technologies and strategies under the pro-*
 24 *gram, the Secretary shall consider—*

- 1 “(1) *land use changes, including impacts on nat-*
 2 *ural and managed ecosystems;*
 3 “(2) *ocean acidification;*
 4 “(3) *net greenhouse gas emissions;*
 5 “(4) *commercial viability;*
 6 “(5) *potential for near-term impact;*
 7 “(6) *potential for carbon reductions on a gigaton*
 8 *scale; and*
 9 “(7) *economic cobenefits.*

10 “(e) *AIR CAPTURE TECHNOLOGY PRIZE COMPETI-*
 11 *TION.—*

12 “(1) *DEFINITIONS.—In this subsection:*

13 “(A) *DILUTE MEDIA.—The term ‘dilute*
 14 *media’ means media in which the concentration*
 15 *of carbon dioxide is less than 1 percent by vol-*
 16 *ume.*

17 “(B) *PRIZE COMPETITION.—The term ‘prize*
 18 *competition’ means the competitive technology*
 19 *prize competition established under paragraph*
 20 *(2).*

21 “(2) *ESTABLISHMENT.—Not later than 1 year*
 22 *after the date of enactment of the Enhancing Fossil*
 23 *Fuel Energy Carbon Technology Act of 2019, the Sec-*
 24 *retary, in consultation with the Administrator of the*
 25 *Environmental Protection Agency, shall establish as*

1 *part of the program a competitive technology prize*
 2 *competition to award prizes for carbon dioxide cap-*
 3 *ture from dilute media.*

4 “(3) *REQUIREMENTS.*—*In carrying out this sub-*
 5 *section, the Secretary, in accordance with section 24*
 6 *of the Stevenson-Wydler Technology Innovation Act of*
 7 *1980 (15 U.S.C. 3719), shall develop requirements*
 8 *for—*

9 “(A) *the prize competition process; and*

10 “(B) *monitoring and verification proce-*
 11 *dures for projects selected to receive a prize*
 12 *under the prize competition.*

13 “(4) *ELIGIBLE PROJECTS.*—*To be eligible to be*
 14 *awarded a prize under the prize competition, a*
 15 *project shall—*

16 “(A) *meet minimum performance standards*
 17 *set by the Secretary;*

18 “(B) *meet minimum levels set by the Sec-*
 19 *retary for the capture of carbon dioxide from di-*
 20 *lute media; and*

21 “(C) *demonstrate in the application of the*
 22 *project for a prize—*

23 “(i) *a design for a promising carbon*
 24 *capture technology that will—*

1 “(I) be operated on a demonstra-
2 tion scale; and

3 “(II) have the potential to achieve
4 significant reduction in the level of
5 carbon dioxide in the atmosphere;

6 “(ii) a successful bench-scale dem-
7 onstration of a carbon capture technology;
8 or

9 “(iii) an operational carbon capture
10 technology on a commercial scale.

11 “(f) *DIRECT AIR CAPTURE TEST CENTER.*—

12 “(1) *IN GENERAL.*—Not later than 1 year after
13 the date of enactment of the Enhancing Fossil Fuel
14 Energy Carbon Technology Act of 2019, the Secretary
15 shall award grants to 1 or more entities for the oper-
16 ation of 1 or more test centers (referred to in this sub-
17 section as a ‘Center’) to provide unique testing capa-
18 bilities for innovative direct air capture and storage
19 technologies.

20 “(2) *PURPOSE.*—Each Center shall—

21 “(A) advance research, development, dem-
22 onstration, and commercial application of direct
23 air capture and storage technologies;

24 “(B) support pilot plant and full-scale dem-
25 onstration projects and test direct air capture

1 *and storage technologies that represent the scale*
 2 *of technology development beyond laboratory test-*
 3 *ing, but not yet advanced to test under oper-*
 4 *ational conditions at commercial scale;*

5 “(C) *develop front-end engineering design*
 6 *and economic analysis; and*

7 “(D) *maintain a public record of pilot and*
 8 *full-scale plant performance.*

9 “(3) *SELECTION.—*

10 “(A) *IN GENERAL.—The Secretary shall se-*
 11 *lect entities to receive grants under this sub-*
 12 *section according to such criteria as the Sec-*
 13 *retary may develop.*

14 “(B) *COMPETITIVE BASIS.—The Secretary*
 15 *shall select entities to receive grants under this*
 16 *subsection on a competitive basis.*

17 “(C) *PRIORITY CRITERIA.—In selecting en-*
 18 *tities to receive grants under this subsection, the*
 19 *Secretary shall prioritize applicants that—*

20 “(i) *have access to existing or planned*
 21 *research facilities for direct air capture and*
 22 *storage technologies;*

23 “(ii) *are institutions of higher edu-*
 24 *cation with established expertise in engi-*
 25 *neering for direct air capture and storage*

1 technologies, or partnerships with such in-
2 stitutions of higher education; or

3 “(iii) have access to existing research
4 and test facilities for bulk materials design
5 and testing, component design and testing,
6 or professional engineering design.

7 “(4) *FORMULA FOR AWARDING GRANTS.*—The
8 Secretary may develop a formula for awarding grants
9 under this subsection.

10 “(5) *SCHEDULE.*—

11 “(A) *IN GENERAL.*—Each grant awarded
12 under this subsection shall be for a term of not
13 more than 5 years, subject to the availability of
14 appropriations.

15 “(B) *RENEWAL.*—The Secretary may renew
16 a grant for 1 or more additional 5-year terms,
17 subject to a competitive merit review and the
18 availability of appropriations.

19 “(6) *TERMINATION.*—To the extent otherwise au-
20 thorized by law, the Secretary may eliminate, and
21 terminate grant funding under this subsection for, a
22 Center during any 5-year term described in para-
23 graph (5) if the Secretary determines that the Center
24 is underperforming.

1 “(g) *LARGE-SCALE PILOTS AND DEMONSTRATION.*—In
 2 *supporting the technology development activities under this*
 3 *section, the Secretary is encouraged to support carbon re-*
 4 *moval pilot and demonstration projects, including—*

5 “(1) *pilot projects that test direct air capture*
 6 *systems capable of capturing 10 to 100 tonnes of car-*
 7 *bon oxides per year to provide data for demonstra-*
 8 *tion-scale projects; and*

9 “(2) *direct air capture demonstration projects*
 10 *capable of capturing greater than 1,000 tonnes of car-*
 11 *bon oxides per year.*

12 “(h) *INTRAAGENCY COORDINATION.*—*The direct air*
 13 *capture activities carried out under subsections (c)(1) and*
 14 *(e) shall be carried out in coordination with, and leveraging*
 15 *lessons learned from, the coal and natural gas technology*
 16 *program established under section 962(b)(1).*

17 “(i) *ACCOUNTING.*—*The Secretary shall collaborate*
 18 *with the Administrator of the Environmental Protection*
 19 *Agency and the heads of other relevant Federal agencies to*
 20 *develop and improve accounting frameworks and tools to*
 21 *accurately measure carbon removal and sequestration meth-*
 22 *ods and technologies across the Federal Government.*

23 “(j) *AUTHORIZATION OF APPROPRIATIONS.*—*There are*
 24 *authorized to be appropriated to the Secretary to carry out*
 25 *this section—*

1 “(1) \$75,000,000 for fiscal year 2020, of which
 2 \$15,000,000 shall be used to carry out subsection (e);
 3 “(2) \$63,500,000 for fiscal year 2021;
 4 “(3) \$66,150,000 for fiscal year 2022;
 5 “(4) \$69,458,000 for fiscal year 2023; and
 6 “(5) \$72,930,000 for fiscal year 2024.”.

7 (b) *TECHNICAL AMENDMENT.*—*The table of contents*
 8 *for the Energy Policy Act of 2005 (Public Law 109–58; 119*
 9 *Stat. 600) (as amended by section 4(a)(2)) is amended by*
 10 *adding at the end of the items relating to subtitle F of title*
 11 *IX the following:*

 “Sec. 969A. Carbon removal.”.

12 **SEC. 6. FOSSIL ENERGY.**

13 Section 961(a) of the Energy Policy Act of 2005 (42
 14 U.S.C. 16291(a)) is amended—

15 (1) in paragraph (6), by inserting “, including
 16 technology development to reduce emissions of carbon
 17 dioxide and associated emissions of heavy metals
 18 within coal combustion residues and gas streams re-
 19 sulting from fossil fuel use and production” before the
 20 period at the end; and

21 (2) by striking paragraph (7) and inserting the
 22 following:

23 “(7) Increasing the export of fossil energy-related
 24 equipment, technology, including emissions control
 25 technologies, and services from the United States.

1 “(8) *Developing carbon removal and utilization*
2 *technologies, products, and methods that result in net*
3 *reductions in greenhouse gas emissions, including di-*
4 *rect air capture and storage, and carbon use and*
5 *reuse for commercial application.*

6 “(9) *Improving the conversion, use, and storage*
7 *of carbon dioxide produced from fossil fuels.*”.

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[Report No. 116-115]

A BILL

To amend the fossil energy research and development provisions of the Energy Policy Act of 2005 to enhance fossil fuel technology, and for other purposes.

SEPTEMBER 24, 2019

Reported with an amendment