

Consolidated Appropriations Act of 2021: Energy Financial Incentives

President Biden has announced ambitious energy and environmental goals in an effort to combat the effects of climate change. Many of the president's goals hinge on increasing support for alternative forms of energy production, increased use of low or zero emissions vehicles and fuels, as well as investment in and deployment of carbon reduction technologies, such as carbon capture and storage ("CCS"). While it remains to be seen what the new administration may seek from Congress in terms of further legislative support, the appropriations and stimulus act passed by Congress and signed into law by the prior administration at the end of 2020 lays the groundwork for the Biden administration, through the Department of Energy, to provide financial support for and form partnerships with the private sector to help meet the administration's climate goals.

The Energy Act of 2020, Division Z of the Consolidated Appropriations Act of 2021, contains a number of provisions intended to modify the Energy Policy Act of 2005 and set forth Congress's agenda to pursue the aggressive development of renewable and low-carbon energy technologies. The Energy Act of 2020 also provides for federal financial support measures in the form of grants and prize competitions to incentivize the development of technologies for carbon management and carbon removal. These programs are a departure from many federal programs to support the development of low-carbon technologies in the past, because the legislation is more focused on the establishment of grants and federal cost-share programs, eschewing the loan guarantee programs that became controversial during the Obama administration.

As V&E has discussed [elsewhere](#), the broader 2021 appropriations bill — of which the Energy Act of 2020 is just a small part — contains a number of significant revisions to tax incentives that are intended to provide continued support to renewables and carbon capture and storage CCS.¹ In particular, Division EE of the Consolidated Appropriations Act of 2021 provided (i) a two-year extension of the investment tax credit ("ITC") at the 26% rate, (ii) a one-year extension of the production tax credit ("PTC") at the 60% PTC rate and election to take the ITC in-lieu-of PTC, and (iii) two-year extension of the residential energy tax credit. It also adds an election (effective retroactively to January 1, 2017) for taxpayers to elect to treat a qualified offshore wind facility as energy property eligible for the ITC. This election is not subject to the rate phaseout otherwise applicable to wind facilities, meaning that taxpayers are eligible for the full 30% ITC if construction of a qualified offshore wind facility begins before January 1, 2026. In addition, the legislation provides a two-year extension of the section 45Q carbon oxide sequestration tax credit. As such, the section 45Q carbon oxide sequestration tax credit — which is a tax credit for qualified carbon oxide captured at a qualified facility during the 12-year period after the facility is placed into service — is available for any qualified facilities the construction of which begins before January 1, 2026.

While many hoped that this legislation would include provisions for direct payments in lieu of tax credits, ultimately Congress chose not to allow for such payments. Notably, while the legislation offers billions in financial incentives to support CCS projects, each individual CCS project eligible for funds will only receive a small fraction of the totals identified in the table below.

Past CCS projects have cost billions of dollars and been subject to significant overruns and delays. For example, the Kemper County coal-fired power plant project located in Mississippi was originally estimated to cost \$2.2 billion but ultimately cost approximately \$7.5 billion; a second example is the Texas Clean Energy Project, which was originally estimated at \$1.98 billion, now has a total project cost estimated at \$3.98 billion and has had to contend with withdrawal of Department of Energy funding. Retrofitting of facilities with CCS technology also comes with a large price tag: the Petra Nova Parish Generating Station in Texas received funding of \$1 billion for its retrofit project.² Given these examples, the financial incentives available under the recent legislation may not be sufficient to significantly spur investment in new CCS projects or retrofits of existing major sources of carbon dioxide emissions. Indeed, the Carbon

¹ Renewable Energy Under the Biden Administration and the Consolidated Appropriations Act of 2021: Spurring Development, V&E ENERGY EVOLUTION SERIES (Feb. 10, 2021), <https://www.velaw.com/insights/renewable-energy-under-the-biden-administration-and-the-consolidated-appropriations-act-of-2021-spurring-development/>.

² Media releases pertaining to retrofitting activities at other facilities indicate a similar cost. For example, retrofitting the San Juan Generating Station with CCS technology was projected to cost \$1.4 billion. See Susan Montoya Bryan, *Officials: Carbon Capture Project Would be Largest in World*, AP NEWS, Oct. 5, 2020, <https://apnews.com/article/technology-environment-new-mexico-archive-3d664a6a242878b769df277646eb3dbf>.

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Capture Coalition recently sent a [memorandum](#) to President Biden calling for a number of additional legislative and executive actions to help spur investment in, and provide federal support for, potential CCS projects. It is important to note, however, that it may be possible to use the federal incentives in the Energy Act of 2020 in combination with some of the federal tax incentive programs that are available to promote renewable and low-carbon energy. The ability to combine these incentives may become an important factor in making the economics for early stage projects favorable.

The legislation incorporates a number of additional objectives for the programs previously authorized under Subtitle F – Fossil Energy of the Energy Policy Act of 2005. These objectives include: “increasing the export of fossil energy-related equipment, technology, including emissions control technologies, and services from the United States”; “decreasing the cost of emissions control technologies for fossil energy production, generation, and delivery”; “significantly lowering greenhouse gas emissions for all fossil fuel production, generation, delivery, and utilization technologies”; “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”; “improving the conversion, use, and storage of carbon oxides produced from fossil fuels”; and “reducing water use, improving water reuse, and minimizing surface and subsurface environmental impact in the development of unconventional domestic oil and natural gas resources.” The Energy Act of 2020 also directs the Secretary of the Department of Energy to prioritize those “activities and strategies that have the potential to significantly reduce emissions for each technology relevant to the applicable objective and the international commitments of the United States.”

The tables below summarize the Waste Heat Recovery (Title I), Nuclear/Fusion (Title II), Renewable Energy – Geothermal Resources (Title III), Carbon Management (Title IV) and Carbon Removal (Title V) sections of the Energy Act of 2020 which include numerous grants or other financial incentives. With respect to the Carbon Management and Carbon Removal provisions, programs established by the 2020 legislation include: the Carbon Capture Technology Program; Carbon Storage Validation and Testing; the Carbon Utilization Program; High Efficiency Turbines; a Study on Blue Hydrogen Technology; Produced Water Research and Development; Carbon Removal; and a Carbon Dioxide Removal Task Force and Report. Each table sets forth the overarching section, the programs thereunder, and, where applicable, additional information such as eligibility, appropriations, and incentives.

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Title I – Waste Heat Recovery

Note: While there are sections (6003 – Industrial Emissions Reduction Technology Development Program; 7002 Mineral Security) that address recovery from waste streams, these sections do not list utilities and/or energy producers as the focus of their programs.

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
CHP Technical Assistance Partnership Program (§ 1013) Program is the re-designation of the Clean Energy Application Centers of the Department of Energy.				
CHP Technical Assistance Partnership Program	The focus of the Program is to “encourage deployment of combined heat and power, waste heat to power, and efficient district energy [CHP] technologies by providing education and outreach to . . . electric and natural gas utility professionals.” While one of the goals is to further waste heat recovery, the recipients of funding are not the affected industries nor utilities.	Institutions of Higher Education, research centers, and other appropriate institutions	12M for each FY2021 through FY2025	Money will be disbursed through the CHP Technical Assistance Partnerships (TAPs). Created by the DOE, these regional partnerships seek opportunities with end users to provide engineering support to manufacturing, commercial, institutional and federal facilities and campuses on issues related to CHP, fuel source, and energy security issues. Funds will be used to, amongst other matters, help create databases that act as a clearinghouse of information related to existing CHP projects and also support seminars, workshops, and other information-sharing efforts related to CHP.

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
				<p>Specific CHP projects identified for funding include hybrid renewable-CHP technologies, biomass CHP, microgrids, and clean energy.</p> <p>Private companies, through the CHP TAPs, may be able to receive funds for field validation and performance evaluations of CHP and other clean energy technologies implemented.</p>

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Title II – Nuclear/Fusion

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
Advanced Nuclear Fuel Availability (\$2001)				
This is a program centered around HA-LEU for use in “civilian domestic research, development, demonstration, and commercial use.”				
Establishment of program to support availability of HA-LEU	Creation of a private consortium for distribution of HA-LEU	Entities involved at any stage of the nuclear fuel cycle	\$31M for FY2021 \$33M for FY2022 \$34.7M for FY2023 \$36.5M for FY2024 \$38.3M for FY2025	
Nuclear Energy Research, Development, Demonstration, and Commercial Application Programs (\$2003)				
Reactor Concepts Research, Development, Demonstration and Commercial Application	Program to support exhibits operating nuclear power plants modernization and improvement	Only available to existing nuclear power plants	\$55M for each of FYs 2021 through 2025	
Advanced Reactor Technologies	Program to coordinate with the private sector to promote the development of advanced nuclear reactor design	Private sector and experts in nuclear non-proliferation, environmental and public health and safety, and economics (does not appear to apply to actual building of nuclear facilities)	\$55M for each of FYs 2021 through 2025	
Nuclear Integrated Energy Systems Research, Development, Demonstration, and Commercial Application Program	Development of nuclear integrated energy systems consisting of “2 or more co-located or jointly operated subsystems of energy generation, energy storage, or other technologies”; awards can be made for research, development, demonstrations, or commercial	National laboratories, institutions of higher education, and the private sector	\$20M for FY2021 \$30M for FY2022 \$30M for FY2023 \$40M for FY2024 \$40M for FY2025	

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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	application of nuclear integrated energy systems			
Used Fuel Cycle Research, Development, Demonstration, and Commercial Application	The goal of the program is to address the environmental, public health and safety impacts, improving fuel cycle performance, and ultimately the storage and disposal of used fuel	Secretary is to conduct the program, i.e., does not appear to involve disbursements to private sector	\$60M for each FY 2021 through FY2025	
Advanced Fuels	This program applies to improving next-generation light water reactor and advanced reactor fuels	Secretary is to conduct the study and prepare report	\$125M for each of FY2021 through FY2025	
Nuclear Science and Engineering Support; Conforming Amendment; University Nuclear Leadership Program	The programs that this section are applicable to are research reactors located at universities and research performed at universities.	Secretary conducts the program management and disburses percentages to university-led projects		
Nuclear Energy Research Infrastructure; Gateway for Accelerated Innovation in Nuclear (GAIN)	<p>This appropriation is for maintenance of the National Laboratories.</p> <p>The goal of the new program GAIN is to promote industry access to cutting edge research and development, and promote technical, regulatory and financial support to move new nuclear</p>	<p>Secretary and the National Laboratories;</p> <p>For GAIN, competitive merit-reviewed awards for industry partners</p>	<p>\$295M for FY2021 \$348M for FY2022 \$525M for FY2023 \$534M for FY2024 \$584M for FY2025</p>	

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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	energy technologies into commercial applications at an accelerated rate.			
Advanced Reactor Demonstration Program	This appropriation is for the development and commercial application of an advanced domestic nuclear reactor, including as part of the power general facilities of an electric utility system.	Candidates are evaluated through an external review by a panel with at least one representative from each of the following: an electric utility, an entity that uses high-temp process heat for manufacturing or industrial processing, an investment community expert, a project management practitioner, and an environmental health and safety expert. The review evaluates cost-competitiveness, technology readiness level, entity team, capacity to meet cost-share requirements and environmental impacts. Entities cannot receive funds under this program if receiving fund from another reactor demonstration program in the same year.	405M for FY2021 405M for FY2022 420M for FY2023 \$455M for FY2024 \$455M for FY2025	

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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International Nuclear Energy Cooperation	Further amendment to subsection (g) to promote international collaboration initiatives, including research and development agreements, coordinated action plans, and multilateral cooperation commitments.			
High Performance Computation Collaborative Research Program (§ 2004)				
Amendment to 42 U.S.C. 16277 directing the Secretary to avoid unnecessary duplication of activities of the program with “other research entities of the Department.				
Nuclear Energy Budget Plan (§ 2005)				
Amendment to 42 U.S.C. 16279 providing for budgeting alternatives, including constant annual funding for 10 year and reports of deviations from the 10-year budget.				
Organization and Administration of Programs (§ 2006)				
Statement on the duty of the Secretary to coordinate activities of Department programs and other relevant Federal Agencies.				
Extension and Expansion of Limitations on Importation of Uranium from Russian Federation (§ 2007)				
Statement promoting reduction of reliance on imports to protect national security interests and strengthening the supply chain of nuclear fuel produced and used in the U.S.				
Fusion Energy Research (§ 2008)				
The Program is directed to carry out fusion energy sciences research and enabling technology development program to result in the construction of a cost competitive fusion power plant and other energy applications.				
Inertial Fusion Research and Development Program	Program of technology development in inertial fusion for energy application, e.g., ion beam, laser and pulsed power fusion systems.	Awarded to institutions of higher education/National Laboratories.	\$25M from funds appropriated under subsection (o) for each FY2021 through FY2025	

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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Alternative and Enabling Concepts	Program supports research and development for solutions to establishing a commercial magnetic fusion power plant	Awarded on a competitive, merit-reviewed basis in the form of grants, vouchers, equipment loans to institutions of higher education/ National Laboratories and contracts to private entities.	\$50M from funds appropriated under subsection (o) for each FY2021 through FY2025	
Milestone-Based Development Program	Requires the Secretary to establish milestone-based fusion energy development program whereby projects have to meet particular milestones <u>before</u> a participant can receive funds. Once awarded, if a milestone is not met, the Secretary may redirect remaining awarded funds to new or existing projects under this section.	Any entity can submit a proposal and participate upon being deemed by the Secretary to have the necessary resources and expertise. Evaluation is based upon scientific, technical and business merits through a peer-review process.	From funds appropriated under subsection (o) until expended: \$45M for FY2021 \$65M for FY2022 \$105M for FY2023 \$65M for FY2024 \$45M for FY2025	
Subsection (o) of § 2008			\$996M for FY2021 \$921M for FY2022 \$961M for FY2023 \$921M for FY2024 \$901M for FY2025	
United States Participation in ITER	Authorization of U.S. participation in the ITER project per the 4/25/2007 Agreement on the Establishment of the ITER International Fusion		From funds appropriated under subsection (o): \$374M for FY2021 \$281M for each of FY2022 through FY2025	

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	Energy Organization for the Joint Implementation of the ITER Project			

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Title III Subtitle A – Renewable Energy: Solar and Subtitle B – Natural Resources Provisions: Solar

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
Subtitle A—Solar Energy Research and Development (§ 3004)				
Solar Energy Technology Program; Advanced Solar Energy Manufacturing Initiative (Grants only); Solar Energy Technology Recycling Research, Development, and Demonstration Program	The goal of these programs is to promote “research, development, demonstration, and commercialization of solar energy technologies,” including supporting “the integration of solar energy technologies with the electric grid and complementary energy technologies,” “to create and improve the conversion of solar energy to other useful forms of energy or other products,” and “to support the domestic solar industry, workforce, and supply chain.” Priority is given to projects 1) from geographically diverse eligible entities, 2) that support development/demonstration in economically distressed areas and areas impacted by pollution and produce cost effective reduction of energy costs, 3)	Institution of higher education, a National Laboratory, a Federal research agency, a State research agency, a research agency associated with a territory or freely associated state, a Tribal energy development organization, an Indian Tribe, a Tribal organization, a Native Hawaiian community-based organization, a nonprofit research organization, an industrial entity, and other entity as determined by the Secretary, and a consortium of the above-listed entities; Grants and awards are made on a competitive, merit-reviewed basis.		

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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	that can be reproduced in other areas with different climates, 4) that include business commercialization plans, 5) that are carried out with native American and minority-serving institutions, territories or freely associated States, and 6) that are carried out with workforces from underrepresented groups pursuing solar energy skills.			
<p>Subtitle B—Natural Resources Provisions – Definitions (§ 3101)</p> <p>These definitions define “eligible project” on Federal public and National Forest System land. An “eligible project” under this title includes “a project carried out on covered land that uses wind, solar, or geothermal energy to generate energy.”</p>				
<p>Subtitle B—National Goal for Renewable Energy Production on Federal Land (§ 3104)</p> <p>The Secretary is directed to establish national goals by September 1, 2022 for renewable energy production on Federal land. Those goals include issuing permits no later than 2025 that authorize production of not less than 25 gigawatts of electricity from wind, solar, and geothermal energy.</p>				

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Title III Subtitle A – Renewable Energy: Geothermal and Subtitle B – Natural Resources Provisions: Geothermal

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
Subtitle A—Advanced Geothermal Innovation Leadership (§ 3002) All programs under Subtitle A, including the non-geothermal components, share in a \$170M appropriation for each of FY2021 through FY2025. For compliance purposes under this section, any energy consumption that is avoided through the use of geothermal energy shall be considered to be renewable energy produced. “Energy consumption avoided through the use of geothermal energy that is considered renewable energy under this section shall not be considered energy efficiency for the purposes of compliance with Federal energy efficiency goals, targets, and incentives.”				
Hydrothermal Research and Development Program	The program under this section promotes research, development, demonstration and commercial application for geothermal production from hydrothermal systems. Activities can involve development of advanced geologic tools for locating and prioritizing hydrothermal resources and exploratory drilling for geothermal resources in collaboration with industry partners.	Institution of higher education, a National Laboratory, a Federal research agency, a State research agency, a nonprofit research organization, an industrial entity, or a consortium of 2 or more the entities above.		
General Geothermal Systems Research and Development: Reservoir Thermal Energy Storage (RTES) Oil and Gas Technology Transfer Initiative (OGTTI) Coproduction of Geothermal Energy and	The programs under this section promote research, development, demonstration and commercial application of components and systems to withstand geothermal	Institution of higher education, a National Laboratory, a Federal research agency, a State research agency, a nonprofit research organization, an industrial entity, or a consortium of 2 or		Calls for the DOE to support studies of the potential environmental impacts resulting from Geothermal resource development (including but not limited to, induced seismicity)

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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<p>Minerals Production Research and Development Initiative (CGEMPRDI)</p> <p>Flexible Operations (FO)</p> <p>Integrated Energy Systems (IES)</p>	<p>environments, to monitor geothermal reservoirs, and to produce geothermal energy; and to research environmental impacts, emission of GHGs, and mitigation.</p> <p>The program under the RTES section promotes research, development, demonstration and commercial application for reservoir thermal energy storage.</p> <p>The program under the OGTTI section promotes research, development, demonstration and commercial application for transfer of oil and gas technologies and techniques for use in geothermal energy harvesting.</p> <p>The program under the CGEMPRDI section provides financial assistance for demonstrating coproduction of critical minerals as a by-product of geothermal extraction.</p> <p>The program under the FO section provides that the Secretary “shall</p>	<p>more the entities above.</p>		<p>concerns, impact to water resources), as well as ways mitigate such impacts</p>

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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	<p>support a research initiative on flexible operations of geothermal power plants.</p> <p>In the IES section the Secretary is tasked with identifying joint projects between geothermal systems and other energy generation or storage systems.</p>			
<p>Enhanced Geothermal Systems Research and Development:</p> <p>Enhanced Geothermal Systems Technologies (EGST)</p> <p>Frontier Observatory for Research in Geothermal Energy (FORGE)</p> <p>Enhanced Geothermal Systems Demonstrations (EGSD)</p>	<p>The programs under this section promote research, development, demonstration and commercial application of enhanced geothermal systems.</p> <p>The EGST program promotes 12 technologies to achieve higher efficiency and lower cost enhanced geothermal systems.</p> <p>Under the FORGE program, up to 3 sites are to be constructed for the purpose of developing, testing and enhancing techniques and tools for enhanced geothermal energy with an operation duration max of 7 years. At the end</p>	<p>Industry partners, institutions of higher education, and national laboratories</p>	<p>There is a carveout from the pool of Subtitle A funds for the FORGE program of:</p> <p>\$45M for FY2021 \$55M for FY2022 \$65M for FY2023 \$70M for FY2024 \$70M for FY2025</p> <p>There is a carveout from the pool of Subtitle A funds for the EGSD program of \$21M for each of FY2021 through FY2025</p>	<p>Technologies that may be a component of enhanced geothermal systems and that therefore may be eligible for funding include, amongst others, those related to:</p> <ul style="list-style-type: none"> • reservoir stimulation • closed-loop reservoir technologies • reservoir characterization • stress and fracture monitoring (including real-time monitoring) • tracer development • seismic imaging

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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	<p>of the operational term these respective sites will either be transferred to public or private entities for further enhanced geothermal testing or subject to additional appropriations for continued as-is operation.</p> <p>Under the EGSD program, 4 demonstration projects are to be developed for enhanced geothermal systems for power production or direct use. Location, geologic identifiers, and techniques will diversify the projects.</p>			<ul style="list-style-type: none"> • well placement and orientation • long-term reservoir management <p>Projects eligible for funding under the EGST program include projects that involve:</p> <ul style="list-style-type: none"> • different geological settings • a variety of development techniques (e.g., open hole, closed hole, stimulation and non-stimulation mechanisms) • sites where geologic characterization and assessment for the siting of geothermal energy has already been performed <p>At least one of the demonstration projects carried out under the EGST program must be located in an area east of the Mississippi River that is suitable for enhanced geothermal demonstration for power, heat, or a</p>

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
				combination of power and heat.
Geothermal Heat Pumps and Direct Use (GHPDU)	This program promotes the research, development, demonstration, and commercial application of geothermal heat pumps and the direct use geothermal energy in areas such as: efficiency and improved installation and operation methods, use in building-scale energy storage, use as a grid management; resource or seasonal energy storage, use of alternative fluids as heat exchange medium, heating on a large-scale (including communities, buildings, and industrial and manufacturing facilities), the use of low temp groundwater for direct use, and system integration of direct use with geothermal electricity production.	State, local and Tribal governments, institutions of higher education, nonprofit entities, National Laboratories, utilities, and for-profit companies		
Advanced Geothermal Computing and Data	This is a program to research and	Coordination between the		

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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Science Research and Development	develop advanced computing and data science tools for geothermal energy.	National Laboratories, institutes of higher education, and the private sector		
<p>Subtitle B—Natural Resources Provisions – Definitions (§ 3101)</p> <p>These definitions define “eligible project” on Federal public and National Forest System land. An “eligible project” under this title includes “a project carried out on covered land that uses wind, solar, or geothermal energy to generate energy.”</p>				
<p>Subtitle B—National Goal for Renewable Energy Production on Federal Land (§ 3104)</p> <p>The Secretary is directed to establish national goals by September 1, 2022 for renewable energy production on Federal land. Those goals include issuing permits no later than 2025 that authorize production of not less than 25 gigawatts of electricity from wind, solar, and geothermal energy.</p>				
<p>Subtitle B—Facilitation of Coproduction of Geothermal Energy on Oil and Gas Leases (§ 3105)</p> <p>For lands subject to an oil and gas lease issued pursuant to the Mineral Leasing Act (30 U.S.C. 181 et seq.) or the Mineral Leasing Act for Acquired Lands (30 U.S.C. 351 et seq.) and where there is an approved permit to drill for and production of oil and gas, those lands may be available for noncompetitive leasing if there is a determination that geothermal energy will be produced from a well producing or capable of producing oil and gas.</p>				

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Title IV-Carbon Management

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
Carbon Capture Technology Program (§ 4002)				
<p>To develop transformational technologies that will “significantly improve the efficiency, effectiveness, costs, emissions reductions, and environmental performance of coal and natural gas use, including in manufacturing and industrial facilities.”³</p> <p>Program to include: (a) a research and development program; (b) large-scale pilot projects; (c) demonstration projects; and (d) a front-end engineering and design program.</p> <p>The Secretary shall develop goals and objectives for the Carbon Capture Technology Program to be applied to the transformational technologies developed within the Program, taking into consideration numerous factors to include “using carbon capture, utilization, and sequestration technologies to decrease the carbon dioxide emissions, from new and existing coal electric generation facilities and natural gas electric generation facilities,” to include “developing net-negative carbon dioxide emissions technologies,” and “developing technologies for the capture of carbon dioxide produced during the production of hydrogen from natural gas,” as well as “entering into cooperative agreements to carry out and expedite demonstration projects (including pilot projects) to demonstrate the technical and commercial viability of technologies to reduce carbon dioxide emissions released from coal electric generation facilities and natural gas electric generation facilities for commercial deployment.”</p>				
Research and Development Program			<ul style="list-style-type: none"> • \$960 million total for FY 2021 to 2025. 	
Large-Scale Pilot Projects	<p>Projects greater than laboratory scale but not yet at operational or commercial scale. Large-Scale Pilot Projects must be large enough to understand the technical and performance risks of the carbon management technology.</p>		<ul style="list-style-type: none"> • \$1 billion total for FY 2021 to 2025. 	

³ Transformational technologies = “a technology that represents a significant change in the methods used to convert energy that will enable a step change in performance, efficiency, cost of electricity, and reduction of emissions as compared to the technology in existence on the date of enactment of the Energy Act of 2020.” The Act identified a number of examples of such technologies, including, but not limited to, advanced combustion methods and replacement of steam cycling, improvements in turbine technology and carbon capture, utilization and storage technology, fuel cell technologies, and any other technology the Secretary recognizes as “transformational.”

Consolidated Appropriations Act of 2021: Energy Financial Incentives

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Demonstration Projects	<p>Through a competitive, merit-reviewed process, the Secretary shall enter into cooperative agreements no later than September 30, 2025 for demonstration projects to demonstrate the construction and operation of 6 facilities to capture carbon dioxide from coal electric generation facilities, natural gas electric generation facilities, and industrial facilities.</p> <p>For the 6 facilities:</p> <ul style="list-style-type: none"> • 2 designed to capture carbon dioxide from a natural gas electric generation facility • 2 designed to capture carbon dioxide from a coal electric generation facility • 2 designed to capture carbon dioxide from an industrial facility 	<p>Industry stakeholders, including any industry stakeholder in partnership with the National Laboratories, institutions of higher education, multi-institutional collaborations, and “other appropriate entities”</p> <p>Application to the Secretary required.</p> <p>Progress reports must be periodically provided by the Secretary to Congress, including a detailed list of technical milestones achieved in connection with the demonstration projects, estimated costs for permitting, constructing, and operating qualifying demonstration projects, and a schedule for the planned construction and operation of both pilot and demonstration projects.</p>	<p>Projects “shall be financed in part by the private sector.”⁴</p> <ul style="list-style-type: none"> • \$2.6 billion total for FY 2021 to 2025. 	<p>If necessary, the project “shall secure agreements for the offtake of carbon dioxide emissions captured by qualifying technologies during the project.”⁵</p> <p>The Secretary shall provide technical assistance to any eligible entity seeking to enter into a cooperative agreement (including obtaining necessary permits and licenses).</p>

⁴ Note the statute does not specify the amount of the federal cost share for Demonstration Projects, meaning this will either be specified in later regulations to govern the demonstration projects or the subject of negotiation in the individual agreements for each of the 6 projects.

⁵ The statute does not specify when offtake agreements would be “necessary.”

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	<p>not purposed for electric generation.</p> <p>Also includes commercial scale demonstration projects which is a program to demonstrate substantial improvements in the efficiency, effectiveness, cost, and environmental performance of carbon capture technologies for power, industrial, and other commercial applications. In addition to the 6 facilities above, funding is available for not more than 2 projects to demonstrate substantial improvements in a particular technology type beyond the first of a kind demonstration.</p>			
Front-End Engineering and Design Program			<ul style="list-style-type: none"> \$200 million total for FY 2021 to 2024. 	
Carbon Capture Test Centers	To advance the research, development, demonstration, and commercial application of carbon capture technologies; support large-scale	Secretary is to develop criteria for entities eligible for these grants, prioritizing research facilities with access to carbon capture equipment	<ul style="list-style-type: none"> \$125 million total for FY 2021 to 2025. <p>Secretary shall award grants to one or more entities for the operation of one or more test centers</p>	Carbon capture centers in existence on the date of enactment of the Energy Act of 2020 are to be prioritized when

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	<p>pilot projects and demonstration projects and test carbon capture technologies; and develop front-end engineering design and economic analysis.</p>	<p>and academic institutions.</p>	<p>to provide distinct testing capabilities for innovative carbon capture technologies.</p> <p>Grants will be awarded on a competitive basis and according to such criteria as the Secretary develops.</p> <p>Grant term of not more than 5 years; Secretary can renew a grant for one or more additional five year terms subject to a competitive merit review and the availability of appropriations.</p>	<p>making funding decisions</p>
<p>Carbon Storage Validation and Testing (§ 4003)</p> <p>Large scale carbon sequestration = a scale that “demonstrates the ability to inject into geologic formations and sequester carbon dioxide; and has a goal of sequestering not less than 50 million metric tons of carbon dioxide over a 10-year period.”⁶</p>				
<p>Carbon Storage Program</p>	<p>Research, development, and demonstration for carbon storage. Includes supporting cost and business model assessments to examine the economic viability of technologies and systems developed under the program and providing information to the EPA, States, local</p>		<ul style="list-style-type: none"> \$800 million total for FY 2021 to 2025. 	

⁶ The threshold for CCS projects qualifying for tax credits under Section 45Q of the Internal Revenue Code is 100,000 metric tons of qualified carbon oxide sequestered per year. 26 U.S.C. § 45Q(d)(2)(C) (2018).

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	governments, Tribal governments, and other appropriate entities, to ensure the protection of human health and the environment.			
Large-scale Carbon Sequestration Program	<p>Demonstration projects to collect and validate information on the cost and feasibility of commercial deployment of large-scale carbon sequestration technologies.</p> <p>Identifies a variety of geologic settings eligible for funds under this program:</p> <ul style="list-style-type: none"> (1) operating oil and gas fields; (2) depleted oil and gas fields; (3) unconventional reservoirs and rock types; (4) residual oil zones (5) unmineable coal seams (6) saline formations in both sedimentary and basaltic geologies; 			May provide additional funding to regional carbon sequestration partnerships ⁷ that are carrying out or have completed a large-scale sequestration demonstration project under this section for additional work on that project.

⁷ The Department of Energy established its Regional Carbon Sequestration Partnership Initiative in 2003 to support the development of CCS projects. Seven regional partnerships have been established. Amongst other forms of support, the Partnerships provide information on best practices and resources for CCS projects with respect to site screening, site selection, and geologic characterization, risk mitigation, public outreach, and monitoring, reporting and verification practices. For more information, see Regional Carbon Sequestration Partnerships (RCSP) Initiative, NAT'L. ENERGY TECH. LABORATORY, <https://www.netl.doe.gov/coal/carbon-storage/storage-infrastructure/regional-carbon-sequestration-partnerships-initiative> (last visited Jan. 12, 2020).

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	<p>(7) geologic systems that may be used as engineered reservoirs to extract economical quantities of brine from geothermal resources of low permeability or porosity; and</p> <p>(8) geologic systems containing in situ carbon dioxide mineralization formations.</p>			
Carbon Utilization Program (\$4004)				
	<p>Research, development, and demonstration for carbon utilization to “(1) assess and monitor (A) potential changes in lifecycle carbon dioxide and other greenhouse gas emissions and (B) other environmental safety indicators or new technologies, practices, processes, or methods used in enhanced hydrocarbon recovery;</p> <p>(2) to identify and assess novel uses for carbon, including the conversion of carbon and carbon</p>	<p>Secretary shall establish and operate a national Carbon Utilization Research Center; Center will be selected on a competitive, merit-reviewed basis. Secretary shall consider applications from the National Laboratories, institutions of higher education, multi-institutional collaborations, and other appropriate entities.</p> <p>2-year demonstration program in each of the 2 major coal-producing regions of the U.S. for the</p>	<ul style="list-style-type: none"> • \$283,140,781 total for FY 2021 to 2025. <p>Center shall receive support for a period of not more than 5 years, subject to the availability of appropriations. Renewal of support available on a merit-reviewed basis for not more than 5 years.</p>	<p>Carbon utilization research centers in existence on the date of enactment of the Energy Act of 2020 prioritized when making funding decisions.</p>

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	<p>dioxides for commercial and industrial products and other products with potential market value;</p> <p>(3) to identify and assess carbon capture technologies for industrial systems; and</p> <p>(4) to identify and assess alternative uses for raw coal and processed coal products in all phases that result in no significant emissions of carbon dioxide or other pollutants, including products derived from carbon engineering, carbon fiber, and coal conversion methods.”</p>	<p>purpose of partnering with private institutions in coal-mining regions to accelerate commercial deployment of coal-carbon products.</p>		
High Efficiency Turbines (§ 4005)				
	<p>Establish a multiyear, multiphase program of research, development, and technology demonstration to improve the efficiency of gas turbines used in power generation systems and aviation.</p>	<p>The Secretary will solicit proposals from industry, small businesses, universities, and other appropriate parties.</p>	<ul style="list-style-type: none"> • \$250 million total for FY 2021 to 2025. <p>Secretary may provide financial assistance, to include grants. Awarded on a competitive basis, with an emphasis on technical merit.</p>	<p>Special consideration given to the extent a proposed project will (a) stimulate the creation or increased retention of jobs in the U.S. and (b) promote and enhance technology leadership in the U.S.</p>
Study on Blue Hydrogen Technology (§ 4007)				

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	<p>Study to examine opportunities for research and development in integrating blue hydrogen technology in the industrial trial power sector and how that could enhance the deployment and adoption of carbon capture and storage.</p>			
Produced Water Research and Development (§ 4008)				
	<p>Research and development program on produced water to develop:</p> <p>“(1) new technologies and practices to reduce the environmental impact; and</p> <p>(2) opportunities for reprocessing of produced water at natural gas or oil development sites.”</p>		<ul style="list-style-type: none"> • \$50 million total for FY 2021 to 2025. 	<p>Priority given to projects that develop and bring to market effective systems for on-site management and repurposing of produced water and new technologies or approaches to reduce the environmental impact of produced water on local water sources and the environment.</p>

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Title V Carbon Removal

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
Carbon Removal (§ 5001)				
<p>Program to test, validate, or improve technologies and strategies to remove carbon dioxide from the atmosphere on a large scale.</p> <p>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 practices; (5) forest management and afforestation; and (6) planned or managed carbon sinks, including natural and artificial.”</p>				
<p>Precommercial-air capture program(s)</p>	<p>Funds limited to projects involving “qualified carbon dioxide” and “qualified direct air capture facility.</p> <p>Qualified carbon dioxide for the air capture program includes any carbon dioxide:</p> <p>(1) captured directly from the ambient air;</p> <p>Or</p> <p>(2) is measured at the source of capture and verified at the point of disposal, injection, or utilization.</p> <p>Carbon dioxide that is recaptured, recycled, and reinjected as part of the enhanced oil and natural gas recovery process is excluded from the definition of qualified carbon dioxide.</p>	<p>For precommercial air capture program, must show that the project “(i) meets minimum performance standards set by the Secretary; (ii) meets minimum levels set by the Secretary for the capture of carbon dioxide from dilute media; and (iii) demonstrate in the application of the project for a prize – (I) a design for a promising carbon capture technology that will (aa) be operated on a demonstration scale; and (bb) have the potential to achieve significant reduction in the level of carbon dioxide atmosphere; (II) a successful bench scale demonstration of a carbon capture technology; or (III)</p>	<p>Competitive technology prize competition for precommercial carbon dioxide capture from dilute media and commercial applications of direct air capture technologies.</p> <ul style="list-style-type: none"> • \$447,038,000 total for FY 2021 to 2025. • In FY 2021, \$15 million shall be used to carry out precommercial carbon dioxide capture from dilute media, and \$100 million shall be used to carry out commercial applications of direct air capture technologies, to remain available until expended. 	

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	<p>A qualified direct air capture facility is one that (a) capture qualified carbon dioxide directly from the ambient air and (b) captures more than 50,000 metric tons of qualified carbon dioxide annually. Facilities that capture carbon dioxide released from naturally occurring subsurface springs or using natural photosynthesis are excluded from the definition of a qualified direct air capture facility.</p>	<p>an operational carbon capture technology on a commercial scale.”</p> <p>Prizes are also awarded for commercial direct air capture facilities. Prize amounts must be allocated equally among the applicants selected by the Secretary. Amounts awarded under the competitive technology prize competition for such facilities shall be determined by the Secretary, but shall not exceed:</p> <p>(1) \$180 per metric ton of qualified carbon dioxide captured and stored in saline storage formations; (2) a lesser amount, determined by the Secretary, for projects involving the capture and storage of qualified carbon dioxide used in conjunction with enhanced oil recovery operations; and (3) a lesser amount, determined by the Secretary, for qualified carbon dioxide captured and utilized in any activity consistent</p>		

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
		with section 45Q(f)(5) of the Internal Revenue Code.		
Commercial applications of direct air capture technologies		The Secretary shall award prizes to qualified direct air capture facilities.		
Direct air capture test center	Advance research, development, demonstration, and commercial application of direct air capture and storage technologies; support large-scale pilot and demonstration projects and test direct air capture and storage technologies; and develop front-end engineering design and economic analysis.	Selection for direct air capture test center will be according to criteria Secretary develops; entities selected on a competitive basis to receive grants. Awarded for not more than 5 years and Secretary may renew a grant for one or more additional 5-year terms, subject to competitive merit review and the availability of appropriations.	Secretary shall award grants to 1 or more entities for the operation of 1 or more test centers to provide distinct testing capabilities for innovative direct air capture and storage technologies.	Priority given to applicants that have access to existing or planned research facilities for direct air capture and storage technologies; 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 have access to existing research and test facilities for bulk materials design and testing, component design and testing, or professional engineering design.
Pilot and Demonstration projects	Pilot projects that direct air capture systems capable of capturing 10 to 100 tonnes of carbon dioxides per year to provide data for			

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	demonstration-scale projects; and direct air capture demonstration projects capable of capturing greater than 1,000 tonnes of carbon dioxides per year.			
Carbon Dioxide Removal Task Force and Report (§ 5002)				
	<p>The Secretary shall prepare a report that:</p> <p>“(1) estimates the magnitude of excess carbon dioxide in the atmosphere that will need to be removed by 2050 to achieve net-zero emissions and stabilize the climate; (2) inventories current and emerging approaches of carbon dioxide removal and evaluates the advantages and disadvantages of each of the approaches; and (3) identifies recommendations for legislation, funding, rules, revision to rules, financing mechanisms, or other policy tools that the Federal Government can use to sufficiently advance the</p>	<p>Secretary shall develop criteria for the selection of members to the task force and then select members in accordance with this criteria.</p>		

Consolidated Appropriations Act of 2021: Energy Financial Incentives

Activity	Description	Eligibility	Authorization of Appropriations	Additional Provisions/Notes
	deployment of carbon dioxide removal projects in order to meet, in the aggregate, the magnitude or needed removals estimated under paragraph (1) [above].”			