NATIONAL ENERGY TECHNOLOGY LABORATORY

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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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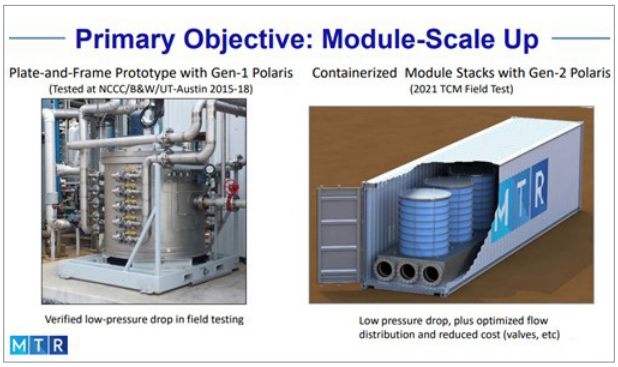
Strategic Vision: The Role of FECM in Achieving Net-Zero GHG Emissions

The U.S. Department of Energy (DOE) Office of Fossil Energy and Carbon Management's (FECM) priority is achieving the Biden-Harris administration's goals of a fully decarbonized power sector by 2035 and net-zero U.S. greenhouse gas (GHG) emissions by 2050. FECM's Strategic Vision will enable DOE to make strategic carbon management decisions and ensure the use of fossil fuels is put into proper context with climate change and is designed for a future that achieves and maintains net-zero GHG emissions. FECM envisions enabling the demonstration and ultimate deployment of technologies for carbon management and mitigating challenges of fossil fuel use in a just and sustainable way. FECM prioritizes the following three strategic directions to achieve these goals: Advancing Justice, Labor, and Engagement; Advancing Carbon Management Approaches Toward Deep Decarbonization; and Advancing Technologies that Lead to Sustainable Energy Resources.

Interagency News and Updates

Membrane-Based Carbon Capture Technology Milestone Demonstrates NETL's Tech Development Expertise



Membrane Technology and Research Inc. (MTR) researchers have been working with NETL experts to develop a cost-effective CO_2 capture process that uses a new class of membrane material known as Polaris™. The latest technology scale-up milestone in the process was the selection of the Polaris technology for a 10-megawatt-electric (MWe) large pilot-scale field test at the Wyoming Integrated Test Center in Gillette, Wyoming. The project will include the construction, installation, and operation of a large pilot system. The next step was a test of second-generation membranes and modules at the Technology Centre Mongstad (TCM) in Norway. Testing there uncovered additional carbon capture potential by using multiple membrane stacks. The TCM tests will continue to run through summer 2022.

New Carbon Capture Membrane Boasts CO_2 Highways

A new, highly permeable carbon capture membrane developed by scientists from DOE's Lawrence Berkeley National Laboratory could lead to more efficient ways of separating carbon dioxide (CO_2) from power plant exhaust, preventing the CO_2 from entering the atmosphere and contributing to climate change. The researchers focused on a hybrid membrane that is part polymer and part metal-organic framework, which is a porous three-dimensional crystal with a large internal surface area that can absorb enormous quantities of molecules. Initial tests show the hybrid membrane is eight times more CO_2 permeable than membranes composed only of polymer.

Regional Carbon Management Applicant Education Workshops

DOE-FECM's National Energy Technology Laboratory (NETL) joined the Regional Carbon Management Applicant Education Workshops, which provided information on how to initiate a variety of carbon capture and storage (CCS) projects. Deputy Director for NETL's Technology Development Center Heather Quedenfeld, along with National Environmental Policy Act Team Supervisor Fred Pozzuto and Contracting Officer Jeff Kooser, spoke during the virtual kickoff. The workshops supported implementation of the Bipartisan Infrastructure Law (BIL). The sessions were intended for potential applicants interested in supporting decarbonization and developing commercial-scale storage facilities, point-source CO_2 capture demonstration projects, direct air capture (DAC) hubs, hydrogen production hubs with CCS, carbon utilization, and CO_2 transport projects required by BIL provisions.

Capture Program Website Updates

The Capture Program website has been converted into two focused carbon capture technology pages: Point Source Carbon Capture and Carbon Dioxide Removal. The new format underscores FECM's adoption of a comprehensive, multi-pronged approach for carbon management.

Interagency News and Updates (continued)

New Study Reveals Algae Can Help Reduce CO_2 Emissions

Researchers at DOE's Argonne National Laboratory (ANL) and Pacific Northwest National Laboratory recently published a study detailing the challenges and opportunities associated with leveraging CO_2 to grow algae in the Midwest. The findings reveal that Midwest conditions can support algae growth and that year-round fuel production can be maintained by using other materials, such as wood residue, to generate fuel in the seasons when algae fail to grow well. It also found that cultivating algae in this manner can reduce the GHG emissions from ethanol production by eliminating the need for ethanol producers to capture the carbon made along the way.

Verdox's Electro-Swing Technology Offers Scalable Carbon Capture Solution

With ARPA-E funding as part of the SEED Exploratory Topic, Verdox set out to develop a scalable, proof-of-concept DAC prototype used for capturing carbon. Verdox's technology uses electrochemical cells to facilitate carbon capture upon charging and release carbon upon discharging, a process they refer to as the "electro-swing." The team developed a new material that can selectively capture CO_2 from a mix of gases when charged with electricity. While many current CO_2 removal solutions are energy-intensive and rely on large amounts of heat and water, the Verdox team's approach eliminates that need.

DOE Announces Carbon Utilization Funding Opportunity

DOE's Bioenergy Technologies Office (BETO) in the Office of Energy Efficiency and Renewable Energy (EERE) and FECM's Carbon Utilization Program posted a funding opportunity announcement (FOA) for up to $19 million in federal funding for the advancement of technologies that utilize waste carbon to reduce GHG emissions and produce reliable feedstocks for biotechnologies. DE-FOA-0002654, entitled "Carbon Utilization Technology: Improving Efficient Systems for Algae," specifically aims to increase the capability of algal systems to capture CO_2 and put it to productive use. Capturing this waste carbon then allows for algae to be cultivated into a variety of biofuels and bioproducts. The deployment of algal technologies in these projects will help lower algal system cost, while decreasing GHG emissions.

States Can Play a Critical Role in FECM's Carbon Management Work

FECM's Acting Assistant Secretary and Principal Deputy Assistant Secretary Dr. Jennifer Wilcox joined a panel of DOE leaders at the National Association of State Energy Officials (NASEO) Energy Policy Outlook Conference to discuss the implementation of the BIL. Dr. Wilcox discussed FECM's work of examining U.S. dependence on fossil fuels across the supply chain, analyzing how those fuels are extracted, and exploring opportunities to mitigate emissions associated with their use. Dr. Wilcox highlighted that the BIL dedicates funding for CCS and CO_2 removal, two necessary tools for achieving a net-zero future. A key theme across all leaders' remarks was the importance of collaboration—across DOE offices and with the states—for the effective implementation of the BIL. Dr. Wilcox emphasized two crucial ways states can partner with FECM: community engagement and regulatory framework.

Interagency News and Updates (continued)

ORNL, TVA Partner to Drive Decarbonization, Explore Carbon-Free Technologies

DOE's Oak Ridge National Laboratory (ORNL) and the Tennessee Valley Authority (TVA) are joining forces to advance decarbonization technologies from discovery through deployment through a new memorandum of understanding (MOU). The institutions will work together to promote, pursue, evaluate, and demonstrate the feasibility, operability, and affordability of utility-scale decarbonization technologies. These technologies will focus on electricity, but the partners may also explore related developments such as hydrogen generation and grid modernization and security.

Carbon-Negative Platform Turns Waste Gases into Valuable Chemicals

Researchers from LanzaTech, Northwestern University, and ORNL have built on LanzaTech technology to develop an efficient new process that converts waste gases, such as emissions from heavy industry or syngas generated from biomass, into either acetone or isopropanol (IPA), using an engineered bacterium called Clostridium autoethanogenum, or C. auto. The carbon-negative platform uses micro-organisms as tiny but powerful factories that convert carbon from agricultural, industrial, and societal waste streams into useful chemicals. The process recycles carbon that would otherwise be released as GHGs that accelerate climate change. Their methods, including a pilot-scale demonstration and life cycle analysis showing the economic viability, are published in the journal Nature Biotechnology.

U.S. and International Events

CCU TEA and LCA Guidance – A Harmonized Approach

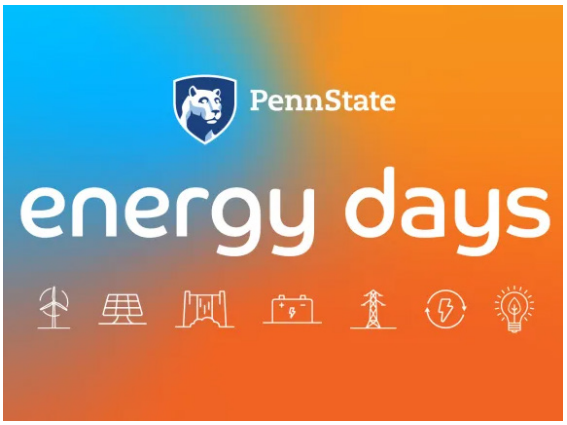
The Carbon Capture and Utilization (CCU) TEA and LCA Guidance workshop, to be held May 18–20, 2022, at the University of Michigan Rackham Graduate School in Ann Arbor, Michigan, is organized and conducted by the International CCU Assessment Harmonization Group. It will be hosted by the Global CO_2 Initiative in collaboration with NETL.

ARPA-E Energy Innovation Summit

The 2022 ARPA-E Energy Innovation Summit, to be held May 23–25, 2022, in Denver, Colorado, brings together experts from different technical disciplines and professional communities to discuss America's energy challenges. Now in its 12th year, the summit offers a three-day program aimed at moving transformational energy technologies out of the lab and into the market.

Penn State Energy Days

Penn State Energy Days, to be held May 25–26, 2022, brings together professionals working in all areas of energy to discuss topics ranging from energy technology to energy policy and justice. The goal is to create an opportunity for a diverse range of stakeholders to collaborate. The purpose is to identify and discuss critical regional, national, and global energy challenges and opportunities for society. Ultimately, the conference looks to create new partnerships to address key research needs and provide innovative solutions to energy challenges.



ASME's Turbomachinery Technical Conference and Exposition

The American Society of Mechanical Engineers (ASME) Turbomachinery Technical Conference and Exposition, to be held June 13–17, 2022, in Rotterdam, Netherlands, attracts the industry's leading professionals and key decision-makers whose innovation and expertise help to shape the future of the turbomachinery industry. The five-day conference and three-day expo will include hundreds of live presenting authors and a panel on utilization, transportation, storage, production, and CCS.

XIX International Conference on Carbon Dioxide Utilization

The Summer 2022 XIX International Conference on Carbon Dioxide Utilization (ICCDU-22), to be held June 26–30, 2022, at Princeton University, New Jersey, is a global meeting place for chemists, engineers, and environmental policy planners to discuss the latest developments in the field of CO_2 capture and utilization.

Business and Industry News

FECM Discusses R&D Priorities and Direction at CERAWeek 2022

FECM attended CERAWeek 2022, an annual conference that brings global industry leaders, government officials, and policymakers together to advance ideas and solutions across the energy landscape. FECM's Acting Assistant Secretary and Principal Deputy Assistant Secretary Dr. Wilcox participated in various panels and meetings, alongside other DOE experts, to discuss the role FECM has in helping the nation achieve net-zero emissions by 2050. Throughout the meetings, U.S. Secretary of Energy Jennifer M. Granholm and Dr. Wilcox underscored DOE's commitment to decarbonizing the economy while providing reliable energy; advancing the development of approaches such as CCS, CO_2 removal, and methane mitigation; improving the conditions of communities impacted by the legacy of fossil fuel use; and creating good-paying jobs for the energy workforce of the future.

U.S. Secretary of Energy Jennifer M. Granholm Hosts The First NPF Ministerial in Houston

Secretary Granholm, together with Energy Minsters from Canada, Norway, Qatar, and Saudi Arabia, formally launched the Net-Zero Producers Forum (NPF) through an inaugural ministerial meeting. The NPF is a voluntary coalition of major oil- and gas-producing nations dedicated to galvanizing cooperation to respond effectively and pragmatically to the global climate challenge and help accelerate the pathway to global net-zero emissions, while supporting a sustainable and secure energy future. Hosting the inaugural NPF Ministerial reinforces the return of U.S. leadership and commitment to international collaboration on clean energy deployment and innovation.

Advancing Next-Generation Hydrogen Energy Storage Technology for Clean Power

DOE selected GTI and partners for funding to advance hydrogen storage technology toward increased duration, reliability, and affordability to meet growing U.S. market demand for cleaner electricity. In GTI's Phase II project, the team will conduct a preliminary front-end engineering design study of a system to demonstrate storage of more than 54 megawatt-hours (MWh) of energy as clean hydrogen produced using natural gas with CCS—and its use for load-following in a selected natural gas combined cycle power plant operated by Southern Company subsidiary Alabama Power in Alabama.

Publications

Assessing the Techno-Economic Performance, Opportunities and Challenges of Mature and Nearly-mature Negative Emissions Technologies (NETs)

IEA GREENHOUSE GAS R&D PROGRAMME, DECEMBER 2021.

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Innovative cycling reaction mechanisms of CO_2 absorption in amino acid salt solvents

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About DOE's Carbon Capture Program

NETL's Carbon Capture Program is developing the next generation of advanced carbon dioxide (CO_2) capture technologies. The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management has adopted a comprehensive multi-pronged approach for the research and development of advanced CO_2 capture technologies that have the potential to provide step-change reductions in both cost and energy requirements as compared to currently available technologies.

The 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 single document.

Carbon Capture Reference Materials

- Carbon Capture Program Factsheet
- Carbon Capture Infographics
- Compendium of Carbon Capture Technology
- Carbon Dioxide Capture Handbook
- CCSI^2
- Systems Analysis
- Conference Proceedings
- Accomplishments Posters
- Fossil Energy Techlines

Contact Us

DOE Carbon Capture contacts:

Andrew Jones, Carbon Dioxide Removal Technology Manager, 412.386.5531

Dan Hancu, DOE Senior Program Manager, Point Source Carbon Capture, 240.220.1186

Lynn Brickett, Director, Point Source Carbon Capture Division, 412.386.6574

1450 Queen Avenue SW
Albany, OR 97321-2198
541-967-5892

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

Program staff are also located in **Houston, Texas** and **Anchorage, Alaska**

CUSTOMER SERVICE: 1-800-553-7681

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