U.S. DEPARTMENT OF ENERGY | OFFICE OF FOSSIL ENERGY AND CARBON MANAGEMENT

U.S. DEPARTMENT OF ENERGY | NATIONAL ENERGY TECHNOLOGY LABORATORY

CTSN CARBON TRANSPORT and STORAGE NEWSLETTER

VOL. 23, NO. 10

CARBON TRANSPORT and STORAGE PROGRAM DOCUMENTS and REFERENCE MATERIALS

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This newsletter was compiled by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon transport and storage. It covers domestic, international, and public and private sector news in the following areas:

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DOE/FECM/NETL HIGHLIGHTS

DOE NOI to Fund CO_2 Transportation System

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) issued a notice of intent (NOI) to provide funding for expanding carbon dioxide (CO_2) transportation infrastructure to help reduce CO_2 emissions throughout the United States. Made available through the Bipartisan Infrastructure Law (BIL), the funding will support DOE's CO_2 Transportation Infrastructure Finance and Innovation (CIFIA) Future Growth Grants Program. Carbon capture projects in the United States are predicted to capture and store 65 million metric tons of CO_2 per year by 2030, 250 million metric tons per year by 2035, and 450 million metric tons per year by 2040. If issued, this Funding Opportunity Announcement (FOA) will provide CIFIA Future Growth Grants to provide financial assistance for developing and building extra CO_2 transport capacity up front that will become available for future carbon capture and direct air capture (DAC) facilities as they are developed and for additional CO_2 storage and/or conversion sites as they become operable.

From *energy.gov*. August 2023.

CONTINUE

DOE/FECM/NETL HIGHLIGHTS *(cont.)*

NETL, Partners Develop Technology to Help Realize Effective Carbon Storage

DOE's National Energy Technology Laboratory (NETL) and partner organizations successfully developed and demonstrated a suite of technologies that can help realize effective geologic carbon storage, hydrogen storage, and geothermal projects, as well as reduce wellbore integrity risks. NETL collaborated with the Illinois State Geological Survey, Intelligent Optical Systems, the University of California at Los Angeles, the University of Pittsburgh, and Carnegie Mellon University to perform an integrated research and development (R&D) effort to create a suite of complementary, multi-functional embedded sensor technologies for real-time subsurface monitoring of wellbore integrity. The effort is in response to needs identified within the Subsurface Science, Technology, Engineering, and Research and Development (SubTER) crosscut initiative.

From *NETL*. August 2023.

DOE Announces Funding for CO_2 Transport Networks

DOE/FECM announced funding to support the transport of CO_2 captured from industrial and power generation facilities, as well as from legacy CO_2 emissions captured directly from the atmosphere, to locations for geologic storage or conversion to useful products. The ***FOA*** will support front-end engineering and design (FEED) studies for regional CO_2 transport networks to transport captured CO_2 from key sources to centralized locations. The projects will focus on carbon transport costs, transport network configurations, and technical and commercial considerations that support broad efforts to develop and deploy carbon capture, conversion, and storage at commercial scale. Responses are due for this FOA by November 16, 2023.

From *energy.gov*. September 2023.

DOE Announces Funding for CO_2-EOR Combined with Carbon Storage

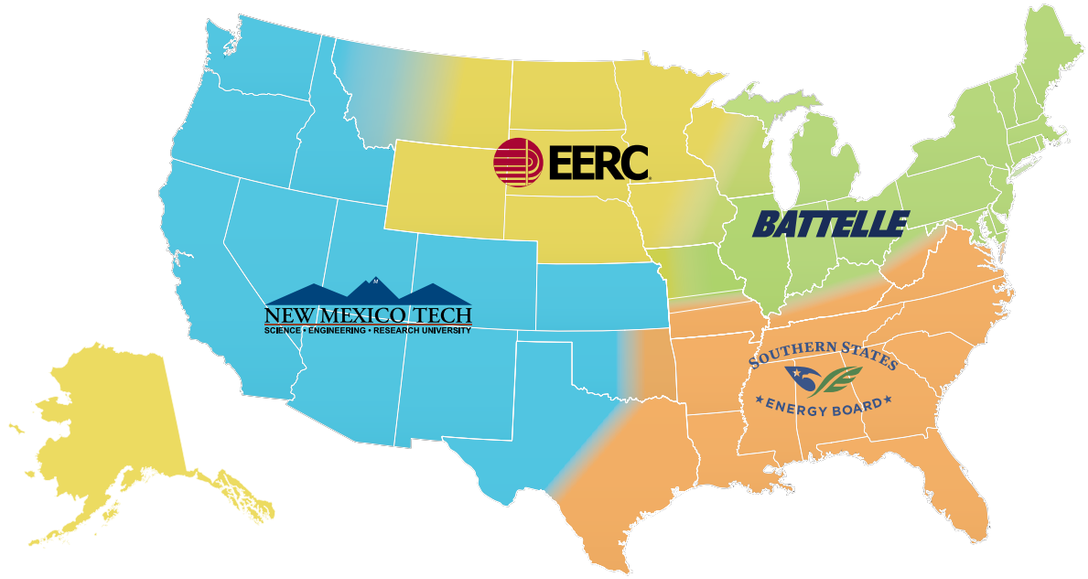
DOE/FECM announced funding to evaluate the potential of using CO_2 for enhanced oil recovery (EOR) in unconventional reservoirs combined with carbon storage. The research targeted through this funding will help to accelerate carbon storage operations in depleted domestic oilfields, repurposing existing infrastructure in support of the Biden-Harris administration's decarbonization goals. Through scientific research carried out using a field laboratory, projects awarded this funding will inject CO_2 under various scenarios, measure the volumes of incremental oil produced and CO_2 stored, and evaluate the conditions under which oil wells in depleted unconventional reservoirs can be transitioned to carbon storage wells in a manner that economically yields a reduction in carbon emissions. Responses are due for this ***FOA*** by December 13, 2023.

From *NETL*. September 2023.

DOE/NETL Regional Initiatives Building on RCSP Initiative

Four DOE/NETL-funded Regional Initiatives (RIs) are working to identify and address challenges facing stakeholders for commercial deployment of carbon capture, utilization, and storage (CCUS). DOE's regional CCUS effort began with the Regional Carbon Sequestration Partnerships (RCSP) Initiative, which ran from 2003 through 2019. To build on the RCSPs, DOE competitively selected four R&D projects under the FY19 FOA titled "Regional Initiative to Accelerate CCUS Deployment." The four R&D projects, known as the RIs, provide a broad range of technical, procedural, and outreach assistance to CCUS efforts throughout the United States. Together, focusing on CCUS deployment in the United States, the RIs have published more than 300 abstracts, papers, and posters on RI efforts and accomplishments related to CCUS deployment; participated in more than 400 presentations and panel sessions throughout the Nation; conducted or hosted more than 100 CCUS workshops, webinars, and technical educational series with a variety of targeted audiences throughout the Nation; and participated in hundreds of collaborative discussions and meetings with project developers, state/federal agencies, and other interested parties involved in CCUS deployment within their respective regions.

From *NETL*. September 2023.



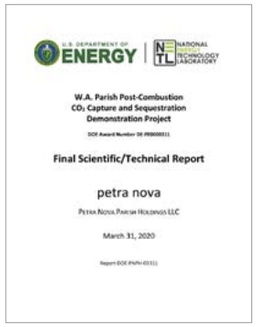
Map of the Regional Initiatives.

ANNOUNCEMENTS

Petra Nova CCS Facility Restarts Operations

Shut down since May 2020, Petra Nova, a carbon capture and storage (CCS) retrofit of a commercial power plant, has restarted operations, JX Nippon Oil and Gas Exploration Corp. announced. The project is designed to remove more than 90% of the CO_2 from a flue gas slipstream from an NRG Energy coal-fired unit at the W.A. Parish generating station in Fort Bend County, Texas. The project previously demonstrated CCS over a three-year period starting in December 2016. DOE, which supported the demonstration, stated in ***a 2020 report*** that during the three-year demonstration period, Petra Nova captured 3,904,978 short tons of CO_2, representing 92.4% of the CO_2 from the slipstream of flue gas processed.

From *POWER Magazine*. September 2023.



2020 DOE Petra Nova Report

NETL Releases Updated Version of CO_2 Transport Cost Model

NETL released an updated version of its open-source tool that helps industry decision-makers, planners, and researchers calculate the cost of transporting CO_2 by pipeline from the point of capture to the point of underground storage or when converted into useful products. The FECM/NETL CO_2 Transport Cost Model (***CO_2_T_COM***) is an Excel-based tool that estimates revenues and capital, operating, and financing costs for transporting liquid phase CO_2 by pipeline.

From *NETL*. August 2023.

NETL has released an updated version of a tool to help decision makers, planners, and researchers calculate costs for installation of new underground CO_2 pipelines.

DOE Announces Start-Up Support for DAC Technology

DOE/FECM announced the selection of 13 semifinalists to receive funding for innovations in carbon dioxide removal (CDR) technology. The 13 DAC Pre-Commercial Energy Program for Innovation (EPIC) Prize "Think It" semifinalists will elevate DAC technology through entrepreneur and start-up support. The ***DAC EPIC Prize*** is one of several prize competitions hosted by DOE and funded by the BIL to support breakthrough DAC technologies that demonstrate strong potential to accelerate economic support and expand domestic carbon removal.

From *energy.gov*. August 2023.

DOE Funding to Advance DAC Development, Demonstrate CO_2 Storage

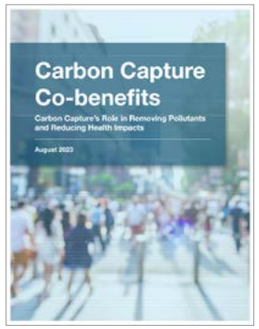
DOE announced funding to advance the development of two commercial-scale DAC facilities in Texas and Louisiana. ***The two projects***, representing the initial selections from the BIL-funded Regional DAC Hubs Program, will help further demonstrate the ability to capture and store atmospheric CO_2. Project Cypress (Calcasieu Parish, Louisiana) seeks to capture more than 1 million metric tons of CO_2 from the atmosphere annually and store it underground. The South Texas DAC Hub (Kleberg County, Texas) seeks to develop and demonstrate a DAC facility designed to remove up to 1 million metric tons of CO_2 annually and store it in an associated saline geologic CO_2 storage site.

From *energy.gov*. August 2023.

NETL, EPA Seeking CCS Stakeholder Input on Computational Tools to Support Class VI Permitting

NETL and the U.S. Environmental Protection Agency (EPA) are seeking input from geologic carbon storage stakeholders on computational tools relevant to environmentally protective permitting of Underground Injection Control (UIC) Class VI wells. In 2022, NETL researchers collaborated with EPA, other contributing national laboratories, and DOE's Regional Initiative to Accelerate CCUS Deployment to release the report "***Rules and Tools Crosswalk: A Compendium of Computational Tools to Support Geologic Carbon Storage Environmentally Protective UIC Class VI Permitting***," which is also available on the EPA UIC Program's website for ***Class VI (Geologic Sequestration) Permit Application and Permitting Tools***. The report summarizes computational tools and methods that may be used to address specific requirements of the UIC Class VI (Geologic Sequestration) permit application process and is intended to serve as a resource for industry, regulatory, academic, and public stakeholders. Stakeholder input on new relevant tools and new functionality of documented tools is requested to inform revision of this report (estimated release: spring 2024). Inquiries can be directed to ***NRAP@netl.doe.gov*** with subject: Rules and Tools Crosswalk.

Report Highlights Health Benefits of CCS



According to a study conducted by the Great Plains Institute and Carbon Solutions LLC, installing CCS technologies has the potential to result in over a billion dollars of annual health benefits in the United States. The report, "***Carbon Capture Co-benefits: Carbon Capture's Role in Removing Pollutants and Reducing Health Impacts***," quantifies the dollar value of the health benefits from reducing harmful co-pollutants by installing these technologies at representative facilities for seven industrial and power sectors across 10 U.S. regions.

From *Carbon Capture Journal*. August 2023.

RGGI Releases Report on Secondary Market

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released the "***Report on the Secondary Market for RGGI CO_2 Allowances: Second Quarter 2023***." Prepared by independent market monitor Potomac Economics, the report found no evidence of anticompetitive conduct in the RGGI CO_2 allowance secondary market.

From *RGGI*. August 2023.

Australia Opens Areas for CCS

The Australian government opened more acreage for offshore CCS, announcing 10 new areas across seven basins in federal waters for CCS exploration. The areas were chosen for their geology and CO_2 storage potential while minimizing impacts to other marine users and the environment.

From *Argus Media*. August 2023.

ANNOUNCEMENTS *(cont.)*

CCS Feasibility Studies Offered To Shipowners, Operators

Technology group Wärtsilä is providing shipowners and operators with feasibility studies to bring maritime CCS technologies to market. The feasibility studies are being conducted across vessels to be built and existing vessels, with the process taking four to six months of study and design work.

From *Marine Insight*. August 20203.

Gulf Coast Storage Network Announced

Barrell Energy Inc. announced it is developing the Gulf Coast Storage Network consisting of four carbon storage sites along the Gulf Coast in Louisiana and Texas. The energy company has performed an extensive evaluation of multiple carbon storage sites targeting the Miocene, Frio, Wilcox, and Cretaceous reservoirs in Louisiana and Texas.

From *Business Wire*. August 2023.

Summit Carbon Solutions Submits Revised Pipeline Application

Summit Carbon Solutions (SCS) submitted a Petition for Reconsideration for their pipeline permit application to the North Dakota Public Service Commission. SCS addressed community feedback and secured nearly 90% of the space needed for its carbon storage sites in North Dakota.

From *SCS Press Release*. August 2023.

PROJECT AND BUSINESS DEVELOPMENTS

CCS Solutions Company Receives License Award for CCS Project

CCS solutions company Carbon Catalyst Limited (CCL) received a license award enabling them to advance a CO_2 storage project in the United Kingdom (UK). The award will enable CCL to partner with Perenco UK (PUK) to store captured CO_2 in PUK's Leman gas field and other adjacent storage reservoirs within the carbon storage license. With an estimated storage capacity of approximately 1 billion metric tons of CO_2, PUK's Poseidon CCS project aims to connect a wide range of emitters across East Anglia, London, and the wider southeastern part of the UK to the offshore Poseidon geologic storage sites.

From *gasworld*. August 2023.

Korean Government Launches CCS R&D Project

The Korean government began R&D for a CCS project in the Ulleung Basin in the East Sea. The Ulleung Basin—an oceanic basin located where the East Sea meets the Korea Strait—was classified as a promising area for CCS in 2021 via a joint study by the Ministry of Trade, Industry, and Energy and the Ministry of Oceans and Fisheries. The carbon storage potential of the Ulleung Basin is estimated to be approximately 193 million tons.

From *Business Korea*. August 2023.

Porthos CCS Project Green Lit

The Netherlands' highest court ruled that construction of the planned Porthos CCS project can proceed. The project is expected to reduce the country's annual CO_2 emissions by approximately 2% for a period of 15 years from 2026. Under the project, CO_2 released by refineries and chemical plants operated by Shell, Exxon Mobil, and Air Liquide and Air Products would be transported to empty gas fields under the North Sea.

From *Reuters*. August 2023.

Partnership to Study Carbon Storage Feasibility in Canada

Carbon removal project developer Deep Sky and carbon capture removal solutions provider Svante Technologies Inc. are partnering to evaluate the feasibility of storing CO_2 in Southern Québec. The two companies will fund research to study the potential to capture, transport, and store CO_2 and have engaged with carbon management consulting firm Sproule to complete the geologic subsurface research.

From *Business Wire*. August 2023.

Norway Awards CO_2 Storage License in North Sea

The Norwegian Ministry of Petroleum and Energy awarded Sval Energi AS, Storegga Norge AS, and Neptune Energy Norge AS a license to store CO_2 in the North Sea. The carbon storage license, called Trudvang, is located east of the Sleipner East field in the North Sea and, according to Neptune Energy, has the potential to store up to 9 million metric tons of CO_2 annually for at least 25 years, with analysis indicating the storage potential could be even higher. The Trudvang project involves capturing CO_2 from several emission sources in North-West Europe and transporting it to export terminals. From there, the CO_2 would be transported to the Trudvang location for injection into and storage under the seabed.

From *Offshore Engineer*. August 2023.

PROJECT AND BUSINESS DEVELOPMENTS *(cont.)*

Partnership To Develop CCS Offering in Northern Europe

Höegh LNG and Aker BP entered a strategic partnership to develop a fully comprehensive CCS offering for industrial CO_2 emitters in Northern Europe. The agreement aims to establish a strong value chain for CCS on the Norwegian Continental Shelf that includes gathering, transporting, and injecting CO_2 for storage in subsea reservoirs.

From *Höegh LNG News Release*. September 2023.

Equinor Joins CCS Project

Equinor acquired a 25% interest in the Bayou Bend CCS project along the Gulf Coast in southeastern Texas. The Bayou Bend CCS project has nearly 140,000 gross acres of pore space for CO_2 storage, including approximately 40,000 gross acres offshore near Beaumont and Port Arthur, Texas. Bayou Bend is a joint venture among Chevron, through its Chevron New Energies division; Talos Energy, through its Talos Low Carbon Solutions division; and Equinor.

From *Offshore Magazine*. August 2023.

LEGISLATION AND POLICY

Denmark To Allocate Funds for CCS

Denmark announced plans to allocate state aid over 15 years for projects to capture and store 2.3 million metric tons of CO_2 emissions per year. The country has a target of reaching net-zero carbon emissions in 2045; according to the country's climate and energy ministry, CCS is expected to help reduce at least 3.2 million metric tons of Denmark's CO_2 emissions by 2030.

From *Reuters*. August 2023.

Proposed Canadian Legislation for CCUS

The Canadian Department of Finance released draft legislation for several investment tax credits, including one that addresses the Investment Tax Credit for CCUS. First announced in the 2022 Canadian Federal Budget and further expanded upon in the 2023 Budget, the CCUS tax credit has varying rates of refund, which are based on the different types of projects encompassed in the CCUS framework.

From *Lexology*. August 2023.

EMISSIONS TRADING

RGGI Auction Results Announced

The RGGI-participating states announced the results of the 61st RGGI auction of CO_2 allowances. A total of 21,948,358 CO_2 allowances were sold at a clearing price of $13.85 (bids ranged from $2.50 to $20.00 per allowance). None of the 11.25 million cost containment reserve (CCR) allowances made available were sold, nor were any of the 10.62 million emissions containment reserve (ECR) allowances. (The CCR is a fixed additional supply of allowances made available for sale if an auction's interim clearing price exceeds $14.88. The ECR is a designated quantity of allowances to be withheld if an auction's interim clearing price is below $6.87.) Additional details are available in the ***Market Monitor Report for Auction 61***.

From *RGGI Press Release*. September 2023.

Singapore, Chile Sign MOU for Carbon Markets

Singapore and Chile signed a Memorandum of Understanding (MOU) to collaborate on carbon markets and carbon pricing. The MOU will include the identification of mutually beneficial projects and the exchange of best practices related to carbon services and trading and ecosystem development.

From *Singapore Business Review*. August 2023.

Nassau Releases Draft Carbon Management Regulations

The Nassau government released draft Carbon Markets and Greenhouse Gases Regulations describing the process for the sale of carbon credits by companies managing those credits. The document provides a draft application form for the registration of a management company and an application to purchase carbon credits. It also lays out the details for companies seeking to engage in emissions reduction initiatives and outlines the companies' responsibilities upon finding any new carbon storage assets within the borders of the Bahamas.

From *The Nassau Guardian*. August 2023.

California and Québec Release Auction Results

California and Québec released the results of the 36th joint cap-and-trade auction of carbon allowances from both jurisdictions. The ***final numbers*** include sales figures and settlement prices for 2023 (current) and 2026 (advance) vintages. The California Cap-and-Trade Program and Québec Cap-and-Trade System are linked, enabling the mutual acceptance of compliance instruments issued by each jurisdiction to be used for compliance with each program.

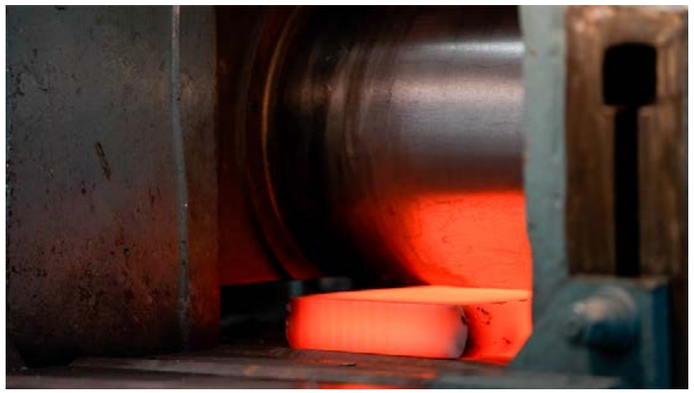
From *California Air Resources Board News Release*. August 2023.

SCIENCE

NETL Researchers Develop Improvements for CO_2 Transport Pipelines

Researchers from NETL's Structural Materials Team ***produced a more robust pipeline material for transporting hydrogen and captured CO_2*** by adding the rare earth element (REE) cerium to create a tougher steel alloy and address two DOE priorities: development of the infrastructure needed for decarbonization and improvement of the critical minerals supply chain. In addition, NETL researchers developed a ***coating technology to protect against corrosion*** in natural gas, hydrogen, and CO_2 pipelines.

From *NETL*. August 2023.



The addition of the REE cerium results in a tougher steel alloy to make pipelines for transporting hydrogen supplies and captured CO_2.

Researchers Add Crushed Volcanic Rock to Soil to Boost CO_2 Storage

According to a study published in ***AGU's journal Earth's Future***, incorporating crushed basalt—a rapidly weathering rock originating from cooled lava—into the soil on farms can help store CO_2. The researchers' model simulated the process of enhanced rock weathering across 1,000 agricultural sites worldwide, spanning from 2006 to 2080, and found that regions with the most promise for this climate strategy are in the warm, wet tropics. The findings also revealed that in just 75 years, these sites could reduce atmospheric CO_2 by 64 gigatons.

From *earth.com*. August 2023.

Study Analyzes CDR Potential in U.S.

A group of researchers, led by the Electric Power Research Institute (EPRI), published a paper analyzing and mapping the CDR potential across the United States. Their ***research*** is based on the Global Change Analysis Model for the United States and is used to analyze how regional resources will influence and be influenced by CDR deployment in service of the U.S. national net-zero targets. The types of CDR primarily examined are direct air capture with permanent storage, bioenergy with carbon capture and storage (BECCS), land-use change, and BECCS liquids (i.e., ethanol and Fischer–Tropsch biofuels with CCS).

From *Carbon Herald*. August 2023.

About DOE'S CARBON TRANSPORT and STORAGE PROGRAM

The **Carbon Transport and Storage Program** at the National Energy Technology Laboratory (NETL) is focused on developing and advancing technologies to enable safe, cost-effective, permanent geologic storage of CO_2, both onshore and offshore, in different geologic settings. The technologies being developed will benefit both industrial and power sector facilities that will need to mitigate future CO_2 emissions. The program also serves to increase the understanding of the effectiveness of advanced technologies in different geologic reservoirs appropriate for CO_2 storage—including saline formations, oil reservoirs, natural gas reservoirs, unmineable coal seams, basalt formations, and organic-rich shale formations—and to improve the understanding of how CO_2 behaves in the subsurface. These objectives are necessary to increasing public confidence in safe, effective, and permanent geologic CO_2 storage.

The ***Carbon Transport and Storage Program Overview*** webpage provides detailed information of the program's structure, as well as links to the webpages that summarize the program's key elements.

Carbon Transport and Storage Program Resources

Newsletters, program fact sheets, best practices manuals, roadmaps, educational resources, presentations, and more information related to the Carbon Transport and Storage Program is available on ***DOE's Energy Data eXchange (EDX) website***.

Get Social with Us

There are several ways to join the conversation and connect with NETL's Carbon Transport and Storage Program:

Disclaimer

About NETL'S CARBON TRANSPORT and STORAGE NEWSLETTER

Compiled by the National Energy Technology Laboratory, this newsletter is a monthly summary of public and private sector carbon transport and storage news from around the world. The article titles are links to the full text for those who would like to read more (note that all links were active at the time of publication).

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