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ENHANCING FOSSIL FUEL ENERGY CARBON TECHNOLOGY ACT OF 2019

SEPTEMBER 24, 2019.—Ordered to be printed

Ms. MURKOWSKI, from the Committee on Energy and Natural Resources, submitted the following

R E P O R T

[To accompany S. 1201]

The Committee on Energy and Natural Resources, to which was referred the bill (S. 1201) 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, having considered the same, reports favorably thereon with an amendment (in the nature of a substitute) and recommends that the bill, as amended, do pass.

AMENDMENT

The amendment is as follows:

Strike all after the enacting clause and insert the following:

SECTION 1. SHORT TITLE.

This Act may be cited as the "Enhancing Fossil Fuel Energy Carbon Technology Act of 2019" or the "EFFECT Act of 2019".

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

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

"SEC. 962. COAL AND NATURAL GAS TECHNOLOGY PROGRAM.

"(a) DEFINITIONS.—In this section:

"(1) LARGE-SCALE PILOT PROJECT.—The term 'large-scale pilot project' means a pilot project that—

"(A) represents the scale of technology development beyond laboratory development and bench scale testing, but not yet advanced to the point of being tested under real operational conditions at commercial scale;

"(B) represents the scale of technology necessary to gain the operational data needed to understand the technical and performance risks of the technology before the application of that technology at commercial scale or in commercial-scale demonstration; and

"(C) is large enough—

"(i) to validate scaling factors; and

"(ii) to demonstrate the interaction between major components so that control philosophies for a new process can be developed and enable the technology to advance from large-scale pilot plant application to commercial-scale demonstration or application.

"(2) NET-NEGATIVE CARBON DIOXIDE EMISSIONS TECHNOLOGY.—The term 'net-negative carbon dioxide emissions technology' means technology—

"(A) for thermochemical co-conversion of coal and biomass fuels that—

"(i) uses a carbon capture system; and

"(ii) with carbon dioxide removal, the Secretary determines can provide electricity, fuels, or chemicals with net-negative carbon dioxide emissions from production and consumption of the end products, while removing atmospheric carbon dioxide; and

"(B) through which each use of coal will be combined with the use 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—

"(I) advanced combustion systems, including oxygen combustion systems and chemical looping; and

"(II) the replacement of steam cycles with supercritical carbon dioxide cycles;

"(ii) improvements in steam or carbon dioxide turbine technology;

"(iii) improvements in carbon capture, utilization, and storage systems technology;

"(iv) improvements in small-scale and modular coal-fired technologies with reduced carbon output or carbon capture that can support incremental power generation capacity additions;

"(v) fuel cell technologies for low-cost, high-efficiency modular power systems;

"(vi) advanced gasification systems;

"(vii) thermal cycling technologies; and

"(viii) any other technology the Secretary recognizes as transformational technology.

"(b) COAL AND NATURAL GAS TECHNOLOGY PROGRAM.—

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

"(2) REQUIREMENTS.—The program shall include—

"(A) a research and development program;

"(B) large-scale pilot projects;

"(C) demonstration projects; and

"(D) a front-end engineering and design program.

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

"(A) Increasing the performance of coal and natural gas plants, including by

"(i) ensuring reliable, low-cost power from new and existing coal and natural gas plants;

"(ii) achieving high conversion efficiencies;

"(iii) addressing emissions of carbon dioxide through high-efficiency platforms;

"(iv) developing small-scale and modular technologies to support incremental capacity additions and load following generation, in addition to large-scale generation technologies;

"(v) supporting dispatchable operations for new and existing applications of coal and natural gas generation; and "(vi) accelerating the development of technologies that have transformational energy conversion characteristics.

"(B) Using carbon capture, utilization, and sequestration technologies to decrease the carbon dioxide emissions, and the environmental impact from carbon dioxide emissions, from new and existing coal and natural gas plants, including by—

"(i) accelerating the development, deployment, and commercialization of technologies to capture and sequester carbon dioxide emissions from new and existing coal and natural gas plants;

"(ii) supporting sites for safe geological storage of large volumes of anthropogenic sources of carbon dioxide and the development of the infrastructure needed to support a carbon dioxide utilization and storage industry;

"(iii) improving the conversion, utilization, and storage of carbon dioxide produced from fossil fuels and other anthropogenic sources of carbon dioxide;

"(iv) lowering greenhouse gas emissions for all fossil fuel production, generation, delivery, and use, to the maximum extent practicable;

"(v) developing carbon utilization technologies, products, and methods, including carbon use and reuse for commercial application; and

"(vi) developing net-negative carbon dioxide emissions technologies.

"(C) Decreasing the non-carbon dioxide relevant environmental impacts of coal and natural gas production, including by—

"(i) further reducing non-carbon dioxide air emissions; and

"(ii) reducing the use, and managing the discharge, of water in power plant operations.

"(D) Accelerating the development of technologies to capture carbon dioxide emissions from industrial facilities, including

"(i) nontraditional fuel manufacturing facilities, including ethanol or other biofuel production plants or hydrogen production plants; and

"(ii) energy-intensive manufacturing facilities that produce carbon dioxide as a byproduct of operations.

"(E) Examining methods of converting coal and natural gas to other valuable products and commodities in addition to electricity, including hydrogen.

"(4) CROSS-CUTTING DIRECTION FOR CARBON CAPTURE, UTILIZATION, AND SEQUESTRATION ACTIVITIES.—The carbon capture, utilization, and sequestration activities described in paragraph (3)(B) shall be—

"(A) cross-cutting in nature; and

"(B) carried out by the Assistant Secretary for Fossil Energy, in coordination with the heads of other relevant offices of the Department, including the Director of the Office of Science and the Assistant Secretary for Energy Efficiency and Renewable Energy.

"(5) CONSULTATIONS REQUIRED.—In carrying out the program, the Secretary shall—

"(A) undertake international collaborations, taking into consideration the recommendations of the National Coal Council;

"(B) use existing authorities to encourage international cooperation; and

"(C) consult with interested entities, including—

"(i) coal and natural gas producers;

"(ii) industries that use coal and natural gas;

"(iii) organizations that promote coal, advanced coal, and natural gas technologies;

"(iv) environmental organizations;

"(v) organizations representing workers; and

"(vi) organizations representing consumers.

"(c) REPORT.

"(1) IN GENERAL.—Not later than 18 months after the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Secretary shall submit to Congress a report describing the program goals and objectives adopted under subsection (b)(3).

"(2) UPDATE.—Not less frequently than once every 2 years after the initial report is submitted under paragraph (1), the Secretary shall submit to Congress

a report describing the progress made towards achieving the program goals and objectives adopted under subsection (b)(3).

"(d) FUNDING.

"(1) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary to carry out this section, to remain available until expended—

"(A) for activities under the research and development program component described in subsection (b)(2)(A)—

"(i) $230,000,000 for each of fiscal years 2020 and 2021; and

"(ii) $150,000,000 for each of fiscal years 2022 through 2024;

"(B) subject to paragraph (2), for activities under the large-scale pilot projects program component described in subsection (b)(2)(B)—

"(i) $347,000,000 for each of fiscal years 2020 and 2021;

"(ii) $272,000,000 for each of fiscal years 2022 and 2023; and

"(iii) $250,000,000 for fiscal year 2024;

"(C) for activities under the demonstration projects program component described in subsection (b)(2)(C)

"(i) $100,000,000 for each of fiscal years 2020 and 2021; and

"(ii) $500,000,000 for each of fiscal years 2022 through 2024; and

"(D) for activities under the front-end engineering and design program described in subsection (b)(2)(D), $50,000,000 for each of fiscal years 2020 through 2023.

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

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

"Sec. 962. Coal and natural gas technology program.".

SEC. 3. CARBON STORAGE VALIDATION AND TESTING.

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

"SEC. 963. CARBON STORAGE VALIDATION AND TESTING.

"(a) DEFINITIONS.—In this section:

"(1) ELECTRIC GENERATION UNIT.—The term 'electric generation unit' means an electric generation unit that—

"(A) uses coal- or natural gas-based generation technology; and

"(B) is capable of capturing carbon dioxide emissions from the unit.

"(2) LARGE-SCALE CARBON SEQUESTRATION.—The term 'large-scale carbon sequestration' means a scale that demonstrates the ability to inject into geologic formations and sequester several million metric tons of carbon dioxide for not less than a 10-year period.

"(3) PROGRAM.—The term 'program' means the program established under subsection (b)(1).

"(b) Carbon Storage Program.—

"(1) IN GENERAL.—The Secretary shall establish a program of research, development, and demonstration for carbon storage.

"(2) PROGRAM ACTIVITIES.—Activities under the program shall include—

"(A) in coordination with relevant Federal agencies, developing and maintaining mapping tools and resources that assess the capacity of geologic storage formation in the United States;

"(B) developing monitoring tools, modeling of geologic formations, and analyses

"(i) to predict carbon dioxide containment; and

"(ii) to account for sequestered carbon dioxide in geologic storage sites;

"(C) researching—

"(i) potential environmental, safety, and health impacts in the event of a leak into the atmosphere or to an aquifer; and

"(ii) any corresponding mitigation actions or responses to limit harmful consequences of such a leak;

"(D) evaluating the interactions of carbon dioxide with formation solids and fluids, including the propensity of injections to induce seismic activity;

"(E) assessing and ensuring the safety of operations relating to geologic sequestration of carbon dioxide;

"(F) determining the fate of carbon dioxide concurrent with and following injection into geologic formations; and

"(G) supporting cost and business model assessments to examine the economic viability of technologies and systems developed under the program.

"(3) GEOLOGIC SETTINGS.—In carrying out research activities under this subsection, the Secretary shall consider a variety of candidate onshore and offshore geologic settings, including—

"(A) operating oil and gas fields;

"(B) depleted oil and gas fields;

"(C) residual oil zones;

"(D) unconventional reservoirs and rock types;

"(E) unmineable coal seams;

"(F) saline formations in both sedimentary and basaltic geologies;

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

"(H) geologic systems containing in situ carbon dioxide mineralization formations.

"(c) LARGE-SCALE CARBON SEQUESTRATION DEMONSTRATION PROGRAM.—

"(1) IN GENERAL.—The Secretary shall establish a demonstration program under which the Secretary shall provide funding for demonstration projects to collect and validate information on the cost and feasibility of commercial deployment of large-scale carbon sequestration technologies.

"(2) EXISTING REGIONAL CARBON SEQUESTRATION PARTNERSHIPS.—In carrying out paragraph (1), the Secretary may provide additional funding to regional carbon sequestration partnerships that are carrying out or have completed a large-scale carbon sequestration demonstration project under this section (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—

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

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

"(C) creates a roadmap for carbon storage research and development activities of the Department through 2025, with the goal of reducing economic and policy barriers to commercial carbon sequestration.

"(d) INTEGRATED STORAGE PROGRAM.

"(1) IN GENERAL.—The Secretary may establish a program to transition large-scale carbon sequestration demonstration projects under subsection (c) into integrated commercial storage complexes.

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

"(A) to identify geologic storage sites that are able to accept large volumes of carbon dioxide acceptable for commercial contracts;

"(B) to understand the technical and commercial viability of carbon dioxide geologic storage sites; and

"(C) to carry out any other activities necessary to transition the large-scale carbon sequestration demonstration projects under subsection (c) into integrated commercial storage complexes.

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

"(f) REPORT ON CARBON DIOXIDE CAPTURE CONTRACTING AUTHORITY.—

"(1) REPORT.—Not later than 180 days 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—

"(A) describes the costs and benefits of entering into long-term binding contracts on behalf of the Federal Government with qualified parties to provide support for capturing carbon 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 the item relating to section 963 and inserting the following:

"Sec.963.Carbon storage validation and testing.".

SEC. 4. CARBON UTILIZATION PROGRAM.

(a) CARBON UTILIZATION PROGRAM.—

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

"SEC. 969. CARBON UTILIZATION PROGRAM.

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

"(1) to assess and monitor—

"(A) potential changes in lifecycle carbon dioxide and other greenhouse gas emissions; and

"(B) other environmental safety indicators of new technologies, practices, processes, or methods used in enhanced hydrocarbon recovery as part of the activities authorized under section 963;

"(2) to identify and assess novel uses for carbon, including the conversion of carbon oxides for commercial and industrial products, such as—

"(A) chemicals;

"(B) plastics;

"(C) building materials;

"(D) fuels;

"(E) cement;

"(F) products of coal use in power systems or other applications; or

"(G) other products with demonstrated market value;

"(3) to identify and assess carbon capture technologies for industrial systems; and

"(4) to identify and assess alternative uses for coal, including products derived from carbon engineering, carbon fiber, and coal conversion methods.

"(b) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the

Secretary to carry out this section—

"(1) $25,000,000 for fiscal year 2020;

"(2) $26,250,000 for fiscal year 2021;

"(3) $27,562,500 for fiscal year 2022;

"(4) $28,940,625 for fiscal year 2023; and

"(5) $30,387,656 for fiscal year 2024.".

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

"Sec. 969. Carbon utilization program.".

(b) STUDY.

(1) IN GENERAL.—The Secretary of Energy shall enter into an agreement with the National Academies of Sciences, Engineering, and Medicine under which the National Academies of Sciences, Engineering, and Medicine shall conduct a

study to assess any barriers and opportunities relating to commercializing carbon dioxide in the United States.

(2) REQUIREMENTS.—The study under paragraph (1) shall—

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

(i) expanding carbon dioxide pipeline capacity;

(ii) mitigating environmental impacts;

(iii) access to capital;

(iv) geographic barriers; and

(v) regional economic challenges and opportunities;

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

(C) assess—

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

(ii) any necessary updates to infrastructure to allow for the integration of safe and reliable carbon dioxide transportation, use, and storage;

(D) describe the economic, climate, and environmental impacts of any well-integrated national carbon dioxide pipeline system, including suggestions for policies that could—

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

(ii) mitigate impacts of the system;

(E) assess the global status and progress of chemical and biological carbon utilization technologies in practice as of the date of the study that utilize anthropogenic carbon, including carbon dioxide, carbon monoxide, methane, and biogas, from power generation, biofuels production, and other industrial processes;

(F) identify emerging technologies and approaches for carbon utilization that show promise for scale-up, demonstration, deployment, and commercialization;

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

(H)(i) assess the major technical challenges associated with increasing the commercial viability of carbon reuse technologies; and

(ii) identify the research and development questions that will address the challenges described in clause (i);

(I)(i) assess research efforts being carried out as of the date of the study, including basic, applied, engineering, and computational research efforts, that are addressing the challenges described in subparagraph (H)(i); and

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

(J) develop a comprehensive research agenda that addresses long- and short-term research needs and opportunities; and

(K)(i) identify appropriate Federal agencies with capabilities to support small business entities; and

(ii) determine what assistance the Federal agencies identified under clause (i) could provide to small business entities to further the development and commercial deployment of carbon dioxide-based products.

(3) DEADLINE.—Not later than 180 days after the date of enactment of this Act, the National Academies of Sciences, Engineering, and Medicine shall submit to the Secretary of Energy a report describing the results of the study under paragraph (1).

SEC. 5. CARBON REMOVAL.

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

"SEC. 969A. CARBON REMOVAL.

"(a) ESTABLISHMENT.—The Secretary, in coordination with the heads of appropriate Federal agencies, including the Secretary of Agriculture, shall establish a research, development, and demonstration program (referred to in this section as the 'program') to tesf, validate, or improve technologies and strategies to remove carbon dioxide from the atmosphere on a large scale.

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

"(1) is cross-cutting in nature; and

"(2) includes the coordinated participation of the Office of Fossil Energy, the Office of Science, and the Office of Energy Efficiency and Renewable Energy.

"(c) PROGRAM ACTIVITIES.—The program may include research, development, and demonstration activities relating to—

"(1) direct air capture and storage technologies;

"(2) bioenergy with carbon capture and sequestration;

"(3) enhanced geological weathering;
"(4) agricultural and grazing practices;
"(5) forest management and afforestation; and
"(6) planned or managed carbon sinks, including natural and artificial.

"(d) REQUIREMENTS.—In developing and identifying carbon removal technologies and strategies under the program, the Secretary shall consider—
"(1) land use changes, including impacts on natural and managed ecosystems;
"(2) ocean acidification;
"(3) net greenhouse gas emissions;
"(4) commercial viability;
"(5) potential for near-term impact;
"(6) potential for carbon reductions on a gigaton scale; and
"(7) economic cobenefits.

"(e) AIR CAPTURE TECHNOLOGY PRIZE COMPETITION.—
"(1) DEFINITIONS.—In this subsection:
"(A) DILUTE MEDIA.—The term 'dilute media' means media in which the concentration of carbon dioxide is less than 1 percent by volume.
"(B) PRIZE COMPETITION.—The term 'prize competition' means the competitive technology prize competition established under paragraph (2).
"(2) ESTABLISHMENT.—Not later than 1 year after the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Secretary, in consultation with the Administrator of the Environmental Protection Agency, shall establish as part of the program a competitive technology prize competition to award prizes for carbon dioxide capture from dilute media.
"(3) REQUIREMENTS.—In carrying out this subsection, the Secretary, in accordance with section 24 of the Stevenson-Wydler Technology Innovation Act of 1980 (15 U.S.C. 3719), shall develop requirements for—
"(A) the prize competition process; and
"(B) monitoring and verification procedures for projects selected to receive a prize under the prize competition.
"(4) ELIGIBLE PROJECTS.—To be eligible to be awarded a prize under the prize competition, a project shall—
"(A) meet minimum performance standards set by the Secretary;
"(B) meet minimum levels set by the Secretary for the capture of carbon dioxide from dilute media; and
"(C) demonstrate in the application of the project for a prize—
"(i) a design for a promising carbon capture technology that will—
"(I) be operated on a demonstration scale; and
"(II) have the potential to achieve significant reduction in the level of carbon dioxide in the atmosphere;
"(ii) a successful bench-scale demonstration of a carbon capture technology; or
"(iii) an operational carbon capture technology on a commercial scale.

"(f) DIRECT AIR CAPTURE TEST CENTER.—
"(1) IN GENERAL.—Not later than 1 year after the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Secretary shall award grants to 1 or more entities for the operation of 1 or more test centers (referred to in this subsection as a 'Center') to provide unique testing capabilities for innovative direct air capture and storage technologies.
"(2) PURPOSE.—Each Center shall—
"(A) advance research, development, demonstration, and commercial application of direct air capture and storage technologies;
"(B) support pilot plant and full-scale demonstration projects and test direct air capture and storage technologies that represent the scale of technology development beyond laboratory testing, but not yet advanced to test under operational conditions at commercial scale;
"(C) develop front-end engineering design and economic analysis; and
"(D) maintain a public record of pilot and full-scale plant performance.
"(3) SELECTION.—
"(A) IN GENERAL.—The Secretary shall select entities to receive grants under this subsection according to such criteria as the Secretary may develop.
"(B) COMPETITIVE BASIS.—The Secretary shall select entities to receive grants under this subsection on a competitive basis.
"(C) PRIORITY CRITERIA.—In selecting entities to receive grants under this subsection, the Secretary shall prioritize applicants that
"(i) have access to existing or planned research facilities for direct air capture and storage technologies;

"(ii) are institutions of higher education with established expertise in engineering for direct air capture and storage technologies, or partnerships with such institutions of higher education; or

"(iii) have access to existing research and test facilities for bulk materials design and testing, component design and testing, or professional engineering design.

"(4) FORMULA FOR AWARDING GRANTS.—The Secretary may develop a formula for awarding grants under this subsection.

"(5) SCHEDULE.—

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

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

"(6) TERMINATION.—To the extent otherwise authorized by law, the Secretary may eliminate, and terminate grant funding under this subsection for, a Center during any 5-year term described in paragraph (5) if the Secretary determines that the Center is underperforming.

"(g) LARGE-SCALE PILOTS AND DEMONSTRATION.—In supporting the technology development activities under this section, the Secretary is encouraged to support carbon removal pilot and demonstration projects, including—

"(1) pilot projects that test direct air capture systems capable of capturing 10 to 100 tonnes of carbon oxides per year to provide data for demonstration-scale projects; and

"(2) direct air capture demonstration projects capable of capturing greater than 1,000 tonnes of carbon oxides per year.

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

"(i) ACCOUNTING.—The Secretary shall collaborate with the Administrator of the Environmental Protection Agency and the heads of other relevant Federal agencies to develop and improve accounting frameworks and tools to accurately measure carbon removal and sequestration methods and technologies across the Federal Government.

"(j) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary to carry out this section—

"(1) $75,000,000 for fiscal year 2020, of which $15,000,000 shall be used to carry out subsection (e);

"(2) $63,500,000 for fiscal year 2021;

"(3) $66,150,000 for fiscal year 2022;

"(4) $69,458,000 for fiscal year 2023; and

"(5) $72,930,000 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) (as amended by section 4(a)(2)) is amended by adding at the end of the items relating to subtitle F of title IX the following:

"Sec. 969A. Carbon removal.".

SEC. 6. FOSSIL ENERGY.

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

(1) in paragraph (6), by inserting ", including technology development to reduce emissions of carbon dioxide and associated emissions of heavy metals within coal combustion residues and gas streams resulting from fossil fuel use and production" before the period at the end; and

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

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

"(8) Developing carbon removal and utilization technologies, products, and methods that result in net reductions in greenhouse gas emissions, including direct air capture and storage, and carbon use and reuse for commercial application.

"(9) Improving the conversion, use, and storage of carbon dioxide produced from fossil fuels.".

PURPOSE

The purpose of S. 1201 is to amend the fossil energy research and development provisions of the Energy Policy Act of 2005 (EPAct 2005, Public Law 109–58) to enhance fossil fuel technology.

BACKGROUND AND NEED

According to a 2019 report by the International Energy Agency, deployment of innovative clean energy technologies is essential to offset the increased greenhouse gas emissions resulting from increased global energy demand. These technologies include carbon capture, utilization, and sequestration (CCUS), a process by which manmade carbon dioxide is captured at its source and is either stored permanently in a geological formation or reused to prevent its release into the atmosphere.

Many facilities across the globe demonstrate the technical and commercial viability of CCUS technologies. In total, there are 18 large-scale CCUS facilities in commercial operation, which are collectively capturing 40 metric tons of carbon dioxide per year, with many more in development. One facility in operation, NRG Energy's 240 megawatt Petra Nova—W.A. Parish Generating Station located near Houston, utilizes post-combustion CCUS technology to capture, condition, and transport emitted flue gas down an 82-mile pipeline to an oil field for enhanced oil recovery. Petra Nova cost a total of approximately $1 billion, $190 million of which came from the Department of Energy (DOE). The facility began operations in January 2017, and within the first 10 months captured more than one million tons of carbon dioxide.

DOE has long supported research, development, demonstration, and deployment of CCUS technologies within the Office of Fossil Energy. DOE's CCUS research and development (R&D) program was originally authorized in EPAct 2005. Specifically, section 962 of EPAct 2005 authorizes a coal and related technologies program, which includes R&D of coal and power systems that utilize CCUS, gasification systems, and other innovative technologies. Section 963 of EPAct 2005 authorizes a 10-year R&D program to capture and store carbon dioxide from new and existing coal-fired power plants.

In order to increase deployment and commercialization of emissions-reducing CCUS technologies, S. 1201, the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019 (EFFECT Act) expands and modernizes DOE's CCUS R&D programs. Specifically, the EFFECT Act replaces section 962 of EPAct 2005 with a broad coal and natural gas technology research, development, demonstration, and commercialization program to improve the efficiency, effectiveness, costs, and environmental performance of coal and natural gas use. It also replaces section 963 of EPAct with a carbon storage validation and testing program to develop commercial storage sites for captured carbon dioxide. It also adds a new section 969 to EPAct 2005 to authorize a carbon utilization program to identify and assess novel uses for carbon, and a new section 969A to develop technologies to remove carbon dioxide directly from the atmosphere on a large scale.

Section 402(i) of EPAct 2005 states that no technology or emissions reduction achieved by any facility receiving financial assistance under sections 962 and 963, as well as any other section of

EPAct 2005, shall be considered adequately demonstrated for purposes of section 111 of the Clean Air Act (CAA) (Public Law 95–95); achievable for purposes of section 169 of the CAA; or achievable in practice for purposes of section 171 of the CAA. Because the EFFECT Act amends EPAct 2005, section 402(i) of EPAct 2005 applies to all technologies or emissions reductions that are achieved by any facility receiving assistance under the EFFECT Act.

LEGISLATIVE HISTORY

S. 1201 was introduced by Senators Manchin, Murkowski, Capito, Cramer, and Daines on April 11, 2019. Senators Jones, Alexander, Hoeven, and Coons were added as cosponsors. The Committee on Energy and Natural Resources held a legislative hearing on S. 1201 on May 16, 2019.

Similar legislation, H.R. 3607, was introduced by Representative Veasey in the House of Representatives on July 10, 2019, and referred to the Science, Space, and Technology Committee.

The Senate Committee on Energy and Natural Resources met in open business session on July 16, 2019, and ordered S. 1201 favorably reported, as amended.

COMMITTEE RECOMMENDATION AND TABULATION OF VOTES

The Senate Committee on Energy and Natural Resources, in open business session on July 16, 2019, by a majority vote of a quorum present, recommends that the Senate pass S. 1201, if amended as described herein.

The roll call vote on reporting the measure was 18 yeas, 2 nays as follows:

YEAS	NAYS
Ms. Murkowski	Mr. Lee
Mr. Barrasso	Mr. Sanders*
Mr. Risch	
Mr. Daines	
Mr. Cassidy	
Mr. Gardner	
Mrs. Hyde-Smith*	
Ms. McSally	
Mr. Alexander*	
Mr. Hoeven	
Mr. Manchin	
Mr. Wyden*	
Ms. Cantwell	
Ms. Stabenow	
Mr. Heinrich	
Ms. Hirono*	
Mr. King	
Ms. Cortez Masto	

* Indicates vote by proxy.

COMMITTEE AMENDMENT

During its consideration of S. 1201, the Committee adopted an amendment in the nature of a substitute. The substitute amendment clarifies that the focus of the coal and natural gas technology

program under section 2(a) should focus on "transformational technologies" (as defined by the bill), and that the goals and objectives of the program should include deployment and commercialization of carbon capture and sequestration technologies as well as their development. It also adds hydrogen production to the carbon utilization technologies that the Secretary should consider in developing the program's goals and objectives.

The substitute amendment also clarifies that the Secretary shall consider both offshore and onshore geologic settings in carrying out the carbon storage validation and testing program established under section 3, and it adds a requirement that the study of barriers and opportunities to commercializing carbon dioxide utilization required under section 4 identify the assistance that Federal agencies could provide to small business to further development and commercial deployment of carbon dioxide-based products.

The substitute amendment adds a new provision to require the Secretary of Energy to award grants to create one or more test centers for research, development, demonstration and commercial application of direct air capture technologies, encourages the Secretary to carry out pilot projects for direct air capture systems, and increases the authorization levels for the carbon removal program established pursuant to section 5. Finally, in section 6, the substitute clarifies that one of the objectives of DOE's fossil energy R&D program is to increase exports of emissions control technologies.

SECTION-BY-SECTION ANALYSIS

Section 1. Short title

Section 1 sets forth the short title.

Sec. 2. Establishment of coal and natural gas technology programs

Section 2 strikes section 962 of EPAct 2005 and adds a new section 962 which directs the Secretary to establish a coal and natural gas technology program to significantly improve the efficiency, effectiveness, costs, and environmental performance of coal and natural gas use. The program includes subprograms for R&D, large-scale pilot projects, demonstration projects, and front-end engineering and design. The program seeks to improve the performance of coal and natural gas-fired power plants and develop technologies to reduce carbon dioxide emissions and other environmental impacts from such plants and industrial facilities. The section is authorized at $727 million in fiscal year (FY) 2020, and $4.3 billion total through FY 2024.

Sec. 3. Carbon storage validation and testing

This section strikes section 963 of EPAct 2005 and adds a new section 963 which directs the Secretary to establish a research, development, and demonstration carbon storage program, a large-scale carbon sequestration demonstration program, and an integrated storage program. The carbon storage program assesses geologic storage capacity in the United States, develops tools to monitor carbon dioxide containment, and supports business model assessments to examine the economic viability of technologies and systems developed under the program. The large-scale carbon se-

questration demonstration program provides funding for demonstration projects on the cost and feasibility of commercial deployment of large-scale carbon sequestration technologies. The integrated storage program transitions a large-scale demonstration project into an integrated commercial storage complex. This section is authorized at $105 million in FY 2020, and about $580 million total through FY 2024.

Sec. 4. Carbon utilization program

This section adds a new section 969 to EPAct 2005 which directs the Secretary to establish a program of research, development, and demonstration for carbon utilization. The purposes of the program are to identify and assess novel uses for carbon, carbon capture technologies for industrial systems, and alternative uses for coal. The program is authorized at $25 million in FY 2020, and about $138 million total through FY 2024. This section also directs DOE to work with the National Academies of Science, Engineering, and Medicine on a study to assess barriers and opportunities related to commercializing carbon dioxide.

Sec. 5. Carbon removal

This section adds a new section 969A to EPAct 2005 to establish a program to develop technologies to remove carbon dioxide from the atmosphere on a large scale. The program includes research, development, and demonstration of direct air capture and storage technologies, bioenergy with carbon capture and sequestration, enhanced geological weathering, agricultural and grazing practices, forest management, and carbon sinks. The program also establishes an air capture technology prize competition, a direct air capture test center, and a direct air capture pilot program. This section is authorized at $75 million in FY 2020, and about $347 million total through FY 2024.

Sec. 6. Fossil energy

This section amends section 961(a) of EPAct 2005 to include the purposes of the EFFECT Act in DOE's fossil energy R&D authorization.

COST AND BUDGETARY CONSIDERATIONS

The Congressional Budget Office estimate of the costs of this measure has been requested but was not received at the time the report was filed. When the Congressional Budget Office completes its cost estimate, it will be posted on the internet at www.cbo.gov.

REGULATORY IMPACT EVALUATION

In compliance with paragraph 11(b) of rule XXVI of the Standing Rules of the Senate, the Committee makes the following evaluation of the regulatory impact which would be incurred in carrying out S. 1201. The bill is not a regulatory measure in the sense of imposing Government-established standards or significant economic responsibilities on private individuals and businesses.

No personal information would be collected in administering the program. Therefore, there would be no impact on personal privacy.

Little, if any, additional paperwork would result from the enactment of S. 1201, as ordered reported.

CONGRESSIONALLY DIRECTED SPENDING

S. 1201, as ordered reported, does not contain any congressionally directed spending items, limited tax benefits, or limited tariff benefits as defined in rule XLIV of the Standing Rules of the Senate.

EXECUTIVE COMMUNICATIONS

The testimony provided by the Department of Energy at the May 16, 2019, hearing on S. 1201 follows:

TESTIMONY OF STEVEN E. WINBERG, ASSISTANT SECRETARY FOR FOSSIL ENERGY, U.S. DEPARTMENT OF ENERGY

Thank you, Chairman Murkowski, Ranking Member Manchin, and Members of the Committee. I appreciate the opportunity to be here today, and it is my pleasure to appear before you to discuss how the Department of Energy (DOE) is advancing an important part of DOE's Fossil Energy (FE) research and development (R&D) portfolio—the commercial deployment of carbon capture, utilization, and storage (CCUS) technologies. With the Committee's ongoing support, we are backing up our commitment to CCUS with the R&D necessary to advance these technologies, improve our environmental footprint, and advance U.S. world leadership in this critical area.

With respect to S. 1201, the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Administration is currently reviewing this legislation and no position has been taken on this bill. S. 1201 directs the Department of Energy to support four programs focused on fossil energy R&D and carbon capture, utilization, and storage:

- A Coal and Natural Gas Technology Program to support large-scale pilot projects, demonstration projects, and the "development of technologies to improve the efficiency, effectiveness, costs, and environmental performance of coal and natural gas use."
- A Carbon Storage Validation and Testing Program to conduct research, development, and demonstration projects for carbon storage and establish a large-scale carbon sequestration demonstration program, with the possibility of transitioning to an integrated commercial storage complex.
- A Carbon Utilization Program to identify and assess novel uses for carbon, carbon capture technologies for industrial systems, and alternative uses for coal.
- A Carbon Removal Program for technologies and strategies to remove atmospheric carbon dioxide on a large scale.

As always, the Administration is ready to provide technical assistance as needed on this legislation moving forward.

All informed experts agree, commercializing and deploying CCUS technologies is a realistic path to reducing CO2 emissions on a large scale. An integral piece to "jumpstart" this deployment is financial incentives, such as section 45Q of the Internal Revenue Service code, which provides a tax credit on a per-ton (metric) basis for storing or utilizing captured CO2. DOE is currently working with the Internal Revenue Service, the Department of the Treasury, the Department of the Interior, and the Environmental Protection Agency to resolve uncertainties regarding implementation.

FE's robust CCUS R&D program has produced some impressive successes, but technical hurdles to commercializing these technologies remain. The most significant hurdle is the cost associated with carbon capture, which needs to be reduced by about 50 percent to $30 a metric ton by 2030 to be competitive with alternative energy sources. That is a challenging goal, and we have made great progress by exploring early-stage R&D on advanced technologies that have the potential to reach our cost reduction goals.

Over the last four decades, DOE has demonstrated a proven track record in significantly reducing emissions from fossil fuel combustion, resulting in a cleaner environment for all Americans. The technologies developed through this R&D program are not only applicable to coal and natural gas-fired power plants, but can also be used with industrial sources such as refineries and steel, cement, chemical and ethanol plants. These technologies can be used to capture CO2 directly from the atmosphere.

Funding provided by Congress through FE has resulted in commercial operation of the world's three largest CCUS demonstration projects in their respective industrial sectors (Petra Nova, Air Products, and Archer Daniels Midland). In total, these projects have captured, utilized, and stored almost 9 million metric tons of CO2.

- Petra Nova: Retrofitted onto the existing W.A. Parish coal-fired unit 8, the 240-megawatt Petra Nova project near Houston, Texas, captures approximately 90 percent of the CO2 from the unit's flue stream and permanently stores about 1.4 million metric tons of CO2 per year for EOR in a depleted oil field approximately 80 miles away. As of March 2019, Petra Nova has captured and sent for storage over 2.4 million metric tons of CO2, and West Ranch Oil Field has produced over 2.8 million barrels of oil through EOR.
- Air Products: The Air Products and Chemicals project at a petroleum refining facility in Port Arthur, Texas, captures over 90 percent of the CO2 produced from the two steam methane reformers for hydrogen production. Air Products has successfully captured and stored over 5 million metric tons of CO2 for EOR.
- Archer Daniels Midland: The Archer Daniels Midland Company project near Decatur, Illinois, demonstrates an integrated system for capturing CO2

from an ethanol production plant and geologically sequestering it in the Mount Simon Sandstone formation—one of the largest saline reservoirs in the world for CO2 storage. As of April 2019, 1.2 million metric tons of CO2 have been injected into the Mount Simon Sandstone.

DOE's FY 2020 budget represents a purposeful shift away from later-stage R&D such as development and scale-up of 2nd generation capture technologies to prioritize early-stage research and development to reflect the proper role of the Federal Government. Industry is better positioned to make decisions on what technologies can be commercialized and how to develop and scale these technologies for cost-competitive deployment.

One important element of FE's R&D effort is Direct Air Capture (DAC). FE was one of the cofunders of the recent National Academy of Sciences (NAS) report on developing a research agenda for negative emissions technologies, which included DAC. The focus of DAC R&D is on improving capture efficiency, reducing energy and capital costs (current cost estimates range between $200–$800/ton CO2), and decreasing water resource demands. FE is conducting technoeconomic analyses to establish a cost baseline for DAC technologies, and is funding exploratory research studies in this area. FE currently has three DAC R&D projects with:

1. Ohio State University—"Novel Carbon Dioxide (CO2)—Selective Membranes for CO2 Capture from less than 1% CO2 Sources";

2. Carbon Engineering, Ltd.—"Dilute Source Carbon Dioxide (CO2) Capture: Management of Atmospheric Coal-Produced Legacy Emissions"; and

3. InnoSepra, LLC—"Process for CO2 Capture from Low Concentration Sources."

DAC technologies (e.g., advanced sorbents, membranes, and solvents) are built upon FE's R&D and are adapted to address issues specific to DAC, such as accelerating reaction kinetics. Existing resources in the FE program can be leveraged to develop new materials and design processes specific to DAC, optimize DAC performance using advanced supercomputers, and validate laboratory R&D through pilot-scale testing. FE takes a holistic approach to DAC specific R&D by developing the technologies, system(s), logistics, and cost reductions to make DAC implementation a reality. Further, FE recognizes the important role that stakeholders play in this area and is planning a workshop later this year to strengthen that engagement. Low concentrations of CO2 associated with DAC create unique challenges, but FE's 19-plus years of CO2 capture expertise will help commercialize DAC.

In addition to DAC R&D, FE is also investigating ways to extract an economic benefit, or additional value, from the captured CO2 through the development of products and services. For example, FE is working on CO2 utilization as a feedstock for commonly used chemicals such as

methanol, synthetic fuels, and baking soda, as well as advanced materials like improved concrete and carbon fiber. While EOR is the most near-term application of CO2, the development of these advanced materials offers opportunities to monetize the captured CO2 and drive domestic innovation.

In the area of Carbon Storage, DOE's goal is to better see the subsurface to improve site selection for geologic storage of CO2; improve CO2 storage and utilization efficiency for enhanced oil recovery; and increase the certainty of secure containment and environmental protection. Previous investments in an initiative called the Regional Carbon Sequestration Partnerships identified CO2 sources and sinks on a regional basis throughout the country and conducted large-scale injection projects. This resulted in over 10 million metric tons of CO2 stored. The work from this effort has been captured in Best Practice Manuals to disseminate that knowledge to industry partners.

Since 2016 DOE has invested over $70 million in the CarbonSAFE initiative, which builds on findings from pilot and field demonstration projects to advance site selection and storage operations at commercial-scale. There are currently six active CarbonSAFE projects regionally distributed throughout the US to determine the feasibility for commercial-scale storage complexes that can store greater than 50 million metric tons of CO2.

We appreciate the Committee's interest, support, and commitment to providing DOE with the tools necessary to advance CCUS technologies, and I look forward to answering any questions you may have.

Thank you.

CHANGES IN EXISTING LAW

In compliance with paragraph 12 of rule XXVI of the Standing Rules of the Senate, the changes in existing law made by S. 1201, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

ENERGY POLICY ACT OF 2005

Public Law 109–58, as Amended

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SECTION 1. SHORT TITLE; TABLE OF CONTENTS

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TITLE IX—RESEARCH AND DEVELOPMENT

* * * * * * *

Subtitle F—Fossil Energy

Sec. 961. Fossil energy.

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SEC. 961. FOSSIL ENERGY

(a) IN GENERAL.—The Secretary shall carry out research, development, demonstration, and commercial application programs in fossil energy, including activities under this part, with the goal of improving the efficiency, effectiveness, and environmental performance of fossil energy production, upgrading, conversion, and consumption. Such programs take into consideration the following objectives:

(1) Increasing the energy conversion efficiency of all forms of fossil energy through improved technologies.

(2) Decreasing the cost of all fossil energy production, generation, and delivery.

(3) Promoting diversity of energy supply.

(4) Decreasing the dependence of the United States on foreign energy supplies.

(5) Improving United States energy security.

(6) Decreasing the environmental impact of energy-related activities, *including technology development to reduce emissions of carbon dioxide and associated emissions of heavy metals within coal combustion residues and gas streams resulting from fossil fuel use and production.*

[(7) Increasing the export of fossil energy-related equipment, technology, and services from the United States.]

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

(8) Developing carbon removal and utilization technologies, products, and methods that result in net reductions in greenhouse gas emissions, including direct air capture and storage, and carbon use and reuse for commercial application.

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

* * * * * * *

[SEC. 962. COAL AND RELATED TECHNOLOGIES PROGRAM

[(a) IN GENERAL.—In addition to the programs authorized under subchapter IV, the Secretary shall conduct a program of technology research, development, demonstration, and commercial application for coal and power systems, including programs to facilitate production and generation of coal-based power through—

[(1) innovations for existing plants (including mercury removal);

[(2) gasification systems;

[(3) advanced combustion systems;

[(4) turbines for synthesis gas derived from coal;

[(5) carbon capture and sequestration research and development;

[(6) coal-derived chemicals and transportation fuels;

[(7) liquid fuels derived from low rank coal water slurry;

[(8) solid fuels and feedstocks;

[(9) advanced coal-related research;

[(10) advanced separation technologies; and

[(11) fuel cells for the operation of synthesis gas derived from coal.

[(b) COST AND PERFORMANCE GOALS.—

(1) IN GENERAL.—In carrying out programs authorized by this section, during each of calendar years 2008, 2010, 2012, and 2016, and during each fiscal year beginning after September 30, 2021, the Secretary shall identify cost and performance goals for coal-based technologies that would permit the continued cost-competitive use of coal for the production of electricity, chemical feedstocks, and transportation fuels.

(2) ADMINISTRATION.—In establishing the cost and performance goals, the Secretary shall—

[(A) consider activities and studies undertaken as of August 8, 2005, by industry in cooperation with the Department in support of the identification of the goals;

[(B) consult with interested entities, including—

[(i) coal producers;

[(ii) industries using coal;

[(iii) organizations that promote coal and advanced coal technologies;

[(iv) environmental organizations;

[(v) organizations representing workers; and

[(vi) organizations representing consumers;

[(C) not later than 120 days after August 8, 2005, publish in the Federal Register proposed draft cost and performance goals for public comments; and

[(D) not later than 180 days after August 8, 2005, and every 4 years thereafter, submit to Congress a report describing the final cost and performance goals for the technologies that includes—

[(i) a list of technical milestones; and

[(ii) an explanation of how programs authorized in this section will not duplicate the activities authorized under the Clean Coal Power Initiative authorized under subchapter IV.

[(c) POWDER RIVER BASIN AND FORT UNION LIGNITE COAL MERCURY REMOVAL.—

[(1) IN GENERAL.—In addition to the programs authorized by subsection (a), the Secretary shall establish a program to test and develop technologies to control and remove mercury emissions from subbituminous coal mined in the Powder River Basin, and Fort Union lignite coals, that are used for the generation of electricity.

[(2) EFFICACY OF MERCURY REMOVAL TECHNOLOGY.—In carrying out the program under paragraph (1), the Secretary shall examine the efficacy of mercury removal technologies on coals

described in that paragraph that are blended with other types of coal.

[(d) FUEL CELLS.—

[(1) IN GENERAL.—The Secretary shall conduct a program of research, development, demonstration, and commercial application on fuel cells for low-cost, high-efficiency, fuel-flexible, modular power systems.

[(2) DEMONSTRATIONS.—The demonstrations referred to in paragraph (1) shall include solid oxide fuel cell technology for commercial, residential, and transportation applications, and distributed generation systems, using improved manufacturing production and processes.]

SEC. 962. COAL AND NATURAL GAS TECHNOLOGY PROGRAM.

(a) DEFINITIONS.—In this section:

(1) LARGE-SCALE PILOT PROJECT.—The term 'large-scale pilot project' means a pilot project that—

(A) represents the scale of technology development beyond laboratory development and bench scale testing, but not yet advanced to the point of being tested under real operational conditions at commercial scale;

(B) represents the scale of technology necessary to gain the operational data needed to understand the technical and performance risks of the technology before the application of that technology at commercial scale or in commercial-scale demonstration; and

(C) is large enough—

(i) to validate scaling factors; and

(ii) to demonstrate the interaction between major components so that control philosophies for a new process can be developed and enable the technology to advance from large-scale pilot plant application to commercial-scale demonstration or application.

(2) NET-NEGATIVE CARBON DIOXIDE EMISSIONS TECHNOLOGY.—The term 'net-negative carbon dioxide emissions technology' means technology—

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

(i) uses a carbon capture system; and

(ii) with carbon dioxide removal, the Secretary determines can provide electricity, fuels, or chemicals with net-negative carbon dioxide emissions from production and consumption of the end products, while removing atmospheric carbon dioxide; and

(B) through which each use of coal will be combined with the use 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—

(I) advanced combustion systems, including oxygen combustion systems and chemical looping; and

(II) the replacement of steam cycles with supercritical carbon dioxide cycles;

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

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

(iv) improvements in small-scale and modular coal-fired technologies with reduced carbon output or carbon capture that can support incremental power generation capacity additions;

(v) fuel cell technologies for low-cost, high-efficiency modular power systems;

(vi) advanced gasification systems;

(vii) thermal cycling technologies; and

(viii) any other technology the Secretary recognizes as transformational technology.

(b) COAL AND NATURAL GAS TECHNOLOGY PROGRAM.—

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

(2) REQUIREMENTS.—The program shall include—

(A) a research and development program;

(B) large-scale pilot projects;

(C) demonstration projects; and

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

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

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

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

(ii) achieving high conversion efficiencies;

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

(iv) developing small-scale and modular technologies to support incremental capacity additions and load fol-

lowing generation, in addition to large-scale generation technologies;

(v) supporting dispatchable operations for new and existing applications of coal and natural gas generation; and

(vi) accelerating the development of technologies that have transformational energy conversion characteristics.

(B) Using carbon capture, utilization, and sequestration technologies to decrease the carbon dioxide emissions, and the environmental impact from carbon dioxide emissions, from new and existing coal and natural gas plants, including by—

(i) accelerating the development, deployment, and commercialization of technologies to capture and sequester carbon dioxide emissions from new and existing coal and natural gas plants;

(ii) supporting sites for safe geological storage of large volumes of anthropogenic sources of carbon dioxide and the development of the infrastructure needed to support a carbon dioxide utilization and storage industry;

(iii) improving the conversion, utilization, and storage of carbon dioxide produced from fossil fuels and other anthropogenic sources of carbon dioxide;

(iv) lowering greenhouse gas emissions for all fossil fuel production, generation, delivery, and use, to the maximum extent practicable;

(v) developing carbon utilization technologies, products, and methods, including carbon use and reuse for commercial application; and

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

(C) Decreasing the non-carbon dioxide relevant environmental impacts of coal and natural gas production, including by—

(i) further reducing non-carbon dioxide air emissions; and

(ii) reducing the use, and managing the discharge, of water in power plant operations.

(D) Accelerating the development of technologies to capture carbon dioxide emissions from industrial facilities, including—

(i) nontraditional fuel manufacturing facilities, including ethanol or other biofuel production plants or hydrogen production plants; and

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

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

(4) CROSS-CUTTING DIRECTION FOR CARBON CAPTURE, UTILIZATION, AND SEQUESTRATION ACTIVITIES.—The carbon capture, utilization, and sequestration activities described in paragraph (3)(B) shall be—

(A) cross-cutting in nature; and

(B) carried out by the Assistant Secretary for Fossil Energy, in coordination with the heads of other relevant offices of the Department, including the Director of the Office of Science and the Assistant Secretary for Energy Efficiency and Renewable Energy.

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

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

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

(C) consult with interested entities, including—

(i) coal and natural gas producers;

(ii) industries that use coal and natural gas;

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

(iv) environmental organizations;

(v) organizations representing workers; and

(vi) organizations representing consumers.

(c) REPORT.—

(1) IN GENERAL.—Not later than 18 months after the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Secretary shall submit to Congress a report describing the program goals and objectives adopted under subsection (b)(3).

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

(d) FUNDING.—

(1) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to the Secretary to carry out this section, to remain available until expended—

(A) for activities under the research and development program component described in subsection (b)(2)(A)—

(i) $230,000,000 for each of fiscal years 2020 and 2021; and

(ii) $150,000,000 for each of fiscal years 2022 through 2024;

(B) subject to paragraph (2), for activities under the large-scale pilot projects program component described in subsection (b)(2)(B)—

(i) $347,000,000 for each of fiscal years 2020 and 2021;

(ii) $272,000,000 for each of fiscal years 2022 and 2023; and

(iii) $250,000,000 for fiscal year 2024;

(C) for activities under the demonstration projects program component described in subsection (b)(2)(C)—

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

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

(D) for activities under the front-end engineering and design program described in subsection (b)(2)(D), $50,000,000 for each of fiscal years 2020 through 2023.

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

[SEC. 963. CARBON CAPTURE RESEARCH AND DEVELOPMENT PROGRAM

[(a) IN GENERAL.— The Secretary shall carry out a 10-year carbon capture and sequestration research, development, and demonstration program to develop carbon dioxide capture and sequestration technologies related to industrial sources of carbon dioxide for use

[(1) in new coal utilization facilities; and

[(2) on the fleet of coal-based units in existence on August 8, 2005.

[(b) OBJECTIVES.—The objectives of the program under subsection (a) shall be—

[(1) to develop carbon dioxide capture technologies, including adsorption and absorption techniques and chemical processes, to remove the carbon dioxide from gas streams containing carbon dioxide potentially amenable to sequestration;

[(2) to develop technologies that would directly produce concentrated streams of carbon dioxide potentially amenable to sequestration;

[(3) to increase the efficiency of the overall system to reduce the quantity of carbon dioxide emissions released from the system per megawatt generated;

[(4) in accordance with the carbon dioxide capture program, to promote a robust carbon sequestration program and continue the work of the Department, in conjunction with the private sector, through regional carbon sequestration partnerships; and

[(5) to expedite and carry out large-scale testing of carbon sequestration systems in a range of geologic formations that will provide information on the cost and feasibility of deployment of sequestration technologies.

[(c) PROGRAMMATIC ACTIVITIES.—

[(1) Fundamental science and engineering research and development and demonstration supporting carbon capture and sequestration technologies and carbon use activities

[(A) IN GENERAL.—The Secretary shall carry out fundamental science and engineering research (including laboratory-scale experiments, numeric modeling, and simulations) to develop and document the performance of new approaches to capture and sequester, or use carbon dioxide to lead to an overall reduction of carbon dioxide emissions.

[(B) PROGRAM INTEGRATION.—The Secretary shall ensure that fundamental research carried out under this paragraph is appropriately applied to energy technology development activities, the field testing of carbon sequestration, and carbon use activities, including—

[(i) development of new or advanced technologies for the capture and sequestration of carbon dioxide;

[(ii) development of new or advanced technologies that reduce the cost and increase the efficacy of advanced compression of carbon dioxide required for the sequestration of carbon dioxide;

[(iii) modeling and simulation of geologic sequestration field demonstrations;

[(iv) quantitative assessment of risks relating to specific field sites for testing of sequestration technologies;

[(v) research and development of new and advanced technologies for carbon use, including recycling and reuse of carbon dioxide; and

[(vi) research and development of new and advanced technologies for the separation of oxygen from air.

[(2) FIELD VALIDATION TESTING ACTIVITIES.—

[(A) IN GENERAL.—The Secretary shall promote, to the maximum extent practicable, regional carbon sequestration partnerships to conduct geologic sequestration tests involving carbon dioxide injection and monitoring, mitigation, and verification operations in a variety of candidate geologic settings, including—

[(i) operating oil and gas fields;

[(ii) depleted oil and gas fields;

[(iii) unmineable coal seams;

[(iv) deep saline formations;

[(v) deep geologic systems that may be used as engineered reservoirs to extract economical quantities of heat from geothermal resources of low permeability or porosity; and

[(vi) deep geologic systems containing basalt formations.

[(B) OBJECTIVES.—The objectives of tests conducted under this paragraph shall be—

[(i) to develop and validate geophysical tools, analysis, and modeling to monitor, predict, and verify carbon dioxide containment;

[(ii) to validate modeling of geologic formations;

[(iii) to refine sequestration capacity estimated for particular geologic formations;

[(iv) to determine the fate of carbon dioxide concurrent with and following injection into geologic formations;

[(v) to develop and implement best practices for operations relating to, and monitoring of, carbon dioxide injection and sequestration in geologic formations;

[(vi) to assess and ensure the safety of operations related to geologic sequestration of carbon dioxide;

[(vii) to allow the Secretary to promulgate policies, procedures, requirements, and guidance to ensure that the objectives of this subparagraph are met in large-scale testing and deployment activities for carbon capture and sequestration that are funded by the Department of Energy; and

[(viii) to provide information to States, the Environmental Protection Agency, and other appropriate entities to support development of a regulatory framework for commercial-scale sequestration operations that ensure the protection of human health and the environment.

[(3) LARGE-SCALE CARBON DIOXIDE SEQUESTRATION TESTING.—

[(A) IN GENERAL.—The Secretary shall conduct not less than 7 initial large-scale sequestration tests, not including the FutureGen project, for geologic containment of carbon dioxide to collect and validate information on the cost and feasibility of commercial deployment of technologies for geologic containment of carbon dioxide. These 7 tests may include any Regional Partnership projects awarded as of December 19, 2007.

[(B) DIVERSITY OF FORMATIONS TO BE STUDIED.—In selecting formations for study under this paragraph, the Secretary shall consider a variety of geologic formations across the United States, and require characterization and modeling of candidate formations, as determined by the Secretary.

[(C) SOURCE OF CARBON DIOXIDE FOR LARGE-SCALE SEQUESTRATION TESTS.—In the process of any acquisition of carbon dioxide for sequestration tests under subparagraph (A), the Secretary shall give preference to sources of carbon dioxide from industrial sources. To the extent feasible, the Secretary shall prefer tests that would facilitate the creation of an integrated system of capture, transportation and sequestration of carbon dioxide. The preference provided for under this subparagraph shall not delay the implementation of the large-scale sequestration tests under this paragraph.

[(D) DEFINITION.—For purposes of this paragraph, the term "large-scale" means the injection of more than 1,000,000 tons of carbon dioxide from industrial sources annually or a scale that demonstrates the ability to inject and sequester several million metric tons of industrial source carbon dioxide for a large number of years.

[(4) PREFERENCE IN PROJECT SELECTION FROM MERITORIOUS PROPOSALS.—In making competitive awards under this subsection, subject to the requirements of section 16353 of this title, the Secretary shall—

[(A) give preference to proposals from partnerships among industrial, academic, and government entities; and

[(B) require recipients to provide assurances that all laborers and mechanics employed by contractors and subcontractors in the construction, repair, or alteration of new or existing facilities performed in order to carry out a demonstration or commercial application activity authorized under this subsection shall be paid wages at rates not less than those prevailing on similar construction in the locality, as determined by the Secretary of Labor in accordance with subchapter IV of chapter 31 of title 40, and the Secretary of Labor shall, with respect to the labor standards

in this paragraph, have the authority and functions set forth in Reorganization Plan Numbered 14 of 1950 (15 Fed. Reg. 3176; 5 U.S.C. Appendix) and section 3145 of title 40.

[(5) COST SHARING.—Activities under this subsection shall be considered research and development activities that are subject to the cost sharing requirements of section 16352(b) of this title.

[(6) PROGRAM REVIEW AND REPORT.—During fiscal year 2011, the Secretary shall—

[(A) conduct a review of programmatic activities carried out under this subsection; and

[(B) make recommendations with respect to continuation of the activities.

[(d) AUTHORIZATION OF APPROPRIATIONS.—There are authorized to be appropriated to carry out this section—

[(1) $240,000,000 for fiscal year 2008;

[(2) $240,000,000 for fiscal year 2009;

[(3) $240,000,000 for fiscal year 2010;

[(4) $240,000,000 for fiscal year 2011; and

[(5) $240,000,000 for fiscal year 2012.]

SEC. 963. CARBON STORAGE VALIDATION AND TESTING.

(a) DEFINITIONS.—In this section:

(1) ELECTRIC GENERATION UNIT.—The term "electric generation unit" means an electric generation unit that—

(A) uses coal- or natural gas-based generation technology; and

(B) is capable of capturing carbon dioxide emissions from the unit.

(2) LARGE–SCALE CARBON SEQUESTRATION.—The term "large-scale carbon sequestration" means a scale that demonstrates the ability to inject into geologic formations and sequester several million metric tons of carbon dioxide for not less than a 10-year period.

(3) PROGRAM.—The term "program" means the program established under subsection (b)(1).

(b) CARBON STORAGE PROGRAM.—

(1) IN GENERAL.—The Secretary shall establish a program of research, development, and demonstration for carbon storage.

(2) PROGRAM ACTIVITIES.—Activities under the program shall include—

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

(B) developing monitoring tools, modeling of geologic formations, and analyses—

(i) to predict carbon dioxide containment; and

(ii) to account for sequestered carbon dioxide in geologic storage sites;

(C) researching—

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

(ii) any corresponding mitigation actions or responses to limit harmful consequences of such a leak;

(D) evaluating the interactions of carbon dioxide with formation solids and fluids, including the propensity of injections to induce seismic activity;

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

(F) determining the fate of carbon dioxide concurrent with and following injection into geologic formations; and

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

(3) GEOLOGIC SETTINGS.—In carrying out research activities under this subsection, the Secretary shall consider a variety of candidate onshore and offshore geologic settings, including—

(A) operating oil and gas fields;

(B) depleted oil and gas fields;

(C) residual oil zones;

(D) unconventional reservoirs and rock types;

(E) unmineable coal seams;

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

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

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

(c) LARGE-SCALE CARBON SEQUESTRATION DEMONSTRATION PROGRAM.—

(1) IN GENERAL.—The Secretary shall establish a demonstration program under which the Secretary shall provide funding for demonstration projects to collect and validate information on the cost and feasibility of commercial deployment of large-scale carbon sequestration technologies.

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

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

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

(C) creates a roadmap for carbon storage research and development activities of the Department through 2025, with the goal of reducing economic and policy barriers to commercial carbon sequestration.

(d) INTEGRATED STORAGE PROGRAM.—

(1) IN GENERAL.—The Secretary may establish a program to transition large-scale carbon sequestration demonstration projects under subsection (c) into integrated commercial storage complexes.

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

(A) to identify geologic storage sites that are able to accept large volumes of carbon dioxide acceptable for commercial contracts;

(B) to understand the technical and commercial viability of carbon dioxide geologic storage sites; and

(C) to carry out any other activities necessary to transition the large-scale carbon sequestration demonstration projects under subsection (c) into integrated commercial storage complexes.

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

(f) REPORT ON CARBON DIOXIDE CAPTURE CONTRACTING AUTHORITY.—

(1) REPORT.—Not later than 180 days 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—

(A) describes the costs and benefits of entering into long-term binding contracts on behalf of the Federal Government with qualified parties to provide support for capturing carbon 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.

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SEC. 969. CARBON UTILIZATION PROGRAM.

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

(1) to assess and monitor—

(A) potential changes in lifecycle carbon dioxide and other greenhouse gas emissions; and

(B) other environmental safety indicators of new technologies, practices, processes, or methods used in enhanced hydrocarbon recovery as part of the activities authorized under section 963;

(2) to identify and assess novel uses for carbon, including the conversion of carbon oxides for commercial and industrial products, such as—

(A) chemicals;
(B) plastics;
(C) building materials;
(D) fuels;
(E) cement;

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

(G) other products with demonstrated market value;

(3) to identify and assess carbon capture technologies for industrial systems; and

(4) to identify and assess alternative uses for coal, including products derived from carbon engineering, carbon fiber, and coal conversion methods.

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

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

SEC. 969A. CARBON REMOVAL.

(a) ESTABLISHMENT.—The Secretary, in coordination with the heads of appropriate Federal agencies, including the Secretary of Agriculture, shall establish a research, development, and demonstration program (referred to in this section as the 'program') to test, validate, or improve technologies and strategies to remove carbon dioxide from the atmosphere on a large scale.

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

(1) is cross-cutting in nature; and

(2) includes the coordinated participation of the Office of Fossil Energy, the Office of Science, and the Office of Energy Efficiency and Renewable Energy.

(c) PROGRAM ACTIVITIES.—The program may include research, development, and demonstration activities relating to—

(1) direct air capture and storage technologies;

(2) bioenergy with carbon capture and sequestration;

(3) enhanced geological weathering;

(4) agricultural and grazing practices;

(5) forest management and afforestation; and

(6) planned or managed carbon sinks, including natural and artificial.

(d) REQUIREMENTS.—In developing and identifying carbon removal technologies and strategies under the program, the Secretary shall consider—

(1) land use changes, including impacts on natural and managed ecosystems;

(2) ocean acidification;

(3) net greenhouse gas emissions;

(4) commercial viability;

(5) potential for near-term impact;

(6) potential for carbon reductions on a gigaton scale; and

(7) economic cobenefits.

(e) AIR CAPTURE TECHNOLOGY PRIZE COMPETITION.—

(1) DEFINITIONS.—In this subsection:

(A) DILUTE MEDIA.—The term 'dilute media' means media in which the concentration of carbon dioxide is less than 1 percent by volume.

(B) PRIZE COMPETITION.—The term 'prize competition' means the competitive technology prize competition established under paragraph (2).

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

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

(A) the prize competition process; and

(B) monitoring and verification procedures for projects selected to receive a prize under the prize competition.

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

(A) meet minimum performance standards set by the Secretary;

(B) meet minimum levels set by the Secretary for the capture of carbon dioxide from dilute media; and

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

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

(I) be operated on a demonstration scale; and

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

(ii) a successful bench-scale demonstration of a carbon capture technology; or

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

(f) DIRECT AIR CAPTURE TEST CENTER.—

(1) IN GENERAL.—Not later than 1 year after the date of enactment of the Enhancing Fossil Fuel Energy Carbon Technology Act of 2019, the Secretary shall award grants to 1 or more entities for the operation of 1 or more test centers (referred to in this subsection as a 'Center') to provide unique testing capabilities for innovative direct air capture and storage technologies.

(2) PURPOSE.—Each Center shall—

(A) advance research, development, demonstration, and commercial application of direct air capture and storage technologies;

(B) support pilot plant and full-scale demonstration projects and test direct air capture and storage technologies that represent the scale of technology development beyond laboratory testing, but not yet advanced to test under operational conditions at commercial scale;

(C) develop front-end engineering design and economic analysis; and

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

(3) SELECTION.

(A) IN GENERAL.—The Secretary shall select entities to receive grants under this subsection according to such criteria as the Secretary may develop.

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

(C) PRIORITY CRITERIA.—In selecting entities to receive grants under this subsection, the Secretary shall prioritize applicants that—

(i) have access to existing or planned research facilities for direct air capture and storage technologies;

(ii) are institutions of higher education with established expertise in engineering for direct air capture and storage technologies, or partnerships with such institutions of higher education; or

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

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

(5) SCHEDULE.—

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

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

(6) TERMINATION.—To the extent otherwise authorized by law, the Secretary may eliminate, and terminate grant funding under this subsection for, a Center during any 5-year term described in paragraph (5) if the Secretary determines that the Center is underperforming.

(g) LARGE-SCALE PILOTS AND DEMONSTRATION.—In supporting the technology development activities under this section, the Secretary is encouraged to support carbon removal pilot and demonstration projects, including—

(1) pilot projects that test direct air capture systems capable of capturing 10 to 100 tonnes of carbon oxides per year to provide data for demonstration-scale projects; and

(2) direct air capture demonstration projects capable of capturing greater than 1,000 tonnes of carbon oxides per year.

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

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

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

(1) $75,000,000 for fiscal year 2020, of which $15,000,000 shall be used to carry out subsection (e);

(2) $63,500,000 for fiscal year 2021;

(3) $66,150,000 for fiscal year 2022;

(4) $69,458,000 for fiscal year 2023; and

(5) $72,930,000 for fiscal year 2024.

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