NATIONAL ENERGY TECHNOLOGY LABORATORY

MAY 2024

CARBON CAPTURE NEWSLETTER

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

A contingent of staff from NETL and the U.S. Department of Energy (DOE) Office of Fossil Energy Carbon Management (FECM) recently toured the Technology Centre Mongstad (TCM). NETL and DOE/FECM personnel with their TCM hosts, from left, are: Gregory Cooney, DOE FECM; Katharina Daniels, NETL; Sara Hamilton, DOE FECM; Blair MacMaster, TCM; Ron Munson, NETL; Raj Gaikwad, DOE FECM; Jeffery Hoffmann, DOE FECM; and Sundus Akhter, TCM.

HIGHLIGHTS

The newsletter is compiled by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon capture.

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NETL Team's Whirlwind Visit to Norway Ensures CO_2 Capture Projects Moving Forward

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) and the National Energy Technology Laboratory (NETL) visited Norway to ensure key projects supported by NETL remain on track to capture greenhouse gases (GHGs) from industrial sources. The focus of the trip was the opportunity to meet with partners at the Technology Centre Mongstad (TCM), an open-access test center for developing carbon capture technologies. The DOE/NETL contingent spent a portion of its TCM visit touring a test unit developed by industry partner InnoSepra Inc. The technology, which received $4 million in DOE research funding and is managed by NETL, is a transformational sorbent-based process designed to significantly reduce carbon dioxide (CO_2) capture costs from power plant and industrial flue gases. A representative of ION Clean Energy Inc. led a tour of a test unit at TCM where ION is testing and scaling-up the ICE-31 solvent. Through a series of projects made possible with DOE funding and NETL oversight, the company has matured this carbon capture system from early-stage research to pilot-scale testing. The DOE/NETL contingent also toured SINTEF, one of Europe's largest independent research organizations, before making the long flight back to the United States.

Interagency News and Updates

FECM Announces Intent to Launch Voluntary CDR Purchasing Challenge

FECM issued a notice of intent (NOI) to launch a Voluntary Carbon Dioxide Removal Purchasing Challenge ("Challenge"). The Challenge will call on external organizations to join DOE in purchasing high-quality carbon dioxide removal (CDR) credits, following DOE's recent commitment to procure $35 million through the CDR Purchase Pilot Prize. The Challenge's innovative public-private partnership structure aims to catalyze CDR credit purchases and improve transparency of the CDR credit supply.

RECS 2024 is Now Accepting Applications for its 20th Annual Program

FECM and NETL invite graduate students and early career professionals who are interested in carbon capture, utilization, and storage (CCUS) to apply for the 2024 Research Experience in Carbon Sequestration (RECS) Program. RECS 2024 will include interactive content on a range of CCUS topics. It will incorporate site tours at a power plant, coal mine, carbon capture facility, direct air capture (DAC) facility, and injection wellhead, and include geology field exercises, live lectures, discussion sessions, and group projects. RECS 2024 is scheduled for July 21–30, 2024, in Colorado and Wyoming. The deadline to apply is May 15, 2024. Visit the RECS website for more information.

National Journal Highlights Features of NETL's CCS Pipeline Route Planning Database

NETL's Carbon Capture and Storage (CCS) Pipeline Route Planning Database—a one-stop-shop for U.S. geospatial data resources collected to help strategically plan safe and sustainable routes for transportation of CO_2 from where it is captured to where it can be stored underground or converted into other products—was the subject of a paper in the science journal Data in Brief. The CCS Pipeline Route Planning Database helps fill data gaps in current research and planning efforts, offering a critical resource for future research, and provides novel datasets not previously available in a geospatial format.

Biden Administration Announces Funding to Transform America's Industrial Sector, Strengthen Domestic Manufacturing, and Reduce GHG Emissions

DOE announced up to $6 billion for 33 projects across more than 20 states to decarbonize energy-intensive industries, reduce industrial GHG emissions, support good-paying union jobs, revitalize industrial communities, and strengthen the nation's manufacturing competitiveness. Funded by the Bipartisan Infrastructure Law (BIL) and Inflation Reduction Act, the projects will focus on the highest-emitting industries where decarbonization technologies will have the greatest impact, including aluminum and other metals, cement and concrete, chemicals and refining, iron and steel, and more. Together, the projects are expected to reduce the equivalent of more than 14 million metric tons of CO_2 emissions each year.

Interagency News and Updates (continued)

Scaling Carbon Capture for Hard-to-Abate Industries in the U.S. and Across the Globe

FECM released a Request for Information (RFI) for Industrial Deployment and Demonstration Opportunities for Carbon Capture Technologies. Through the RFI, FECM seeks input from key partners (domestic and international) on what is needed to accelerate deployment of CCUS for industrial systems to support the energy transition, eliminate GHG emissions, produce clean energy, create well-paying union jobs, and enable a net-zero carbon emissions economy by 2050, all while prioritizing environmental equity and support for underserved communities. The information being sought is intended to assist DOE in the planning of priorities and initiatives to catalyze the development, demonstration, and deployment of CCUS for industrial decarbonization.

NETL/FECM Visit to Switzerland Focuses on DAC Technology

Dave Luebke, technical director of the DAC Center at NETL, and Rory Jacobson, acting division director for CDR at FECM, recently met with industry and scientific leaders in Switzerland to discuss accelerating the commercialization of critical technologies for DAC. Luebke and Jacobson first met with Marco Mazzotti, a professor of process engineering at ETH Zurich and one of the world's top DAC experts. The second stop was a visit to Climeworks, where Luebke and Jacobson met with Stefan Schenk, head of testing. Climeworks specializes in the development of DAC technologies and opened the world's first commercial carbon capture facility in Switzerland in 2017. Since 2021, Climeworks has operated the world's first large-scale, commercial DAC-plus-storage facility in Iceland.


Direct Air Capture technology rendering (Source: NETL)

OCED Issues Funding to DAC Hub Project Cypress

DOE's Office of Clean Energy Demonstrations (OCED) announced an award of more than $50 million as part of its Regional DAC Hubs Program to Project Cypress. This first portion of funding is for activities in the initial project phase, which is expected to take two to three years and includes planning, design, and community and labor engagement activities. OCED is working with Battelle to manage the project and with technology providers Climeworks Corporation and Heirloom Carbon Technologies. Climeworks employs a solid sorbent capture and thermal regeneration technology, while Heirloom utilizes limestone to absorb CO_2 as it is repeatedly cycled through heating, hydration, and exposure to air. Project Cypress plans to transport the captured CO_2 to a partner who has obtained a permit for permanent geological storage. For more information about this award, including the community benefits commitments, please visit the project selection webpage.

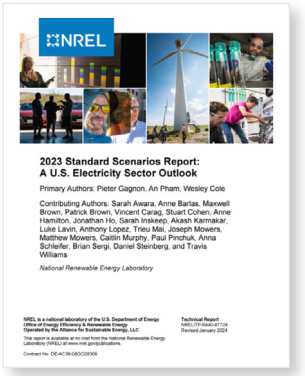
DAC Center Fact Sheet Available

FECM's NETL DAC Center fact sheet provides an overview of the one-of-a-kind facility dedicated to supporting private sector technology maturation by leveraging national laboratory competencies and knowledge through collaborative research efforts. With testing beginning in 2023, the DAC Center aims to accelerate the commercialization of innovative DAC technologies that are technically and economically viable to achieve the nation's goal of net-zero emissions by 2050.

Interagency News and Updates (continued)

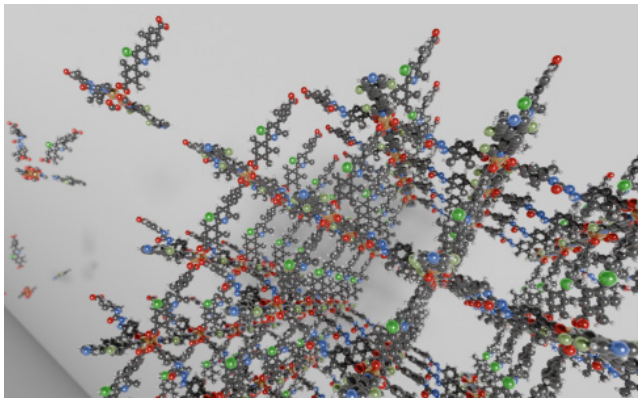
NREL Releases the 2023 Standard Scenarios

The National Renewable Energy Laboratory (NREL) just released its 2023 Standard Scenarios, which shows how the U.S. electricity sector might change through 2050. The scenarios can guide power system planning and enable dialogue using a common set of assumptions. The Standard Scenarios is one of several annually updated NREL products designed to support decisionmakers in the U.S. electricity sector. Every year, NREL uses its Regional Energy Deployment System model to create the new scenarios, taking into account the latest projections for technology costs and performance from NREL's Annual Technology Baseline. Now in its ninth installment, the Standard Scenarios includes 53 possible futures that are available to view or download from NREL's Scenario Viewer.



Argonne Scientists Use AI to Identify New Materials for Carbon Capture

Designing metal-organic frameworks (MOFs) with optimal carbon selectivity and capacity is a significant challenge. Until now, MOF design has relied on painstaking experimental and computational work. This can be costly and time-consuming. By exploring the MOF design space with generative artificial intelligence (AI), a team at DOE's Argonne National Laboratory was able to quickly assemble, building block by building block, more than 120,000 new MOF candidates within 30 minutes. They then turned to the Delta supercomputer at the University of Illinois Urbana-Champaign to carry out time-intensive molecular dynamics simulations, using only the most promising candidates. The goal is to screen them for stability, chemical properties, and capacity for carbon capture.



Scientific visualization of the AI-guided assembly of a novel metal organic framework with high carbon dioxide adsorption capacity and synthesizable linkers. Building blocks, predicted by generative AI, are shown on the left, while the final AI-predicted structure is shown on the right. (Image by Xiaoli Yan/University of Illinois Chicago and the ALCF Visualization & Data Analytics Team.)

NETL Team Shares Expertise at Carbon Capture Houston Event

NETL experts in the field of carbon management participated in the CCUS conference in Houston, Texas, where leaders from research institutions, universities, and industry demonstrated the ongoing need for skilled petroleum geologists, geophysicists, and engineers to help define the future of carbon management. Traci Rodosta, senior program manager for Carbon Infrastructure at FECM, was a featured speaker. Amanda Raddatz, director for Carbon Transport and Storage at FECM, participated as a keynote speaker. Also presenting from FECM were Gilly Rosen, Robert Smith, and Rajesh Pawar. Several NETL researchers and FECM staff served as presenters and NETL's work was featured in a conference exhibit booth.

Explore Career Opportunities with FECM

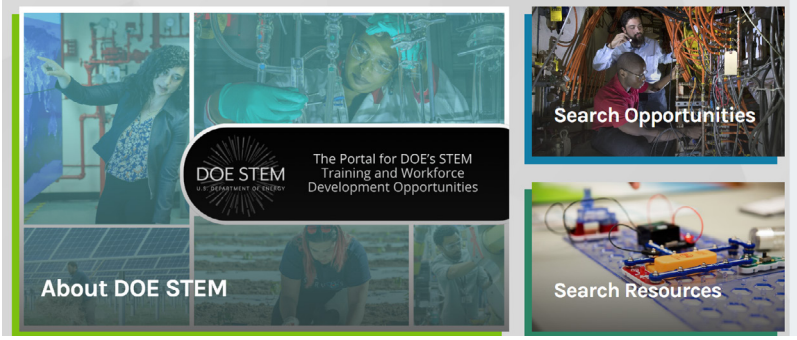
FECM is looking for enthusiastic, driven professionals to join the team and help define the future of energy. Sign up for FECM career alerts now to receive the newest vacancies. Text FECM CAREERS to 468311 to receive text message alerts or subscribe here.

Interagency News and Updates (continued)

Explore Career Opportunities at NETL

At the core of NETL's success is its commitment to hiring the right people for the right positions. DOE's only government-owned and government-operated national laboratory offers exciting federal careers in research and engineering, technical project management, procurement, finance and budget, legal, and administrative support. Learn more at NETL Careers.

DOE STEM Portal



DOE is building pathways for a diverse workforce to pursue science, technology, engineering, and mathematics (STEM) careers. DOE seeks to engage learners at all levels to promote STEM and energy literacy and to attract, inspire, and develop a STEM identity and a sense of belonging in STEM. DOE is committed to promoting and supporting people from all backgrounds and perspectives, including individuals and communities that have been historically underrepresented in STEM fields and activities at DOE.

Bipartisan Infrastructure Law Hub

BIL HUB
Resources for the Bipartisan Infrastructure Law

The BIL represents the most dramatic changes to DOE since its founding in 1977. The BIL is standing up 60 new DOE programs, including 16 demonstration and 32 deployment programs, and expand funding for 12 existing research, development, demonstration, and deployment programs. NETL's BIL Hub provides information on the BIL, including links to the Guidebook, DOE's Clean Energy Corps, DOE's Applicant Portal, and DOE's Grid Resilience Program, as well as information on solicitations and funding opportunities.

U.S. and International Events

Conference: CO_2 Capture, Storage & Reuse 2024

CO_2 Capture, Storage & Reuse 2024, to be held May 15–16, 2024, in Copenhagen, Denmark, will focus on presentations, industry panel discussion, technical insights, and networking. The day before the main event (on May 14, 2024), a limited number of conference participants will have a unique opportunity to visit the state-of-the-art Amager Bakke facility managed by ARC.

U.S. and International Events (continued)

Conference: Carbon Unbound

Carbon Unbound USA 2024, to be held May 21–23, 2024, will bring together 400 global pioneers of engineered and nature-based CDR solutions to discuss the most pressing challenges, forge cross-industry partnerships, and shine a light on the next-generation solutions needed to reach gigaton scale. The event will include live sessions, breakout discussions, and the opportunity to schedule one-on-one meetings onsite with other like-minded leaders and speakers.

Conference: Carbon Capture & Storage Summit

The Carbon Capture & Storage Summit, to be held June 10–12, 2024, in Minneapolis, Minnesota, will offer attendees a comprehensive look at the economics of carbon capture and storage, the infrastructure required to make it possible, and the financial and marketplace impacts to participating producers.

Conference: Carbon Capture Technology Expo

The Carbon Capture Technology Expo, to be held June 26–27, 2024, in Houston, Texas, will unveil the latest current and emerging technologies from some of the sector's leading experts and energy leaders while providing a showcase for innovative models that can capture carbon's potential by turning CO_2 byproducts into profitable applications for concrete, carbon fiber, polymers, food, fertilizers, liquid fuels, chemicals, graphene, and more.

Conference: Carbon Capture World Expo & Conference

The Carbon Capture World Expo & Conference, to be held June 26–27, 2024, in Essen, Germany, brings together carbon capture experts from the global marketplace to provide an opportunity to meet with all parties—technology providers, equipment builders, engineering companies, and end users—determined to resolve anthropogenic CO_2 emissions.

Conference: Carbon Capture APAC 2024

Carbon Capture APAC 2024, to be held July 9–10, 2024, is Asia-Pacific's (APAC) leading event for CCUS. This conference brings together international governments and CCUS industry decision-makers to foster regional exchange and enhance industry dynamics. The discussions cover dialogues on topics such as policy, market models, supply chain, technology, international cooperation, and the carbon economy.

Conference: 2024 FECM/NETL Carbon Management Research Project Review Meeting

The 2024 FECM/NETL Carbon Management Research Project Review Meeting, to be held Aug. 5–9, 2024, in Pittsburgh, PA, will provide attendees with a chance to share in the knowledge and insights gained by more than 150 DOE-sponsored research and development (R&D) projects from the following FECM R&D programs: *Point Source Carbon Capture*, *Carbon Dioxide Removal*, *Carbon Conversion*, and *Carbon Transport and Storage*. A mixture of plenary, multi-topic breakout, and interactive poster sessions will be used to share research results and provide opportunities for discussion and collaboration on the subject research efforts, both domestic and international. In addition to the project researchers, participants may include employees of other government agencies, electric utilities, research organizations, and industry.

U.S. and International Events (continued)

Conference: GHGT-17

Registration for the 17th Greenhouse Gas Control Technologies Conference (GHGT-17) is now open! GHGT-17 will be held Oct. 20–24, 2024, in Calgary, Alberta, Canada. GHGT-17 is the premier international conference on CCUS. The GHGT conference series is at the forefront of advancing low-carbon solutions to combat climate change. GHGT-17 will host more than 1,500 delegates from across the world to see 355 presentations and 500+ e-posters, keynote speeches, and technical plenary talks.

Conference: National Carbon Capture Conference & Expo

The National Carbon Capture Conference & Expo, to be held Nov. 19–20, 2024, is designed specifically for companies and organizations advancing technologies and policy that support CDR from all sources, including fossil fuel-based power plants, ethanol production plants, and industrial processes, as well as directly from the atmosphere. The program will focus on research, data, trends, and information on all aspects of CCUS with the goal to help companies build knowledge, connect with others, and better understand the market and carbon utilization.

Business and Industry News

NCCC Announces First Cryogenic Carbon Capture Testing

Carbon America is commencing testing of its FrostCCTM cryogenic CO_2 separation method at the National Carbon Capture Center (NCCC). The FrostCC technology utilizes cryogenic cooling to capture CO_2 directly from industrial sources, providing a more sustainable alternative to conventional carbon capture methods. Unlike traditional methods, FrostCC does not require any outside refrigerant to operate. Instead, the technology involves compressing and expanding the flue gas flow with recuperative heat integration, resulting in a flue gas that cools itself. A key advantage of FrostCC is its ability to freeze CO_2 along with almost all other pollutants in the flue gas. The captured CO_2 is then stored as a liquid, making it easier to transport and store.

Google Sets Aside Funding for CDR Credits, Becomes First Company to Answer DOE Call

Google plans to procure a minimum of $35 million worth of CDR credits within the upcoming year. The pledge comes after DOE announced in September 2023 that it plans to provide $35 million for establishing the first building blocks of a CDR market. DOE shared details about the benefits of the initiative, as well as details about how interested companies can join up. With Google joining the challenge and making an advance commitment to buy CDR credits, there is an expectation that other tech giants might also follow suit. Amazon and Microsoft have been making multiple purchases throughout 2023 of such credits directly from companies that issue them.

W&J Center Hosting Webinar on Carbon Capture

The Center for Energy Policy and Management (CEPM) at Washington & Jefferson College (W&J) has resumed its Energy Lecture Series. CEPM hosted “The Future of Carbon Capture,” a free webinar focusing on the basics of carbon capture and DAC. As the featured speaker, David Luebke explained the basics of CCS and how point-source CCS and DAC can help the nation reduce its CO_2 atmospheric levels. He also talked about NETL’s DAC on its Pittsburgh campus, which was established in 2023 as a federal government initiative.

Publications

Nanoengineering membrane surfaces: A new paradigm for efficient CO_2 capture

LEIQING HU, VINH T. BUI, NARJES ESMAEILI, HAIQING LIN, CARBON CAPTURE SCIENCE & TECHNOLOGY, VOLUME 10, MARCH 2024.

Combined carbon capture and catalytic oxidative dehydrogenation of propane to propylene conversion through a plug-flow dual-phase membrane reactor

KANGKANG ZHANG, SHICHEN SUN, KEVIN HUANG, CHEMICAL ENGINEERING JOURNAL, VOLUME 481, ISSUE C, FEB. 1, 2024. (SUBSCRIPTION MAY BE REQUIRED.)

Investigation of a Hybrid Carbon Capture System at a NGCC Power Plant that Performs Direct Air Capture During Off-Peak Hours

KATHERINE HORNBOSTEL, ADVANCED RESEARCH PROJECTS AGENCY – ENERGY, JAN. 24, 2024.

Modeling and Techno-Economic Optimization of a Tetraamine-Appended Metal–Organic Framework for NGCC-Based CO_2 Capture Using Fixed Bed Contactors

RYAN HUGHES, DAISON YANCY-CABALLERO, MIGUEL ZAMARRIPA-PEREZ, BENJAMIN OMELL, MICHAEL MATUSZEWSKI, DEBANGSU BHATTACHARYYA, ENERGY AND FUELS JOURNAL, VOLUME 38, ISSUE 3, JAN. 18, 2024. (SUBSCRIPTION MAY BE REQUIRED.)

An effective air–liquid contactor for CO_2 direct air capture using aqueous solvents

ABISHEK KASTURI, GYOUNG GUG JANG, ADEOLA DONA-TELLA AKIN, AMIEE JACKSON, JIHEON JUN, DIĀNA STAMBERGA, RADU CUSTELCEAN, DAVID S. SHOLL, SOTIRA YIACOUMI, COSTAS TSOURIS, SEPARATION AND PURIFICATION TECHNOLOGY, VOLUME 324, NOV. 1, 2023. (SUBSCRIPTION MAY BE REQUIRED.)

Climate vs Energy Security: Quantifying the Trade-offs of BECCS Deployment and Overcoming Opportunity Costs on Set-Aside Land

ELENA BLANC-BETES, NURIA GOMEZ-CASANOVAS, MELANNIE D. HARTMAN, TARA W. HUDIBURG, MADHU KHANNA, WILLIAM J. PARTON, AND EVAN H. DELUCIA, ENVIRONMENTAL SCIENCE AND TECHNOLOGY, VOLUME 57, ISSUE 48, NOV. 7, 2023. (SUBSCRIPTION MAY BE REQUIRED.)

About DOE Carbon Capture:

DOE/NETL is developing the next generation of advanced CO_2 capture technologies through NETL's Point Source Carbon Capture Program (PSCC) and advancing a diverse set of CDR approaches to directly remove CO_2 emissions from the atmosphere through NETL's Carbon Dioxide Removal Program.

The Digital Compendium of Carbon Capture Technology provides a technical summary of the DOE/NETL's Carbon Capture Program, assembling carbon dioxide capture technology research and development (R&D) descriptions in a searchable database.

Carbon Capture Reference Materials

- Point Source Carbon Capture Program Fact Sheet
- Carbon Dioxide Removal Program Fact Sheet
- Carbon Capture Infographics
- Interactive Project Maps: PSCC and CDR
- Compendium of Carbon Capture Technology
- Carbon Dioxide Capture Handbook
- CCSI^2
- Systems Analysis
- Conference Proceedings
- Accomplishments Posters: PSCC and CDR

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