

117TH CONGRESS  
2D SESSION

# H. R. 9318

To provide for advancements in carbon removal research, quantification, and commercialization, including by harnessing natural processes, and for other purposes.

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## IN THE HOUSE OF REPRESENTATIVES

NOVEMBER 16, 2022

Mr. PETERS (for himself and Mr. CURTIS) introduced the following bill; which was referred to the Committee on Science, Space, and Technology, and in addition to the Committees on Natural Resources, and Energy and Commerce, for a period to be subsequently determined by the Speaker, in each case for consideration of such provisions as fall within the jurisdiction of the committee concerned

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## A BILL

To provide for advancements in carbon removal research, quantification, and commercialization, including by harnessing natural processes, 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; TABLE OF CONTENTS.**

4 (a) SHORT TITLE.—This Act may be cited as the  
5 “Carbon Removal and Emissions Storage Technologies  
6 Act of 2022” or the “CREST Act of 2022”.

(b) TABLE OF CONTENTS.—The table of contents for this Act is as follows:

Sec. 1. Short title; table of contents.  
Sec. 2. Definitions.

#### TITLE I—CARBON REMOVAL RESEARCH AND DEVELOPMENT

##### Subtitle A—Biomass Carbon Removal

Sec. 101. Biomass carbon removal programs.  
Sec. 102. Biological carbon dioxide conversion programs.

##### Subtitle B—Geological Carbon Removal

Sec. 111. Carbon mineralization pilot projects.  
Sec. 112. Carbon mineralization resource assessment.  
Sec. 113. Tailings and waste mineralization program.

##### Subtitle C—Aquatic Carbon Removal

Sec. 121. Ocean carbon removal mission.  
Sec. 122. Direct ocean capture assessment.  
Sec. 123. Offshore carbon storage program and assessment.

##### Subtitle D—Atmospheric Carbon Removal

Sec. 131. Direct air capture technology manufacturing research program.

##### Subtitle E—Carbon Removal Quantification

Sec. 141. Carbon removal quantification.

#### TITLE II—CARBON REMOVAL FIRST MOVERS PILOT PROGRAM

Sec. 201. Carbon Removal First Movers Pilot Program.

### SEC. 2. DEFINITIONS.

In this Act:

(1) CARBON REMOVAL.—The term “carbon removal” means the intentional removal, including by harnessing natural processes, of carbon dioxide directly from the atmosphere or upper hydrosphere and subsequent storage of the carbon dioxide in geological, biobased, or ocean reservoirs or in value-added products that results in a net removal of car-

1       bon dioxide from the atmosphere, as measured on a  
2       lifecycle basis.

3               (2) CARBON REMOVAL TECHNOLOGY OR AP-  
4       PROACH.—The term “carbon removal technology or  
5       approach” includes—

6                       (A) direct air capture with durable storage;

7                       (B) soil carbon sequestration;

8                       (C) biomass carbon removal and storage;

9                       (D) enhanced mineralization;

10                      (E) ocean-based carbon dioxide removal;

11                      and

12                      (F) afforestation or reforestation.

13               (3) SECRETARY.—The term “Secretary” means  
14       the Secretary of Energy.

15       **TITLE I—CARBON REMOVAL**  
16       **RESEARCH AND DEVELOPMENT**  
17       **Subtitle A—Biomass Carbon**  
18       **Removal**

19       **SEC. 101. BIOMASS CARBON REMOVAL PROGRAMS.**

20       (a) OFFICE OF SCIENCE.—Section 306 of the De-  
21       partment of Energy Research and Innovation Act (42  
22       U.S.C. 18644) is amended by adding at the end the fol-  
23       lowing:

24       “(e) ALGAL BIOMASS CARBON REMOVAL.—

1           “(1) IN GENERAL.—The Director shall carry  
2           out a research and development program to gain un-  
3           derstanding of the underlying biology of algal bio-  
4           mass systems and the possible use of algal biomass  
5           systems as a means of carbon removal (as defined  
6           in section 2 of the Carbon Removal and Emissions  
7           Storage Technologies Act of 2022) from the air and  
8           aquatic sources.

9           “(2) REQUIREMENTS.—The program carried  
10          out under paragraph (1) shall—

11               “(A) support efforts to reduce long-term  
12               technical barriers for algal biomass with carbon  
13               capture; and

14               “(B) coordinate closely with the Bioenergy  
15               Technologies Office and the Office of Fossil En-  
16               ergy and Carbon Management.”.

17          (b) OFFICE OF ENERGY EFFICIENCY AND RENEW-  
18          ABLE ENERGY.—Section 932 of the Energy Policy Act of  
19          2005 (42 U.S.C. 16232) is amended—

20               (1) in subsection (b)—

21                     (A) in paragraph (5), by striking “and”  
22                     after the semicolon;

23                     (B) in paragraph (6), by striking the pe-  
24                     riod and inserting “; and”; and

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

1 “(7) biological carbon removal (as defined in  
2 section 2 of the Carbon Removal and Emissions  
3 Storage Technologies Act of 2022).”; and

4 (2) by inserting after subsection (e) the fol-  
5 lowing:

6 “(f) BIOLOGICAL CARBON REMOVAL.—

7 “(1) DEFINITION OF CARBON REMOVAL.—In  
8 this subsection, the term ‘carbon removal’ has the  
9 meaning given the term in section 2 of the Carbon  
10 Removal and Emissions Storage Technologies Act of  
11 2022.

12 “(2) GOALS.—The goals of the biological car-  
13 bon removal program under subsection (b)(7) shall  
14 be to develop and deploy, in partnership with indus-  
15 try and institutions of higher education—

16 “(A) improved tools and understanding of  
17 feedstocks, supplies, and logistics with respect  
18 to carbon removal using biomass sources;

19 “(B) technologies for the optimized conver-  
20 sion of aquatic and terrestrial biomass for car-  
21 bon removal;

22 “(C) cost-competitive carbon capture tech-  
23 nologies applied to bioenergy, including—

24 “(i) algal, terrestrial, and marine bio-  
25 mass;

1 “(ii) biofuels; and

2 “(iii) bioproducts; and

3 “(D) applied research on best practices in  
4 macroalgae cultivation and phenotype selection,  
5 including by carrying out aquatic pilot projects.

6 “(3) COORDINATION.—Activities conducted  
7 under this subsection shall be coordinated with the  
8 relevant programs of the Office of Science, the Of-  
9 fice of Fossil Energy and Carbon Management, and  
10 the Department of Agriculture.”.

11 (c) OFFICE OF FOSSIL ENERGY AND CARBON MAN-  
12 AGEMENT.—Section 962(b) of the Energy Policy Act of  
13 2005 (42 U.S.C. 16292(b)) is amended—

14 (1) in paragraph (1), by striking “performance  
15 of” and all that follows through the period at the  
16 end and inserting the following: “performance of—

17 “(A) coal and natural gas use;

18 “(B) biomass with carbon capture for utili-  
19 zation or permanent storage; and

20 “(C) manufacturing and industrial facili-  
21 ties.”; and

22 (2) in paragraph (3)—

23 (A) in subparagraph (A)—

24 (i) in clause (v), by striking “and”  
25 after the semicolon;

1 (ii) in clause (vi), by striking the pe-  
 2 riod at the end and inserting “; and”; and

3 (iii) by adding at the end the fol-  
 4 lowing:

5 “(vii) developing advanced boilers to  
 6 enable net-negative lifecycle carbon emis-  
 7 sions through co-firing with biomass.”; and  
 8 (B) by adding at the end the following:

9 “(G) Developing carbon capture tech-  
 10 nologies applied to bioenergy systems that re-  
 11 sult in net-negative lifecycle carbon emissions,  
 12 including—

13 “(i) biofuels production;

14 “(ii) bioproducts;

15 “(iii) biomass used in power systems  
 16 and industrial applications; and

17 “(iv) fossil fuel power systems and in-  
 18 dustrial systems co-fired with biomass.”.

19 (d) OFFICE OF ENERGY EFFICIENCY AND RENEW-  
 20 ABLE ENERGY.—

21 (1) IN GENERAL.—The Energy Independence  
 22 and Security Act of 2007 (42 U.S.C. 17001 et seq.)  
 23 is amended by striking section 228 (121 Stat. 1535)  
 24 and inserting the following:

1 **“SEC. 228. AQUATIC BIOMASS.**

2 “(a) IN GENERAL.—The Director of the Bioenergy  
3 Technologies Office shall carry out applied research on—

4 “(1) microalgae and macroalgae cultivation and  
5 phenotype selection; and

6 “(2) optimization of aquatic biomass conversion  
7 pathways.

8 “(b) REQUIREMENTS.—The research carried out  
9 under subsection (a) shall support efforts—

10 “(1) to develop best practices in microalgae and  
11 macroalgae cultivation and phenotype selection, in-  
12 cluding by carrying out aquatic pilot projects—

13 “(A) on microalgae and macroalgae; and

14 “(B) in freshwater and seawater; and

15 “(2) to optimize aquatic biomass conversion  
16 pathways that result in carbon removal (as defined  
17 in section 2 of the Carbon Removal and Emissions  
18 Storage Technologies Act of 2022) for biopower,  
19 biofuels, and other uses.

20 “(c) FUNDING.—There are authorized to be appro-  
21 priated to the Secretary to carry out this section—

22 “(1) \$3,000,000 for fiscal year 2023;

23 “(2) \$8,000,000 for fiscal year 2024; and

24 “(3) \$20,000,000 for each of fiscal years 2025  
25 through 2027.”.



1           (2) CLERICAL AMENDMENT.—The table of con-  
 2           tents for the Energy Independence and Security Act  
 3           of 2007 (Public Law 110–140; 121 Stat. 1493) is  
 4           amended by striking the item relating to section 228  
 5           and inserting the following:

“Sec. 228. Aquatic biomass.”.

6   **SEC. 102. BIOLOGICAL CARBON DIOXIDE CONVERSION PRO-**  
 7           **GRAMS.**

8           (a) IN GENERAL.—The Energy Policy Act of 2005  
 9           is amended by inserting after section 977 (42 U.S.C.  
 10          16317) the following:

11   **“SEC. 977A. BIOLOGICAL CARBON DIOXIDE CONVERSION**  
 12           **PROGRAMS.**

13          “(a) GENETIC MODELING AND TOOLS;  
 14          BIOPROSPECTING.—

15               “(1) IN GENERAL.—The Director of the Office  
 16               of Science shall establish a program to improve ge-  
 17               netic modeling and manipulation for carbon dioxide  
 18               conversion.

19               “(2) METHODOLOGY.—The program established  
 20               under paragraph (1) shall—

21                       “(A) support efforts to improve carbon di-  
 22                       oxide uptake and conversion through genetic  
 23                       manipulation of crops and trees, including—

24                               “(i) soil enhancements;

1 “(ii) enhanced photosynthesis, includ-  
2 ing microbial soil amendments and  
3 perennialization; and

4 “(iii) root growth; and

5 “(B) support efforts to bioprospect using  
6 tools and high-throughput screening methods  
7 for organisms with unique attributes related to  
8 carbon dioxide conversion.

9 “(3) COORDINATION.—In carrying out the pro-  
10 gram established under paragraph (1), the Director  
11 of the Office of Science shall coordinate with the  
12 National Science Foundation and the Agricultural  
13 Research Service.

14 “(b) NEW MATERIALS DEVELOPMENT AND APPLICA-  
15 TION.—

16 “(1) DEFINITION OF CARBON REMOVAL.—In  
17 this subsection, the term ‘carbon removal’ has the  
18 meaning given the term in section 2 of the Carbon  
19 Removal and Emissions Storage Technologies Act of  
20 2022.

21 “(2) PROGRAM.—The Assistant Secretary for  
22 Energy Efficiency and Renewable Energy, in con-  
23 sultation with the Secretary of Agriculture, shall es-  
24 tablish a program to develop new biologically based

1 carbon dioxide utilization products and coproducts  
2 that result in carbon removal.

3 “(3) METHODOLOGY.—The program established  
4 under paragraph (2) shall—

5 “(A) support efforts to develop new carbon  
6 dioxide utilization products that result in car-  
7 bon removal;

8 “(B) prioritize products that have the po-  
9 tential to be deployed at a large scale; and

10 “(C) support efforts to develop valorization  
11 of coproducts for—

12 “(i) feed;

13 “(ii) fuel; and

14 “(iii) other uses.”.

15 (b) CLERICAL AMENDMENT.—The table of contents  
16 for the Energy Policy Act of 2005 (Public Law 109–58;  
17 119 Stat. 600) is amended by inserting after the item re-  
18 lating to section 977 the following:

“Sec. 977A. Biological carbon dioxide conversion programs.”.

19 **Subtitle B—Geological Carbon**  
20 **Removal**

21 **SEC. 111. CARBON MINERALIZATION PILOT PROJECTS.**

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

1 **“SEC. 963A. CARBON MINERALIZATION PILOT PROJECTS.**

2 “(a) IN GENERAL.—The Secretary, in consultation  
3 with the Administrator of the National Oceanic and At-  
4 mospheric Administration and the Director of the United  
5 States Geological Survey, shall conduct field experiments  
6 of ex situ and in situ carbon mineralization approaches  
7 for the purposes of advancing carbon removal technologies  
8 or approaches (as defined in section 2 of the Carbon Re-  
9 moval and Emissions Storage Technologies Act of 2022).

10 “(b) ACTIVITIES.—In carrying out subsection (a), the  
11 Secretary shall—

12 “(1) conduct field experiments of ex situ carbon  
13 mineralization—

14 “(A) using desalination brine treatment;  
15 and

16 “(B) through the broadcast of reactive  
17 minerals on—

18 “(i) soils;

19 “(ii) beaches; and

20 “(iii) shallow oceans; and

21 “(2) conduct field experiments of in situ carbon  
22 mineralization, including through drilling and injec-  
23 tion in reactive formations for—

24 “(A) mantle peridotite;

25 “(B) basalt; and

26 “(C) other relevant formations.

1       “(c) FIELD EXPERIMENT GOALS AND OBJEC-  
 2 TIVES.—The Secretary shall develop goals and objectives  
 3 for field experiments carried out under this section to de-  
 4 crease the energy requirements and costs to produce the  
 5 resulting mineralized carbon.

6       “(d) ENVIRONMENTAL IMPACT.—In carrying out  
 7 field experiments under this section, the Secretary shall  
 8 comply with all applicable environmental laws and regula-  
 9 tions.

10       “(e) FUNDING.—There are authorized to be appro-  
 11 priated to the Secretary to carry out this section—

12               “(1) \$4,000,000 for fiscal year 2023;

13               “(2) \$9,000,000 for fiscal year 2024;

14               “(3) \$18,000,000 for fiscal year 2025; and

15               “(4) \$30,000,000 for each of fiscal years 2026  
 16 and 2027.”.

17       (b) CLERICAL AMENDMENT.—The table of contents  
 18 for the Energy Policy Act of 2005 (Public Law 109–58;  
 19 119 Stat. 600) is amended by inserting after the item re-  
 20 lating to section 963 the following:

“Sec. 963A. Carbon mineralization pilot projects.”.

21 **SEC. 112. CARBON MINERALIZATION RESOURCE ASSESS-**  
 22 **MENT.**

23       (a) IN GENERAL.—The Secretary of the Interior (re-  
 24 ferred to in this section as the “Secretary”) shall complete  
 25 a national assessment of the potential for using carbon

1 mineralization for carbon removal, in accordance with the  
2 methodology developed under subsection (b).

3 (b) METHODOLOGY.—Not later than 2 years after  
4 the date of enactment of this Act, the Secretary, acting  
5 through the Director of the United States Geological Sur-  
6 vey, shall develop a methodology to assess geological re-  
7 sources, mine tailings, and other alkaline industrial wastes  
8 to identify sustainable sources of reactive minerals suit-  
9 able for carbon mineralization, while taking into consider-  
10 ation minerals and mineral classes with high reactivity and  
11 fast kinetics.

12 (c) COORDINATION.—

13 (1) FEDERAL COORDINATION.—To ensure the  
14 maximum usefulness and success of the assessment  
15 under subsection (a), the Secretary shall—

16 (A) consult with the Secretary of Energy  
17 and the Administrator of the Environmental  
18 Protection Agency on the format and content of  
19 the assessment; and

20 (B) share relevant data with the Depart-  
21 ment of Energy and the Environmental Protec-  
22 tion Agency.

23 (2) STATE COORDINATION.—The Secretary  
24 shall consult with State geological surveys and other  
25 relevant entities to ensure, to the maximum extent

1 practicable, the usefulness and success of the assess-  
2 ment under subsection (a).

3 (d) REPORT.—

4 (1) IN GENERAL.—Not later than 180 days  
5 after the date on which the assessment under sub-  
6 section (a) is completed, the Secretary shall submit  
7 to the Committee on Energy and Natural Resources  
8 of the Senate and the Committee on Natural Re-  
9 sources of the House of Representatives a report de-  
10 scribing the findings under the assessment, including  
11 the locations and available quantities of suitable re-  
12 active minerals.

13 (2) PUBLIC AVAILABILITY.—Not later than 30  
14 days after the date on which the Secretary submits  
15 the report under paragraph (1), the Secretary shall  
16 make the report publicly available.

17 **SEC. 113. TAILINGS AND WASTE MINERALIZATION PRO-**  
18 **GRAM.**

19 (a) TAILINGS AND WASTE MINERALIZATION PRO-  
20 GRAM.—

21 (1) IN GENERAL.—The Secretary shall conduct  
22 field experiments to examine the use of mine tailings  
23 and industrial wastes for the purpose of carbon min-  
24 eralization.

1           (2) ACTIVITIES.—The field experiments using  
2       mine tailings and industrial wastes conducted under  
3       paragraph (1) shall assess—

4           (A) the reusing of industrial slags and  
5       mine tailings in manufacturing; and

6           (B) other industrial wastes that may have  
7       carbon mineralization properties.

8       (b) STUDY ON ENVIRONMENTAL IMPACTS OF MIN-  
9       ERALIZATION PRODUCTS.—

10           (1) IN GENERAL.—Not later than 3 years after  
11       the date of enactment of this Act, the Secretary  
12       shall conduct, and submit to Congress a report that  
13       describes the results of, a study on the environ-  
14       mental impacts of—

15           (A) broadcasting materials and distrib-  
16       uting piles of mine tailings at various scales for  
17       the purposes of enhanced carbon mineralization;  
18       and

19           (B) additional mining for the purposes of  
20       carbon mineralization.

21           (2) REQUIREMENTS.—The study under para-  
22       graph (1) shall include an analysis of—

23           (A) the relative carbon removal potential  
24       associated with various scales of carbon min-  
25       eralization;



1 (B) the cost of environmental mitigation of  
 2 the environmental impacts identified under the  
 3 study; and

4 (C) opportunities—  
 5 (i) for remediation;  
 6 (ii) to co-extract reactive minerals  
 7 with conventional mining operations; and  
 8 (iii) for the use of reactive minerals in  
 9 mining remediation.

## 10 **Subtitle C—Aquatic Carbon** 11 **Removal**

### 12 **SEC. 121. OCEAN CARBON REMOVAL MISSION.**

13 Section 969D of the Energy Policy Act of 2005 (42  
 14 U.S.C. 16298d) is amended—

15 (1) in subsection (a) by inserting “and aquatic  
 16 sources” after “atmosphere”; and

17 (2) in subsection (c)—

18 (A) in paragraph (5), by striking “and”  
 19 after the semicolon;

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

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

23 “(7) ocean carbon removal and strategies, such  
 24 as—

1           “(A) blue carbon, which is the manage-  
2           ment of vegetated coastal habitats (including  
3           mangroves, tidal marshes, seagrasses, kelp for-  
4           ests, and other tidal, freshwater, or saltwater  
5           wetlands) that sequester carbon (including  
6           autochthonous carbon and allochthonous car-  
7           bon) from the atmosphere, accumulate carbon  
8           in biomass, and store the carbon in soils;

9           “(B) direct ocean capture (as described in  
10          section 122(a) of the Carbon Removal and  
11          Emissions Storage Technologies Act of 2022);

12          “(C) microalgae and macroalgae cultiva-  
13          tion for—

14                 “(i) biofuels;

15                 “(ii) bioproducts; and

16                 “(iii) carbon storage; and

17          “(D) ocean alkalinity enhancement; and

18          “(8) any combination of activities described in  
19          paragraphs (1) through (7) that have the potential  
20          for significant carbon removal (as defined in section  
21          2 of the Carbon Removal and Emissions Storage  
22          Technologies Act of 2022).”.

1 **SEC. 122. DIRECT OCEAN CAPTURE ASSESSMENT.**

2 (a) IN GENERAL.—The Secretary shall conduct a  
3 comprehensive assessment of the potential for removing  
4 carbon dioxide directly from the oceans.

5 (b) METHODOLOGY.—In conducting the assessment  
6 under subsection (a), the Secretary shall consider the po-  
7 tential and relative merits of—

8 (1) pathways, methods, and technologies that  
9 are able to directly remove carbon dioxide from the  
10 oceans through engineered or inorganic processes;  
11 and

12 (2) technologies such as filters, membranes,  
13 phase change systems, chemical conversion, or other  
14 technological pathways.

15 (c) INCLUSION.—In conducting the assessment under  
16 subsection (a), the Secretary shall incorporate any infor-  
17 mation on the results of activities conducted under section  
18 223 of the National Defense Authorization Act for Fiscal  
19 Year 2020 (10 U.S.C. 4001 note; Public Law 116–92).

20 (d) REPORT.—Not later than 1 year after the date  
21 of enactment of this Act, the Secretary, in consultation  
22 with the Administrator of the National Oceanic and At-  
23 mospheric Administration, shall submit to the Committees  
24 on Energy and Natural Resources and Commerce,  
25 Science, and Transportation of the Senate and the Com-  
26 mittee on Energy and Commerce of the House of Rep-

1 representatives a report describing the results of the assess-  
2 ment under subsection (a).

3 (e) AUTHORIZATION OF APPROPRIATIONS.—There  
4 are authorized to be appropriated to the Secretary to carry  
5 out this section—

6 (1) \$2,000,000 for fiscal year 2023;

7 (2) \$4,000,000 for fiscal year 2024; and

8 (3) \$8,000,000 for each of fiscal years 2025  
9 through 2027.

10 **SEC. 123. OFFSHORE CARBON STORAGE PROGRAM AND AS-**  
11 **SESSMENT.**

12 (a) CARBON DIOXIDE IMPACTS AND FATE IN THE  
13 OCEAN.—

14 (1) IN GENERAL.—The Department of Energy  
15 Carbon Capture and Sequestration Research, Devel-  
16 opment, and Demonstration Act of 2007 (Public  
17 Law 110–140; 121 Stat. 1704) is amended by add-  
18 ing at the end the following:

19 **“SEC. 709. CARBON DIOXIDE IMPACTS AND FATE IN THE**  
20 **OCEAN.**

21 “(a) IN GENERAL.—The Secretary shall establish a  
22 program to monitor, research, and model the ecological  
23 impacts of ocean carbon dioxide removal and storage tech-  
24 niques.

1       “(b) COORDINATION.—In carrying out the program  
 2 established under subsection (a), the Secretary shall co-  
 3 ordinate with the Administrator of the National Oceanic  
 4 and Atmospheric Administration and the Administrator of  
 5 the National Aeronautics and Space Administration.

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

9               “(1) \$2,000,000 for fiscal year 2023; and

10              “(2) \$5,000,000 for each of fiscal years 2024  
 11 through 2027.”.

12              (2) CLERICAL AMENDMENT.—The table of con-  
 13 tents for the Energy Independence and Security Act  
 14 of 2007 (Public Law 110–140; 121 Stat. 1496) is  
 15 amended by inserting after the item relating to sec-  
 16 tion 708 the following:

“Sec. 709. Carbon dioxide impacts and fate in the ocean.”.

17       (b) OUTER CONTINENTAL SHELF RESOURCE AS-  
 18 SESSMENT.—

19              (1) IN GENERAL.—Not later than 1 year after  
 20 the date of enactment of this Act, the Secretary  
 21 shall—

22                      (A) expand the CarbonSAFE Initiative of  
 23 the Department of Energy to complete a na-  
 24 tional carbon mineralization assessment that ex-  
 25 amines the full range of carbon mineralization

1 storage potential for the outer Continental  
2 Shelf region; and

3 (B) submit to the Committees on Energy  
4 and Natural Resources and Commerce, Science,  
5 and Transportation of the Senate and the Com-  
6 mittee on Energy and Commerce of the House  
7 of Representatives a report describing the re-  
8 sults of the assessment.

9 (2) AUTHORIZATION OF APPROPRIATIONS.—

10 There is authorized to be appropriated to the Sec-  
11 retary to carry out this subsection \$5,000,000 for  
12 each of fiscal years 2023 through 2027.

13 (c) ASSESSMENT TO DETERMINE THE POTENTIAL  
14 FOR OFFSHORE CARBON STORAGE.—

15 (1) IN GENERAL.—The Secretary, in consulta-  
16 tion with the Secretary of the Interior, the Adminis-  
17 trator of the Environmental Protection Agency, and  
18 the Administrator of the National Oceanic and At-  
19 mospheric Administration, shall conduct a com-  
20 prehensive assessment of the potential for offshore  
21 carbon storage, including an assessment of—

22 (A) the potential for offshore carbon stor-  
23 age—

24 (i) in deep offshore sub-seabed loca-  
25 tions, such as in geological formations;

- 1 (ii) at the seabed, such as through  
2 biomass sinking; and  
3 (iii) within the oceans, such as liquid  
4 carbon dioxide storage; and  
5 (B) other relevant methods of offshore car-  
6 bon storage.

7 (2) INCLUSION.—The assessment under para-  
8 graph (1) shall include recommendations of meas-  
9 ures that the Department of Energy may take to im-  
10 prove the ease, safety, and security of offshore car-  
11 bon dioxide storage.

12 (3) REPORTING.—Not later than 2 years after  
13 the date of enactment of this Act, the Secretary  
14 shall submit to the Committees on Energy and Nat-  
15 ural Resources and Commerce, Science, and Trans-  
16 portation of the Senate and the Committee on En-  
17 ergy and Commerce of the House of Representatives  
18 a report describing the results of the assessment  
19 under paragraph (1).

20 **Subtitle D—Atmospheric Carbon**  
21 **Removal**

22 **SEC. 131. DIRECT AIR CAPTURE TECHNOLOGY MANUFAC-**  
23 **TURING RESEARCH PROGRAM.**

24 (a) INITIATIVE.—

1           (1) IN GENERAL.—The Secretary shall establish  
2           a program for the research, development, and dem-  
3           onstration of manufacturing techniques for direct air  
4           capture technologies (referred to in this section as  
5           the “program”).

6           (2) COORDINATION.—In carrying out the pro-  
7           gram, the Secretary shall leverage expertise and re-  
8           sources from—

9                   (A) the Office of Science;

10                   (B) the Office of Energy Efficiency and  
11           Renewable Energy; and

12                   (C) the Office of Fossil Energy and Car-  
13           bon Management.

14           (b) CONTACTOR DESIGN.—

15           (1) IN GENERAL.—In carrying out the program,  
16           the Secretary shall conduct research on applied tech-  
17           nology development of air contactor design.

18           (2) REQUIREMENTS.—The research under para-  
19           graph (1) shall support efforts to improve air  
20           contactors with—

21                   (A) low pressure drop;

22                   (B) high surface area; and

23                   (C) high longevity.

24           (c) MANUFACTURING IMPROVEMENT.—



1           (1) IN GENERAL.—In carrying out the program,  
2           the Secretary shall conduct research scaling-up man-  
3           ufacturing of direct air capture components.

4           (2) REQUIREMENTS.—The research under para-  
5           graph (1) shall—

6                   (A) support efforts to improve techniques  
7                   for low-cost manufacturing of direct air capture  
8                   components and materials; and

9                   (B) be coordinated with private industry  
10                  and universities.

11          (d) AUTHORIZATION OF APPROPRIATIONS.—There  
12          are authorized to be appropriated to the Secretary—

13               (1) to carry out subsection (b)—

14                   (A) \$3,000,000 for fiscal year 2023;

15                   (B) \$7,000,000 for fiscal year 2024; and

16                   (C) \$10,000,000 for each of fiscal years  
17                  2025 through 2027; and

18               (2) to carry out subsection (c)—

19                   (A) \$2,000,000 for fiscal year 2023;

20                   (B) \$5,000,000 for fiscal year 2024; and

21                   (C) \$10,000,000 for each of fiscal years  
22                  2025 through 2027.

## **Subtitle E—Carbon Removal Quantification**

### **SEC. 141. CARBON REMOVAL QUANTIFICATION.**

(a) IN GENERAL.—Title V of the Energy Act of 2020 (42 U.S.C. 16298e et seq.) is amended by adding at the end the following:

#### **“SEC. 5003. QUANTIFYING THE BENEFITS OF CARBON REMOVAL.**

“(a) PURPOSES.—The purposes of this section are—

“(1) to quantify the net carbon removed through atmospheric and aquatic carbon removal pathways;

“(2) to determine the current and projected carbon removal capacity of atmospheric and aquatic carbon removal pathways;

“(3) to determine the current and likely future technical readiness of carbon removal technologies or approaches for large-scale carbon removal deployment; and

“(4) to aid in the commercialization of carbon removal technologies or approaches.

“(b) DEFINITIONS.—In this section:

“(1) CARBON REMOVAL; CARBON REMOVAL TECHNOLOGY OR APPROACH.—The terms ‘carbon removal’ and ‘carbon removal technology or approach’

1 have the meanings given the terms in section 2 of  
2 the Carbon Removal and Emissions Storage Tech-  
3 nologies Act of 2022.

4 “(2) ELIGIBLE ENTITY.—The term ‘eligible en-  
5 tity’ means any of the following entities:

6 “(A) An institution of higher education.

7 “(B) A National Laboratory.

8 “(C) A Federal research agency.

9 “(D) A State research agency.

10 “(E) A nonprofit research organization.

11 “(F) An industrial entity.

12 “(G) A consortium of 2 or more entities  
13 described in subparagraphs (A) through (F).

14 “(3) SECRETARY.—The term ‘Secretary’ means  
15 the Secretary of Energy.

16 “(c) CARBON REMOVAL FOOTPRINT PROGRAM.—

17 “(1) ESTABLISHMENT.—Not later than 1 year  
18 after the date of enactment of this section, the Sec-  
19 retary shall establish a program to carry out the  
20 purposes described in subsection (a), including by  
21 providing financial assistance to eligible entities to  
22 examine the technological, economic, and environ-  
23 mental impacts of carbon removal pathways and  
24 technologies.

1           “(2) ELIGIBLE ACTIVITIES.—Activities eligible  
2           to receive financial assistance under this section in-  
3           clude—

4                   “(A) assessments of technological or eco-  
5                   nomic barriers to the widescale deployment of  
6                   carbon removal pathways and technologies; and

7                   “(B) lifecycle assessments for carbon re-  
8                   moval pathways and technologies, including  
9                   gathering data in partnership with a direct air  
10                  capture test center authorized under section  
11                  969D(f)(1) of the Energy Policy Act of 2005  
12                  (42 U.S.C. 16298d(f)(1)).

13           “(3) APPLICATIONS.—An eligible entity seeking  
14           financial assistance under this section shall submit  
15           to the Secretary an application that includes a de-  
16           scription of—

17                   “(A) the applicable project;

18                   “(B) the software programs, consultants,  
19                   and general methodologies to be used to con-  
20                   duct the assessment;

21                   “(C) the location of any applicable facility  
22                   or project;

23                   “(D) expected feedstocks and other inputs;  
24                   and

25                   “(E) the expected use of carbon removed.

1           “(4) PRIORITY.—In selecting eligible entities to  
 2           receive financial assistance under this section, the  
 3           Secretary shall give priority to eligible entities  
 4           that—

5                   “(A) make the assessment publicly avail-  
 6                   able, with confidential business information re-  
 7                   dacted or removed; and

8                   “(B) have not previously received financial  
 9                   assistance under this section.”.

10          (b) CLERICAL AMENDMENT.—The table of contents  
 11          for the Energy Act of 2020 (Public Law 116–260; 134  
 12          Stat. 2419) is amended by inserting after the item relating  
 13          to section 5002 the following:

“Sec. 5003. Quantifying the benefits of carbon removal.”.

## 14           **TITLE II—CARBON REMOVAL** 15           **FIRST MOVERS PILOT PROGRAM**

### 16           **SEC. 201. CARBON REMOVAL FIRST MOVERS PILOT PRO-** 17           **GRAM.**

18          (a) IN GENERAL.—Subtitle F of title IX of the En-  
 19          ergy Policy Act of 2005 (42 U.S.C. 16291 et seq.) is  
 20          amended by adding at the end the following:

### 21           **“SEC. 969E. CARBON REMOVAL FIRST MOVERS PILOT PRO-** 22           **GRAM.**

23          “(a) PURPOSES.—The purposes of this section are—

1 “(1) to accelerate the deployment and commer-  
2 cialization of carbon removal pathways and tech-  
3 nologies;

4 “(2) to stimulate the development and commer-  
5 cialization of low-carbon products made with carbon  
6 dioxide removed from the atmosphere or oceans; and

7 “(3) to support the development of technologies  
8 relating to carbon removal.

9 “(b) DEFINITIONS.—In this section:

10 “(1) ADDITIONAL.—The term ‘additional’, with  
11 respect to carbon dioxide removed from the atmos-  
12 phere or upper hydrosphere, means that carbon di-  
13 oxide was removed pursuant to an intentional carbon  
14 removal activity that delivers a net removal of car-  
15 bon dioxide from the atmosphere, measured on a  
16 lifecycle basis, that would not have occurred without  
17 the carbon removal activity.

18 “(2) ALL-IN COST.—The term ‘all-in cost’  
19 means the total cost of—

20 “(A) the capture, transport, and storage of  
21 carbon dioxide; and

22 “(B) the measurement, reporting, and  
23 verification of carbon dioxide removed on a net  
24 ton carbon dioxide equivalent basis.

1           “(3) ELIGIBLE ENTITY.—The term ‘eligible en-  
2           tity’ means a carbon removal facility that—

3                   “(A) is located in the United States;

4                   “(B) meets all applicable Federal and  
5           State permitting requirements; and

6                   “(C) meets financial and technical criteria  
7           established by the Secretary.

8           “(4) REMOVAL.—The term ‘removal’ means—

9                   “(A) the capture of carbon dioxide from  
10          the atmosphere or upper hydrosphere through a  
11          chemical, physical, or other process; and

12                   “(B) the subsequent permanent storage or  
13          use of the carbon dioxide in a manner that en-  
14          sures that the carbon dioxide does not reenter  
15          the atmosphere or upper hydrosphere.

16           “(5) UPPER HYDROSPHERE.—The term ‘upper  
17          hydrosphere’ means the total liquid water existing  
18          on the surface level of the earth, including—

19                   “(A) oceans;

20                   “(B) lakes;

21                   “(C) rivers; and

22                   “(D) other surface bodies of water.

23          “(c) PROGRAM.—

24                   “(1) ESTABLISHMENT.—The Secretary shall es-  
25          tablish a competitive purchasing pilot program under

1       which the Secretary shall purchase from eligible en-  
2       tities carbon dioxide removed from the atmosphere  
3       or upper hydrosphere.

4           “(2) PURCHASE.—In carrying out the pilot pro-  
5       gram under paragraph (1), the Secretary shall pur-  
6       chase, subject to the availability of appropriations,  
7       removed carbon dioxide from eligible entities—

8           “(A) until the date on which the first re-  
9       verse auction is held under paragraph (3), by  
10      making a payment per net ton carbon equiva-  
11      lent basis to account for lifecycle greenhouse  
12      gas inputs to carbon removal in an amount de-  
13      termined by the Secretary; and

14          “(B) beginning with the first reverse auc-  
15      tion held under paragraph (3), in accordance  
16      with the reverse auction procedures described in  
17      that paragraph.

18          “(3) REVERSE AUCTION PROCEDURES.—

19          “(A) IN GENERAL.—Not later than 2 years  
20      after the date of enactment of this section, and  
21      annually thereafter, the Secretary shall conduct  
22      a reverse auction under which—

23           “(i) the Secretary shall solicit bids  
24      from eligible entities in each tier described



1 in subparagraph (B)(ii) (referred to in this  
2 section as a ‘permanence tier’); and

3 “(ii) eligible entities shall submit to  
4 the Secretary sealed bids describing—

5 “(I) a desired price for the re-  
6 moved carbon dioxide on a per net ton  
7 carbon dioxide equivalent basis;

8 “(II) the estimated net ton car-  
9 bon dioxide equivalent removed by the  
10 eligible entity annually that the eligi-  
11 ble entity desires the Secretary to  
12 purchase at the desired price;

13 “(III) details of the permanence  
14 of the removed carbon dioxide;

15 “(IV) details on the purity, loca-  
16 tion, and transportation options for  
17 the removed carbon dioxide to be pur-  
18 chased by the Secretary for purposes  
19 of the all-in costs;

20 “(V) a lifecycle assessment of the  
21 operation to quantify the net carbon  
22 dioxide removed, while accounting for  
23 greenhouse gas emissions associated  
24 with the production of the inputs nec-

1           essary for the carbon dioxide removal  
2           and storage processes; and

3                   “(VI) any other details the Sec-  
4           retary may require.

5           “(B) SELECTION.—

6                   “(i) IN GENERAL.—The Secretary  
7           shall—

8                           “(I) examine the bids submitted  
9                           under subparagraph (A)(ii) to deter-  
10                          mine which bids are acceptable under  
11                          the criteria established by the Sec-  
12                          retary for the applicable permanence  
13                          tier; and

14                           “(II) of the bids determined to be  
15                           acceptable under subclause (I), select  
16                           the bids containing the lowest desired  
17                           price for carbon dioxide until the  
18                           amount of funds available for the ap-  
19                           plicable permanence tier of the reverse  
20                           auction is obligated.

21                           “(ii) PERMANENCE TIERS.—In select-  
22                          ing bids under clause (i), the Secretary  
23                          shall group the permanence of each carbon  
24                          removal bid into 1 of the following 2 tiers:

1                   “(I) Medium-term tier for bids  
2                   providing for the removal of carbon  
3                   dioxide for at least 100 years, but  
4                   fewer than 1,000 years.

5                   “(II) Long-term tier for bids pro-  
6                   viding for the removal of carbon diox-  
7                   ide for 1,000 years or more.

8                   “(iii) PRIORITY.—In any case in  
9                   which the desired price in 2 or more bids  
10                  submitted under subparagraph (A)(ii) for  
11                  an applicable permanence tier is equal, the  
12                  Secretary shall give priority to eligible enti-  
13                  ties that demonstrate outstanding potential  
14                  for local and regional economic develop-  
15                  ment in carrying out projects to remove  
16                  carbon dioxide from ambient air or aquatic  
17                  sources.

18                  “(4) COST CAP.—

19                  “(A) IN GENERAL.—Subject to subpara-  
20                  graph (B), for purposes of a reverse auction  
21                  under paragraph (3), the Secretary shall—

22                  “(i) determine the current average  
23                  market price per net ton carbon dioxide  
24                  equivalent basis to account for lifecycle

1 greenhouse gas inputs of removed carbon  
2 within each permanence tier; and

3 “(ii) set that price as the maximum  
4 price per ton to be paid under the reverse  
5 auction within each permanence tier.

6 “(B) INCREASED CAP.—In the case of an  
7 eligible entity that uses a technology that has  
8 the potential to eventually remove carbon diox-  
9 ide at an all-in cost of less than \$100 per net  
10 ton carbon dioxide equivalent, the Secretary  
11 shall double the maximum price per net ton  
12 carbon dioxide equivalent established under  
13 subparagraph (A)(ii) with respect to the eligible  
14 entity.

15 “(5) REQUIREMENT.—In purchasing removed  
16 carbon dioxide under the program under paragraph  
17 (1), the Secretary shall determine that the carbon  
18 dioxide—

19 “(A) is additional;

20 “(B) shall be delivered not later than 5  
21 years after the date of the purchase;

22 “(C) shall have a monitoring, reporting,  
23 and verification plan approved by the Depart-  
24 ment of Energy; and

1                   “(D) has not less than a 99 percent likeli-  
2                   hood of being stored for not fewer than 100  
3                   years.

4           “(d) USE OF CARBON DIOXIDE.—Carbon dioxide  
5           purchased under the pilot program under subsection (c),  
6           at the discretion of the Secretary, may be used or stored  
7           in any manner that ensures that the carbon dioxide does  
8           not reenter the atmosphere or upper hydrosphere during  
9           the time period associated with the applicable permanence  
10          tier.

11          “(e) PILOT PROGRAM COORDINATION.—Amounts  
12          made available under this section may be made available  
13          to carry out pilot and demonstration projects described in  
14          section 969D(f)(2)(B) and section 969D(g).

15          “(f) CONFIDENTIALITY.—The Secretary shall estab-  
16          lish procedures to ensure that any confidential, private,  
17          proprietary, or privileged information that is included in  
18          a sealed bid submitted under this section is not publicly  
19          disclosed or otherwise improperly used.

20          “(g) AUTHORIZATION OF APPROPRIATIONS.—

21                  “(1) IN GENERAL.—There are authorized to be  
22                  appropriated to the Secretary to carry out this sec-  
23                  tion—

24                          “(A) \$20,000,000 for fiscal year 2023;

25                          “(B) \$30,000,000 for fiscal year 2024; and

1                   “(C) \$60,000,000 for each of fiscal years  
2                   2025 through 2027.

3                   “(2) ALLOCATION.—Amounts made available  
4                   under paragraph (1) for each fiscal year shall be al-  
5                   located between the permanence tiers as follows:

6                   “(A) 70 percent shall be allocated for the  
7                   permanence tier described in subsection  
8                   (c)(3)(B)(ii)(II).

9                   “(B) 30 percent shall be allocated for the  
10                  permanence tier described in subsection  
11                  (c)(3)(B)(ii)(I).”.

12                  (b) CLERICAL AMENDMENT.—The table of contents  
13                  for the Energy Policy Act of 2005 (Public Law 109–59;  
14                  119 Stat. 600; 134 Stat. 2550) is amended by adding at  
15                  the end of the items relating to subtitle F of title IX the  
16                  following:

                  “Sec. 969E. Carbon Removal First Movers Pilot Program.”.

○