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

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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

NETL Oversees Research to Protect Caprock Integrity at Carbon Storage Sites

An experiment, completed through the U.S. Department of Energy's (DOE) Lawrence Berkeley National Laboratory and its partners, is expected to generate insights into the behavior of faults and other seismic activity when carbon dioxide (CO_2) is injected into geologic formations for storage. Completed at the Mont Terri Underground Research Laboratory in Switzerland, the experiment involved injecting water mixed with CO_2 into a subsurface fault for approximately five hours. The injection caused a controlled CO_2-induced fault slip to determine its impact on the caprock that prevents CO_2 leakage. The novel geophysical field data collected during the injection will provide significant information about fault slip and strain related to CO_2 injection and the effect that CO_2-induced fault activation has on storage reservoir caprocks. The National Energy Technology Laboratory (NETL) provided oversight.

From *NETL*. September 2023.

CONTINUE

ANNOUNCEMENTS

DOE/NETL's CarbonSAFE Initiative Progressing Toward Commercialization

The DOE/NETL-led Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative has funded 24 projects—and is currently negotiating 20 additional projects—throughout the United States to address key gaps on the path toward commercial carbon capture and storage (CCS) deployment. The ***CarbonSAFE Initiative*** began in 2016, building on the knowledge and experience gained from the ***Regional Carbon Sequestration Partnerships' (RCSPs)*** efforts. The vision of CarbonSAFE is to provide examples and data on the development of CCS storage complexes from the feasibility study until the point of injection through the following phases of project progress: ***Integrated CCS Pre-Feasibility***; ***Storage Complex Feasibility***; ***Site Characterization and Permitting***; and, ultimately, ***Construction***.

From *NETL*. September 2023.

NETL's CO_2-SCREEN Attracts Users

To date, CO_2-SCREEN—a tool developed by NETL researchers to estimate the feasibility of storing CO_2 in underground geologic environments—has been downloaded more than 1,900 times by users, including academic institutions and international- and U.S.-based organizations. ***CO_2-SCREEN*** offers a graphical user interface that enables users to enter geologic data and efficiency factor ranges quickly and easily, providing CO_2 storage and efficiency outputs in the form of probability estimates. The tool uses DOE methods and equations as a consistent mechanism for calculating prospective CO_2 storage resources.

From *NETL*. September 2023.

DOE Announces Funding for CO_2-EOR Combined with Carbon Storage

DOE's Office of Fossil Energy and Carbon Management (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. Responses for this ***Funding Opportunity Announcement (FOA)*** are due by December 13, 2023.

From *NETL*. September 2023.

DOE Announces Funding to Accelerate CDR

DOE/FECM announced funding to advance carbon dioxide removal (CDR) technologies. The CDR Purchase Pilot Prize will enable companies to compete for the opportunity to sell CO_2 removal credits directly to DOE, helping to build standards for successful CDR programs and create a market to encourage technology innovation and the growth of the industry. The prize will provide cash awards in the form of offtake agreements from the federal government in four CDR pathways: direct air capture with storage, biomass with carbon removal and storage, enhanced weathering and mineralization, and planned or managed carbon sinks.

From *energy.gov*. September 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 Carbon Capture, Utilization, and Storage (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 the revision of this report (estimated release: spring 2024). Inquiries can be directed to ***NRAP@netl.doe.gov*** with the subject: Rules and Tools Crosswalk.

NETL Geodata Update Includes CCS Database

Since November 2021, demand for NETL's geo-data science expertise to help map and visualize energy data and affiliated environmental, community, and justice data has grown. An example of NETL's analyses and mapping efforts include DOE/FECM's Carbon Capture and Storage Environmental Justice and Social Justice (CCS-EJ-SJ) Database, supporting the need for information and data on environmental, social, economic, and energy justice metrics to support planning and engagement for CCS projects.

From *NETL*. September 2023.

ANNOUNCEMENTS *(cont.)*

DOE Announces Launch of Regional Clean Hydrogen Hubs

DOE announced the launch of seven ***Regional Clean Hydrogen Hubs (H_2Hubs)***, several of which will have a CO_2 transport and storage component. The Appalachian Hydrogen Hub, for example, will leverage the region's (West Virginia, Ohio, Pennsylvania) ample access to low-cost natural gas to produce low-cost clean hydrogen and permanently store the associated carbon emissions.

From *energy.gov*. October 2023.

ADNOC Awards CCUS Project

Adnoc Gas, a subsidiary of Abu Dhabi National Oil Company, awarded the Habshan CCUS project to the UK's Petrofac. Located at the Habshan gas processing plant, about 90 miles southwest of Abu Dhabi, the project is expected to triple Adnoc's carbon capture capacity to 2.3 million metric tons per year.

From *Upstream Online*. October 2023.

Geomaterials Characterization Lab Tour

A new virtual tour video reviews NETL's geomaterials characterization work to support carbon storage projects.

From *NETL YouTube Channel*. September 2023.

CCSA Studies Accelerated Deployment of CCS

The Carbon Capture and Storage Association's (CCSA) Delivery Plan examines the pipeline of potential CCS projects across the United Kingdom to identify the economic opportunities available as well as the hurdles to successful deployment. According to CCSA, there are enough schemes in the pipeline to capture approximately 94 million metric tons of CO_2 per year, which is a 29% increase from 73 million metric tons last year.

From *The Engineer*. September 2023.

GoM Carbon Storage Study Released

CGG—a global technology and high-performance computing company—announced the delivery of the eastern phase of its GeoVerse Carbon Storage Gulf of Mexico Study and the commencement of its westward extension. Combined, the studies provide a map-based assessment of carbon storage opportunities—coupled with a desktop-ready well database and web-based visualization dashboards—for informed and rapid decision-making.

From *World Oil*. October 2023.

Screening and Ranking Tool for CO_2 Storage Sites Launched

Oilfield services company SLB (formerly known as Schlumberger) launched its carbon storage ***screening and ranking solution*** that provides a detailed assessment of CO_2 storage sites. The tool increases confidence in site-selection decisions based on scientific analysis of the long-term integrity and economic potential of an asset. It screens and ranks carbon storage sites using both technical and nontechnical data to provide a detailed assessment of their capacity and economic viability while identifying potential risks.

From *Carbon Herald*. October 2023.

PROJECT AND BUSINESS DEVELOPMENTS

Deep Learning Tool to Ensure Safe Carbon Storage Developed in NETL-Sponsored Project

With NETL support, Zanskar Geothermal and Minerals Inc. concluded a project that developed a deep learning tool for subsurface monitoring that could help ensure the safe storage of CO_2 at geologic sites. The tool was trained on distributed acoustic sensing measurements using convolutional neural networks. This deep-learning approach resulted in a data filter that has better computational efficiency and an improved signal-to-noise ratio relative to other commonly applied filters. This project was funded with a Phase I award through the ***Small Business Innovation Research (SBIR) Program***, which encourages domestic small businesses to engage in federal research and development (R&D) with the potential for commercialization. The technology could be further developed into a real-time monitoring tool, and this project was recently selected for an SBIR Phase II award, where researchers will develop a seismic monitoring workflow that could be deployed at carbon storage sites.

From *NETL*. September 2023.

Licenses Awarded for Carbon Storage in UK North Sea

The North Sea Transition Authority (NSTA) announced a total of 14 companies have accepted 21 licenses for carbon storage in depleted oil and gas reservoirs and saline formations in the North Sea. Combined, the locations have the potential to store approximately 30 million metric tons of CO_2 per year by 2030. The NSTA will assess the response and quality of opportunities in the locations across the United Kingdom (UK) before deciding when to run a second round of their carbon storage licensing process. (The NTSA estimates that as many as 100 storage licenses will be needed to meet the requirements for reaching net-zero.)

From *Offshore Engineer*. September 2023.

PROJECT AND BUSINESS DEVELOPMENTS *(cont.)*

Floating Carbon Storage, Injection Unit Receives Approval

The American Bureau of Shipping awarded Approval in Principle for Bumi Armada's design for a floating carbon storage and injection unit. Bumi Armada's concept is a floating terminal capable of storing and injecting liquified carbon dioxide (LCO_2) into depleted oil and gas fields or aquifers. The unit can receive LCO_2 from various sources, such as electricity generation, manufacturing, and construction.

From *World Oil*. September 2023.

Successful Completion of Carbon Storage Pilot Plant

Canada Nickel Company announced the successful completion of its carbon storage pilot plant, confirming the feasibility study design parameters. In addition, its novel carbon storage process—In-Process Carbonation—was successfully applied to a material from a third-party company.

From *Canada Nickel Company News Release*. October 2023.

More CO_2 Storage Spaced Approved for Project Tundra

The North Dakota Industrial Commission approved a permit for the state's sixth CO_2 storage facility, which is expected to be capable of storing 123 million metric tons of CO_2 over 20 years. The facility will be operated by Dakota Carbon Center West, a subsidiary of Minnkota Power Cooperative, and provides extra CO_2 storage space for Project Tundra, the cooperative's planned project that will capture emissions from the coal-fired Milton R. Young Station in Oliver County, North Dakota.

From *The Bismarck Tribune*. October 2023.

Carbon Storage Survey Project Completed

Shearwater GeoServices completed a carbon storage survey project for TotalEnergies in the Danish North Sea. The survey covered a CO_2 geological storage license awarded to the operator in February 2023.

From *Offshore Magazine*. September 2023.

LEGISLATION AND POLICY

CDR R&D Act Introduced in US House

Legislation to boost investment in research, development, and deployment of different CDR technologies was introduced in the U.S. House of Representatives. ***The Carbon Dioxide Removal Research and Development Act of 2023*** would support 10-year cross-agency R&D and incorporate diverse and innovative technologies, including direct air capture, biological carbon removal, and ocean-based carbon removal. The funding would also establish a National Science Foundation research program to ensure that CDR developments are guided by the best available science and data.

From *Carbon Herald*. September 2023.

Climate Disclosure Bill Signed in California

A climate bill that passed the California state legislature and was signed by the governor requires major companies to publicly disclose their greenhouse gas (GHG) emissions. Under the law, approximately 5,000 companies will be required to report the amount of GHGs directly released into the atmosphere by their operations, as well as the amount of indirect emissions released, such as from employee travel, waste disposal, and supply chains.

From *The Hill*. October 2023.

EMISSIONS TRADING

Global Carbon Credit Investment Report Released

A ***report*** by Trove Research found that investment in carbon credit projects between 2012 and 2022 totaled $36 billion, with half of it occurring in the last three years and more than $3 billion in future investment already committed. According to the report, the investments are expected to deliver more than 1,000 new carbon-reduction projects, ranging from forest protection to CCS.

From *Trove Research*. September 2023.

Indonesia Carbon Credit Trading Platform Inaugurated

Indonesia's president inaugurated the country's first ***carbon emissions credit trading system***, with the first session seeing the exchange of 13 carbon credits (equivalent to nearly 460,000 metric tons of CO_2). The credits were initially priced at 69,600 Indonesian rupiah (approximately USD 4.48) per ton and were traded on the Indonesia Stock Exchange's dedicated carbon trading platform. Indonesia has pledged to achieve carbon neutrality by 2060.

From *Carbon Herald*. September 2023.

EMISSIONS TRADING *(cont.)*

Zimbabwe, UAE Sign Carbon Credit MOU

The United Arab Emirates (UAE) Global Carbon Investments (GCI) signed a memorandum of understanding (MOU) with the Ministry of Environment, Climate, and Wildlife to unlock the value of Zimbabwe's carbon sinks and carbon mitigation measures. The MOU will be used to finance the development and sale of future carbon credits, in the form of Internationally Transferable Mitigation Outcomes, aligned with Article 6 of the Paris Agreement. Under the agreement, financing will be directed toward the prefinancing of carbon credit projects in Zimbabwe that will be developed by Blue Carbon, a GCI fully-owned subsidiary and project developer specializing in nature-based solutions.

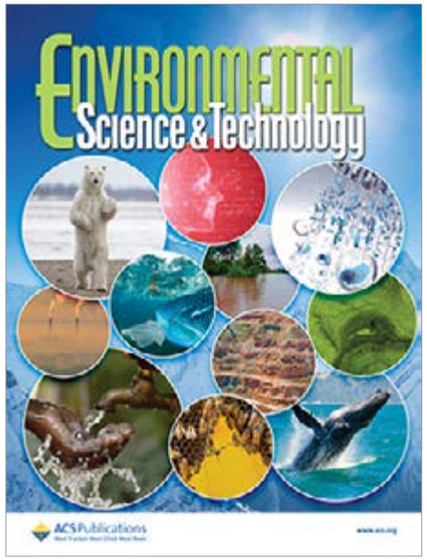
From *The Herald*. October 2023.

SCIENCE

New Ions Facilitate Low-Energy Carbon Storage

Leveraging technology powered by humidity, as discussed in their recent article published in ***Environmental Science & Technology***, a Northwestern University research team discovered several new ions that facilitate low-energy carbon storage. The materials being developed for direct air carbon capture (DAC) are utilized in a "moisture-swing" technique, that captures CO_2 at low humidities and releases it at high humidities. This research enhances our understanding of DAC and offers a more energy-efficient carbon capture method compared to traditional techniques. (Hegarty, J. et al. (2023). Expanding the library of ions for moisture-swing carbon capture. Environmental Science & Technology. ***https://doi.org/10.1021/acs.est.3c02543***)

From *SciTechDaily*. October 2023.



Researchers Use CCU Technology to Recycle Industrial CO_2

Korean researchers are studying carbon capture and utilization (CCU) processes that use waste materials or abundant natural resources as raw materials to ensure their economic feasibility. The Chung-Ang University study, published in the ***Chemical Engineering Journal***, discussed the utilization of industrial CO_2 and dolomite for the production of two commercially viable products: calcium formate and magnesium oxide. (Yoon, H. et al. (2023). Kinetic conversion of magnesium and calcium ions of dolomite into useful value-added products using CO_2. Chemical Engineering Journal, 469, 143684. ***https://doi.org/10.1016/j.cej.2023.143684***)

From *Phys.org*. September 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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