NATIONAL ENERGY TECHNOLOGY LABORATORY

JUNE 2024

CARBON CAPTURE NEWSLETTER

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

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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2024 FECM/NETL Carbon Management Research Project Review Meeting

Registration is now open for the 2024 Office of Fossil Energy and Carbon Management (FECM)/National Energy Technology Laboratory (NETL) Carbon Management Research Project Review Meeting, to be held Aug. 5–9, in Pittsburgh, Pennsylvania. This meeting will provide attendees a chance to share in the knowledge and insights gained by more than 150 U.S. Department of Energy (DOE)-sponsored research and development (R&D) projects from the following programs: Point Source Carbon Capture (PSCC), Carbon Dioxide Removal (CDR), 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 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. The full meeting is open to the public, including foreign national attendees, and will consist solely of publicly available information.

Interagency News and Updates

NETL-Supported Technology for Capturing CO_2 From NGCC Power Plant Flue Gas Set for Key Testing

NETL experts and representatives of DOE visited North Carolina to review final preparations to ship and test a lower-cost transformational technology developed by CORMETECH Inc. that is designed to capture at least 95% of carbon dioxide (CO_2) from the flue gas of natural gas combined cycle (NGCC) power plants. The technology will be tested at the National Carbon Capture Center (NCCC) in Alabama. CORMETECH received funding from DOE/NETL to develop the technology for the project *Bench Scale Test of a Polyethyleneimine Monolith Carbon Capture Process for Natural Gas Combined Cycle Point Sources (DE-FE0032138)*. NETL supported the project through its PSCC Program.

NETL experts and representatives of DOE visited North Carolina to review final preparations to ship and test a lower-cost transformational technology developed by CORMETECH Inc.

DOE-Announced Funding Supports CDR

The Direct Air Capture (DAC) Pre-Commercial Energy Program for Innovation Clusters (EPIC) Prize is one of several prize competitions hosted by DOE and funded by the Bipartisan Infrastructure Law (BIL) to support breakthrough DAC technologies that demonstrate strong potential to accelerate economic support and expand domestic CDR. FECM announced five finalists of the "Move It" Phase of the prize to receive a total of $1.5 million for developing commercialization programs that support technologies to reduce CO_2 emissions by removing it directly from the atmosphere. Each finalist team will receive $300,000 in cash prizes and is eligible to advance to the "Prove It" Phase of the prize competition.

NETL CDR Expert Highlights DAC Hub Opportunities

NETL's Andy Jones, technology manager for the CDR Program, shared details of how DOE intends to kick-start a nationwide network of large-scale CDR sites using DAC technology to address legacy CO_2 pollution and complement rapid emissions reductions. Jones presented the information during a webinar hosted by gener8tor, a startup accelerator and venture capital firm that received funding through the DAC EPIC Prize. He began his panel presentation by describing the pathways DOE outlined for CDR in its Carbon Negative Shot and also spoke on NETL's new DAC Center.

NETL's Andy Jones shared details on regional DAC Hub opportunities during a webinar.

Interagency News and Updates (continued)

DOE Invests Funding for Projects to Advance Carbon Capture Technologies That Decarbonize Industrial Processes and Produce Valuable Products

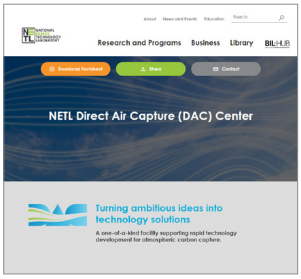
FECM announced $8 million in federal funding for 14 projects to advance technologies that capture CO_2 from industrial facilities and power plants and convert them into valuable products. Six projects will focus on advancing R&D to use CO_2 captured from sources such as industrial and power generation facilities to produce algae-derived, value-added products. Eight projects will seek to advance oxygen-based approaches such as oxy-combustion and chemical looping, which could lead to reductions in CO_2 emissions associated with industrial production processes. NETL will manage the selected projects.

7th Post-Combustion Capture Conference (PCCC-7) Proceedings Now Available

The 7th edition of the Post-Combustion Capture Conference (PCCC-7) was held in September 2023 and jointly hosted by the International Energy Agency Greenhouse Gas R&D Programme, DOE and NETL, and sponsored by Worley, Shell and Mitsubishi Heavy Industries. Conference proceedings now available online include essential highlights from the conference keynotes, technical sessions and side events.

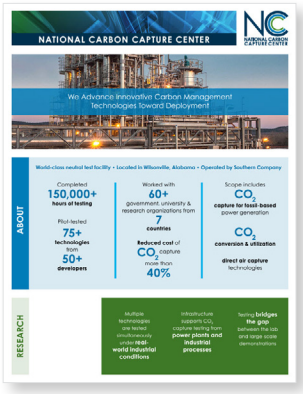
NETL DAC Center Website Launched

The NETL DAC Center's mission is to commercialize innovative DAC technologies and provide the testing facilities and national laboratory support to accelerate technically and economically viable DAC solutions. As part of the effort, a website was launched to provide details regarding the DAC Center's testing capabilities, partnering opportunities, facility overview, team overview and related news, along with a fact sheet.



NCCC Fact Sheet Now Available

NCCC is working to accelerate the commercialization of advanced technologies to reduce greenhouse gas (GHG) emissions. NCCC has worked with more than 60 government, university, and research organizations from seven countries. As a unique test bed for third-party developers, NCCC bridges the gap between laboratory research and large-scale demonstrations. The state-of-the-art facilities provide realistic industrial operating conditions and the infrastructure to evaluate promising technologies for scale-up and future commercial deployment. View a site map and details of NCCC testing structure and details on NCCC developers.



Interagency News and Updates (continued)

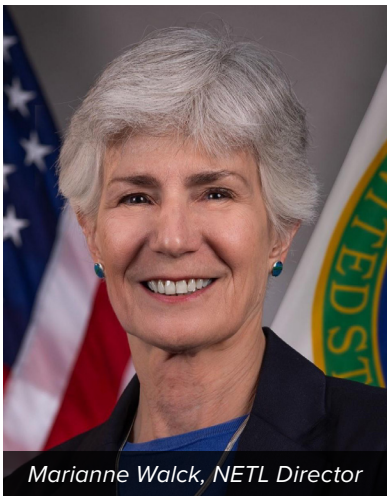
NETL Welcomes New Chief Operating Officer

Heather Quedenfeld has been named chief operating officer of NETL. During her 32 years of federal service, Quedenfeld has worked in all technology program-related areas, resulting in diverse experience at NETL. She has held numerous senior-level positions, including acting chief operating officer, deputy director for the Technology Development Center, associate director for Carbon Management research, acting chief of staff for the laboratory director, and acting lead for the Office of Science and Technology Career Management. Quedenfeld holds a bachelor's degree in mechanical engineering from Penn State University and a master's degree in industrial engineering from West Virginia University. As chief operating officer, Quedenfeld will provide strategic direction, leadership and management of NETL's operations, support functions and services.

Heather Quedenfeld, NETL Chief Operating Officer

NETL Director Marianne Walck Elected 2023 AAAS Fellow

The American Association for the Advancement of Science (AAAS) elected NETL Director Marianne Walck as a 2023 AAAS Fellow for distinguished contributions and technical excellence in geophysics, earth sciences, and energy and climate science; strategic leadership at two national laboratories; and unwavering diversity, equity, and inclusion leadership and advocacy. Walck leads NETL in its mission to drive innovation and deliver solutions for an environmentally sustainable and prosperous energy future. A tradition dating back to 1874, election is a lifetime honor. AAAS Fellows have included notable scientists, engineers, and science advocates such as W.E.B DuBois, Maria Mitchell, Steven Chu, Ellen Ochoa, Irwin M. Jacobs, Alan Alda, Mae Jemison and Ayanna Howard. Walck is among the 502 scientists, engineers and innovators who have been elected 2023 Fellows for their scientifically and socially distinguished achievements throughout their careers.



Marianne Walck, NETL Director

Celebrating Women Leaders at NETL

At NETL, women play a vital role in all aspects of advancing the laboratory's critical mission. Whether they are working hands-on in scientific research or ensuring that NETL operations run smoothly, the laboratory's ground-breaking work would not be successful without the exceptional women of NETL's workforce. In honor of Women's History Month, NETL is highlighting the following outstanding women leaders: Tammie Borders; Patcharin Burke, Ph.D.; Colleen Butcher; Deborah Buterbaugh; Heidi Dahmer; Pierina Fayish; Alexandra Hakala, Ph.D.; Melinda Kennedy; Allyn Milojevich, Ph.D.; Ranjani Siriwardane, Ph.D.; Jan Steckel, Ph.D.; Maria Vargas; Marianne Walck, Ph.D.; and Jacqulyn Wilson.

Interagency News and Updates (continued)

DOE STEM Portal

DOE is building pathways for a diverse workforce to pursue careers in science, technology, engineering and mathematics (STEM). 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.

Explore Career Opportunities with FECM

FECM is looking for enthusiastic, driven professionals to join the team and help define the future of energy. Learn more about FECM's *Workforce Programs* and sign up for FECM career alerts to receive the newest vacancies. Text FECM CAREERS to 468311 to receive text message alerts or subscribe here.

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.

Bipartisan Infrastructure Law Hub

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 is expanding 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: 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, in Melbourne, Australia, is Asia-Pacific's (APAC) leading event for carbon capture, utilization and storage (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.

U.S. and International Events (continued)

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

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FECM / NETL
Carbon Management
Research Project Review Meeting

Conference: GHGT-17

The 17th Greenhouse Gas Control Technologies (GHGT) Conference, to be held Oct. 20–24, 2024, in Calgary, Alberta, Canada, is the principal international conference on GHG mitigation technologies. The GHGT conferences are held every two years in member countries, rotating between North America, Europe and Asia. Each conference is a forum for technical discussions related to the field of GHGT.

Carbon Capture Technology Expo Europe

Carbon Capture Technology Expo Europe, to be held Oct. 23–24, 2024, in Messe Hamburg, Germany, is a solutions-driven forum that will discuss the development of new carbon capture technologies and propel carbon capture into the mainstream for stationary and mobile applications. The two-day event will explore how to rapidly accelerate the deployment and commercialization of CDR technologies as a key solution on the pathway to net-zero carbon emissions.

2024 National Carbon Capture Conference & Expo

The 2024 National Carbon Capture Conference & Expo, to be held Nov. 19–20, 2024, in St. Paul, Minnesota, is designed 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

LLNL Explores Carbon Capture With Wineries

A team at Lawrence Livermore National Laboratory (LLNL) recently completed a carbon storage proof-of-concept demonstration at the Continuum Estate winery in California. Fermenting wine grapes in California alone produce some 450,000 tons of CO_2 per year, according to LLNL, equivalent to the annual emissions of almost 100,000 cars. The project piped fermentation gases through an absorber tower that, through specialized internal shapes, allowed the CO_2 from fermenting wine grapes to react with a solvent. The reaction produced a mineral called nesquehonite that holds the carbon. Compared to the emissions of a power plant, composed of about 4% CO_2, the gases from the fermenters are almost pure CO_2, allowing for carbon capture with very low power requirements.

Oregon State University Scientists Discover Metal Capable of DAC

Oregon State University scientists studying ways to filter GHGs from the air recently discovered that when molecules of the metal vanadium are bound with oxygen molecules as peroxide, they can pull CO_2 from the air. The carbon molecules can be siphoned off using a small amount of energy that is then funneled into other uses, like making limestone for buildings or enhancing the atmospheric carbon in greenhouses, accelerating plant growth. The process could help improve nascent technologies in capturing CO_2 from the air. The discovery was published in Chemical Science in December 2023. The project received funding in 2021 from DOE.

Finding New Chemistry to Capture Double the Carbon

Pacific Northwest National Laboratory (PNNL) scientists were surprised to find that a familiar solvent is even more promising than originally anticipated. New details about the solvent's underlying structure suggest that the liquid could hold twice as much CO_2 as previously thought. The newly revealed structure could also hold the key to creating a suite of carbon-based materials that could help keep even more CO_2 out of the atmosphere. The PNNL team developed the solvent several years ago and has studied it in a variety of scenarios. The team has worked to dial down the costs of using the solvent and turn up its efficiency. The work was published in *Nature Chemistry*.

An established carbon capture solvent can form clusters that could significantly increase the amount of carbon dioxide stored.

(Photo by Andrea Starr; Composite image by Cortland Johnson | Pacific Northwest National Laboratory)

Publications

Isotherm modeling and techno-economic analysis of a TSA moving bed process using a tetraamine-appended MOF for NGCC applications

Daison Yancy-Caballero, Ryan Hughes, Miguel A. Zamarripa, Benjamin Omell, Michael Matuszewski, Debangsu Bhattacharyya, INTERNATIONAL JOURNAL OF GREENHOUSE GAS CONTROL, VOLUME 128, 2023. (SUBSCRIPTION MAY BE REQUIRED.)

A generative artificial intelligence framework based on a molecular diffusion model for the design of metal-organic frameworks for carbon capture

Hyun Park, Xiaoli Yan, Ruijie Zhu, Eliu A. Huerta, Santanu Chaudhuri, Donny Cooper, Ian Foster, Emad Tajkhorshid, COMMUNICATIONS CHEMISTRY, VOLUME 7, ISSUE 21, FEB. 14, 2024.

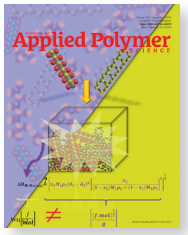
Future of hydrogen in the U.S. energy sector: MARKAL modeling results

Nadejda Victor, Christopher Nichols, APPLICATIONS IN ENERGY AND COMBUSTION SCIENCE, VOLUME 18, JUNE 2024.

Performance and Cost Potential for Direct-Fired Supercritical CO_2 Natural Gas Power Plants

Sandeep Pidaparti, Charles White, Eric Liese, Nathan Weiland, PRESENTED AT THE 5TH EUROPEAN SUPERCRITICAL CO_2 CONFERENCE FOR ENERGY SYSTEMS, MARCH 14, 2023.

Understanding the performance of membrane for direct air capture of CO_2



Palash Panja, Chamila Manankandayalage, Maksudul M. Alam, Milind Deo, JOURNAL OF APPLIED POLYMER DESIGN, VOLUME 141, ISSUE 3, JAN. 15, 2024. (SUBSCRIPTION MAY BE REQUIRED.)

Engineering Study of Svante's Solid Sorbent Post-Combustion CO_2 Capture Technology at a Linde Steam Methane Reforming H_2 Plant

Minish M. Shah, Jason Haley, Nazmul Hassan, Thomas McNamara, Alexander Laugwitz, Lidia Ganzer, Alan Stevens, Anil Kumar, David McNally, Russ McLandsborough, NETL FINAL REPORT, DEC. 4, 2023.

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

Contact Us

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