118TH	CONGRESS
181	SESSION

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

# IN THE SENATE OF THE UNITED STATES

Ms.	COLLINS	(for	hersel	lf, M	Is.	CANTY	VELL	, Mr.	Cass.	IDY,	Mr.	Kn	٧G,	and	Mr.
	Coons) i	intro	duced	the	foll	lowing	bill;	which	was	read	l twi	ce a	and	refe	rred
	to the Co	mmi	ttee or	ı					_						

# 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 2023" or the "CREST Act of 2023".
  - 7 (b) Table of Contents.—The table of contents for
  - 8 this Act is as follows:
    - Sec. 1. Short title; table of contents.

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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 PURCHASING PILOT PROGRAM

Sec. 201. Carbon removal purchasing pilot program.

#### SEC. 2. DEFINITIONS.

- 2 In this Act:
- (1) CARBON REMOVAL.—The term "carbon re-3
- 4 moval" means the intentional removal, including by
- 5 harnessing natural processes, of carbon dioxide di-
- 6 rectly from the atmosphere or upper hydrosphere
- 7 and subsequent storage of the carbon dioxide in geo-
- 8 logical, biobased, or ocean reservoirs or in value-
- 9 added products that results in a net removal of car-
- 10 bon dioxide from the atmosphere, as measured on a
- 11 lifecycle basis.

1	(2) CARBON REMOVAL TECHNOLOGY OR AP-
2	PROACH.—The term "carbon removal technology or
3	approach" includes—
4	(A) direct air capture with durable storage;
5	(B) soil carbon sequestration;
6	(C) biomass carbon removal and storage;
7	(D) enhanced mineralization;
8	(E) ocean-based carbon dioxide removal;
9	and
10	(F) afforestation or reforestation.
11	(3) Secretary.—The term "Secretary" means
12	the Secretary of Energy.
13	TITLE I—CARBON REMOVAL
14	RESEARCH AND DEVELOPMENT
15	Subtitle A—Biomass Carbon
16	Removal
17	SEC. 101. BIOMASS CARBON REMOVAL PROGRAMS.
18	(a) Office of Science.—Section 306 of the De-
19	partment of Energy Research and Innovation Act (42
20	U.S.C. 18644) is amended—
21	(1) by redesignating subsections (k) and (l) as
22	subsections (l) and (m), respectively; and
23	(2) by inserting after subsection (j) the fol-
24	lovvino
	lowing:

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 2023) 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 2023)."; 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	2023.
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	(11) 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 2023) 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 2024;
23	(2) \$8,000,000 for fiscal year 2025; and
24	"(3) \$20,000,000 for each of fiscal years 2026
25	through 2028.".

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:
1	"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 Agricultura
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	2023.
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:

T	"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 2023).
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 "(e) 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 2024;
- "(2) \$9,000,000 for fiscal year 2025;
- 14 "(3) \$18,000,000 for fiscal year 2026; and
- 15 "(4) \$30,000,000 for each of fiscal years 2027
- 16 and 2028.".
- 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-
0	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

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eralization.

	10
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 submi-
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

and industrial wastes for the purpose of carbon min-

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
[4	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 <del></del>

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 2023);
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 2023).".

1	SEC	122	DIRECT	OCEAN	CADTITOR	ASSESSMENT.
1	DEC.	IZZ.	DIRECT	UCEAN	CAPTURE	ASSESSIVENT.

- 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,
- phase change systems, chemical conversion, or other
- 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 resentatives 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 2024;
- 7 (2) \$4,000,000 for fiscal year 2025; and
- 8 (3) \$8,000,000 for each of fiscal years 2026
- 9 through 2028.
- 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-
- opment, and Demonstration Act of 2007 (Public
- 17 Law 110-140; 121 Stat. 1704) is amended by add-
- 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 2024; and
10	"(2) \$5,000,000 for each of fiscal years 2025
11	through 2028.".
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 Continenta
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 2024 through 2028.
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 2024;
15	(B) \$7,000,000 for fiscal year 2025; and
16	(C) \$10,000,000 for each of fiscal years
17	2026 through 2028; and
18	(2) to carry out subsection (c)—
19	(A) \$2,000,000 for fiscal year 2024;
20	(B) \$5,000,000 for fiscal year 2025; and
21	(C) \$10,000,000 for each of fiscal years
22	2026 through 2028

25

## Subtitle E—Carbon Removal 1 Quantification 2 3 SEC. 141. CARBON REMOVAL QUANTIFICATION. 4 (a) IN GENERAL.—Title V of the Energy Act of 2020 5 (42 U.S.C. 16298e et seq.) is amended by adding at the end the following: "SEC. 5003. QUANTIFYING THE BENEFITS OF CARBON RE-8 MOVAL. 9 "(a) Purposes.—The purposes of this section are— "(1) to quantify the net carbon removed 10 11 through atmospheric and aquatic carbon removal 12 pathways: 13 "(2) to determine the current and projected 14 carbon removal capacity of atmospheric and aquatic 15 carbon removal pathways; "(3) to determine the current and likely future 16 17 technical readiness of carbon removal technologies or 18 approaches for large-scale carbon removal deploy-19 ment; and 20 "(4) to aid in the commercialization of carbon 21 removal technologies or approaches. 22 "(b) Definitions.—In this section: 23 "(1) CARBON REMOVAL; CARBON REMOVAL 24 TECHNOLOGY OR APPROACH.—The terms 'carbon re-

moval' 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 2023.
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	PURCHASING PILOT PROGRAM
16	SEC. 201. CARBON REMOVAL PURCHASING 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 PURCHASING PILOT PRO-
22	GRAM.

1	"(1) to accelerate the deployment and commer-
2	cialization of technologically diverse carbon removal
3	pathways and technologies;
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 and diversifica-
8	tion of technologies 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, technical, and tech-
7	nological diversity criteria established by the
8	Secretary.
9	"(4) Removal.—The term 'removal' means—
10	"(A) the capture of carbon dioxide from
11	the atmosphere or upper hydrosphere through a
12	chemical, physical, or other process; and
13	"(B) the subsequent permanent storage or
14	use of the carbon dioxide in a manner that en-
15	sures that the carbon dioxide does not reenter
16	the atmosphere or upper hydrosphere.
17	"(5) UPPER HYDROSPHERE.—The term 'upper
18	hydrosphere' means the total liquid water existing
19	on the surface level of the earth, including—
20	"(A) oceans;
21	"(B) lakes;
22	"(C) rivers; and
23	"(D) other surface bodies of water.
24	"(c) Program.—

1	"(1) Establishment.—The Secretary shall es-
2	tablish a competitive purchasing pilot program under
3	which the Secretary shall purchase from eligible en-
4	tities carbon dioxide removed from the atmosphere
5	or upper hydrosphere.
6	"(2) Purchase.—In carrying out the pilot pro-
7	gram under paragraph (1), the Secretary shall pur-
8	chase, subject to the availability of appropriations,
9	removed carbon dioxide from eligible entities—
10	"(A) until the date on which the first re-
11	verse auction is held under paragraph (3), by
12	making a payment per net ton carbon equiva-
13	lent basis to account for lifecycle greenhouse
14	gas inputs to carbon removal in an amount de-
15	termined by the Secretary; and
16	"(B) beginning with the first reverse auc-
17	tion held under paragraph (3), in accordance
18	with the reverse auction procedures described in
19	that paragraph.
20	"(3) REVERSE AUCTION PROCEDURES.—
21	"(A) IN GENERAL.—Not later than 2 years
22	after the date of enactment of this section, and
23	annually thereafter, the Secretary shall conduct
24	a reverse auction under which—

1	"(i) the Secretary shall solicit bids
2	from eligible entities in each tier described
3	in subparagraph (B)(ii) (referred to in this
4	section as a 'permanence tier'); and
5	"(ii) eligible entities shall submit to
6	the Secretary sealed bids describing—
7	"(I) a desired price for the re-
8	moved carbon dioxide on a per net ton
9	carbon dioxide equivalent basis;
10	"(II) the estimated net ton car-
11	bon dioxide equivalent removed by the
12	eligible entity annually that the eligi-
13	ble entity desires the Secretary to
14	purchase at the desired price;
15	"(III) details of the permanence
16	of the removed carbon dioxide;
17	"(IV) details on the purity, loca-
18	tion, and transportation options for
19	the removed carbon dioxide to be pur-
20	chased by the Secretary for purposes
21	of the all-in costs;
22	"(V) a lifecycle assessment of the
23	operation to quantify the net carbon
24	dioxide removed, while accounting for
25	greenhouse gas emissions associated

1	with the production of the inputs nec-
2	essary for the carbon dioxide removal
3	and storage processes; and
4	"(VI) any other details the Sec-
5	retary may require.
6	"(B) SELECTION.—
7	"(i) In General.—The Secretary
8	shall—
9	"(I) examine the bids submitted
10	under subparagraph (A)(ii) to deter-
11	mine which bids are acceptable under
12	the criteria established by the Sec-
13	retary for the applicable permanence
14	tier; and
15	"(II) of the bids determined to be
16	acceptable under subclause (I), iden-
17	tify a technologically diverse set of
18	carbon removal approaches, and for
19	each of those selected approaches, se-
20	lect the bids containing the lowest de-
21	sired price for carbon dioxide, subject
22	to clause (iv), until the amount of
23	funds available for the applicable per-
24	manence tier of the reverse auction is
25	obligated.

1	"(ii) Permanence tiers.—In select-
2	ing bids under clause (i), the Secretary
3	shall group the permanence of each carbon
4	removal bid into 1 of the following 2 tiers:
5	"(I) Medium-term tier for bids
6	providing for the removal of carbon
7	dioxide for at least 100 years, but
8	fewer than 1,000 years.
9	"(II) Long-term tier for bids pro-
10	viding for the removal of carbon diox-
11	ide for 1,000 years or more.
12	"(iii) Priority.—In any case in
13	which the desired price in 2 or more bids
14	submitted under subparagraph (A)(ii) for
15	an applicable permanence tier is equal, the
16	Secretary shall give priority to eligible enti-
17	ties that demonstrate outstanding potential
18	for local and regional economic develop-
19	ment in carrying out projects to remove
20	carbon dioxide from ambient air or aquatic
21	sources.
22	"(iv) Limitation on funds re-
23	CEIVED BY A SINGLE COMPANY.—To the
24	extent that there are sufficient bids accept-
25	able under clause (i)(I), the Secretary shall

1	ensure that one or more eligible entities
2	under common control does not receive
3	more than 15 percent of the amounts
4	made available for a fiscal year under this
5	section.
6	"(4) Cost cap.—
7	"(A) In General.—Subject to subpara-
8	graph (B), for purposes of a reverse auction
9	under paragraph (3), the Secretary shall—
10	"(i) determine the current average
11	market price per net ton carbon dioxide
12	equivalent basis to account for lifecycle
13	greenhouse gas inputs of removed carbon
14	within each permanence tier; and
15	"(ii) set that price as the maximum
16	price per ton to be paid under the reverse
17	auction within each permanence tier.
18	"(B) INCREASED CAP.—In the case of an
19	eligible entity that uses a technology that has
20	the potential to eventually remove carbon diox-
21	ide at an all-in cost of less than \$100 per net
22	ton carbon dioxide equivalent, the Secretary
23	shall double the maximum price per net ton
24	carbon dioxide equivalent established under

Ţ	subparagraph (A)(ii) with respect to the eligible
2	entity.
3	"(5) REQUIREMENT.—In purchasing removed
4	carbon dioxide under the program under paragraph
5	(1), the Secretary shall determine that the carbon
6	dioxide—
7	"(A) is additional;
8	"(B) shall be delivered not later than 5
9	years after the date of the purchase;
10	"(C) shall have a monitoring, reporting,
11	and verification plan approved by the Depart-
12	ment of Energy; and
13	"(D) has not less than a 99 percent likeli-
14	hood of being stored for not fewer than 100
15	years.
16	"(d) USE OF CARBON DIOXIDE.—Carbon dioxide
17	purchased under the pilot program under subsection (c),
18	at the discretion of the Secretary, may be used or stored
19	in any manner that ensures that the carbon dioxide does
20	not reenter the atmosphere or upper hydrosphere during
21	the time period associated with the applicable permanence
22	tier.
23	"(e) PILOT PROGRAM COORDINATION.—Amounts
24	made available under this section may be made available

1	to carry out pilot and demonstration projects described in
2	section 969D(f)(2)(B) and section 969D(g).
3	"(f) Confidentiality.—The Secretary shall estab-
4	lish procedures to ensure that any confidential, private,
5	proprietary, or privileged information that is included in
6	a sealed bid submitted under this section is not publicly
7	disclosed or otherwise improperly used.
8	"(g) AUTHORIZATION OF APPROPRIATIONS.—
9	"(1) IN GENERAL.—There are authorized to be
10	appropriated to the Secretary to carry out this sec-
11	tion—
12	"(A) \$20,000,000 for fiscal year 2024;
13	"(B) \$30,000,000 for fiscal year 2025; and
14	"(C) \$60,000,000 for each of fiscal years
15	2026 through 2028.
16	"(2) ALLOCATION.—Amounts made available
17	under paragraph (1) for each fiscal year shall be al-
18	located between the permanence tiers as follows:
19	"(A) 70 percent shall be allocated for the
20	permanence tier described in subsection
21	(e)(3)(B)(ii)(II).
22	"(B) 30 percent shall be allocated for the
23	permanence tier described in subsection
24	(e)(3)(B)(ii)(I).".

- 1 (b) CLERICAL AMENDMENT.—The table of contents
- 2 for the Energy Policy Act of 2005 (Public Law 109-59;
- 3 119 Stat. 600; 134 Stat. 2550) is amended by adding at
- 4 the end of the items relating to subtitle F of title IX the
- 5 following:

"Sec. 969E. Carbon removal purchasing pilot program.".