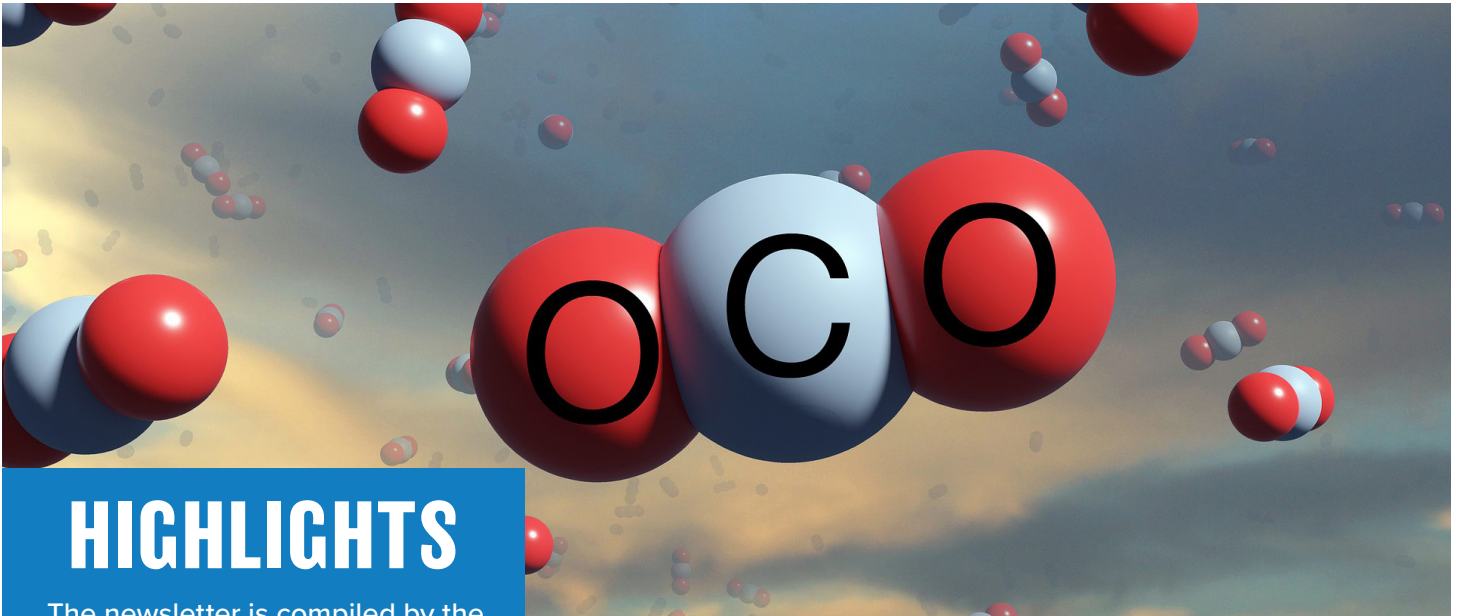


CARBON CAPTURE NEWSLETTER

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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DOE Announces Funding for Direct Air Capture Projects

The U.S. Department of Energy (DOE) announced approximately \$12 million in federal funding for six research and development (R&D) projects that are advancing direct air capture (DAC) technology, a carbon dioxide (CO₂) removal approach that extracts CO₂ emissions from the atmosphere. When deployed, this next generation of clean energy technology will help reach the Biden-Harris Administration's goal of a net-zero emissions by 2050. The six projects that were selected under DE-FOA-0002402 "Carbon Capture R&D: Bench Scale Testing of Direct Air Capture Components (TRL 3) and Initial Engineering Design for Carbon Capture, Utilization and Storage Systems from Air (TRL 6)" will be managed by DOE's Office of Fossil Energy and Carbon Management (FECM) and the National Energy Technology Laboratory (NETL).

CONTINUED ON PAGE 2

DOE Announces Funding for Direct Air Capture Projects (continued)

Three projects were chosen under AOI 1: “Bench-Scale Testing of Structured Material Systems or Component Designs (TRL 3) for Optimized Direct Air Capture” and will aim to:

- Increase the amount of CO₂ captured in DAC operations – Cormetech, Inc. (Charlotte, NC) plans to develop a DAC contactor, the process and material through which air and CO₂ is moved and captured, that will maximize the amount of CO₂ captured from the atmosphere, while reducing the amount of energy needed to operate. (Award amount: \$1,500,000)
- Initiate early-stage testing of DAC systems operated by low-cost wind power – The Research Triangle Institute (Research Triangle Park, North Carolina) team will design, fabricate, and test an early-stage DAC contactor powered by low-cost wind energy, increasing the efficiency of DAC technology operations. (Award amount: \$1,500,000)
- Develop high-capacity regenerative materials for novel DAC technology – The project housed at Susteon Inc. (Cary, North Carolina) intends to reduce the cost of DAC operations by developing a structured material that is both regenerative and able to capture and contain high amounts of CO₂. By developing new materials with the ability to capture more CO₂ it can reduce the amount of energy required to operate the system—reducing overall costs. (Award amount: \$1,500,000)

Three of the six selected projects will also explore DAC operations in three distinct geographical locations, with varying climates, in an effort to create a first-ever DAC system that can capture 100,000 metric tons of CO₂ per year. Currently, no existing DAC system has this CO₂ capacity. Three were selected under AOI-2. “Initial Engineering Design of Carbon Capture Utilization and Storage Systems (TRL 6) for Direct Air Capture,” and will:

- Execute early-stage engineering designs for DAC technology – The Black & Veatch Corporation (Overland Park, Kansas) team will develop an initial engineering design of a DAC system to be placed in Odessa, Texas; Bucks, Alabama; and Goose Creek, Illinois, aimed at capturing 100,000 metric tons of CO₂ from the atmosphere per year. (Award amount: \$2,500,000)
- Implement an initial design of three carbon farms using a commercial-scale DAC system – Silicon Kingdom Holdings Limited (Dublin, Ireland) will complete three initial designs using a commercial-scale, passive DAC system that absorbs CO₂. This design, developed at Arizona State University (Tempe, AZ), aims to capture a steady capacity of 1,000 metric tons of CO₂ per day. (Award amount: \$2,500,000)
- Utilize low-carbon energy sources to power commercial scale DAC operations – The University of Illinois (Champaign, Illinois) team will develop preliminary designs for large-scale DAC and work with partners to perfect the designs to permanently store CO₂ at underground facilities in Wyoming, Louisiana, and California. In addition to examining the effects of different climate conditions, the project will measure the impact of using different low-carbon power sources (e.g., geothermal, solar, wind, or waste heat) to reduce the life-cycle emissions of DAC technology. (Award amount: \$2,499,798)

Interagency News and Updates

NETL Advances the Development of DAC Technology

NETL researchers are using analytical tools and modeling to determine the efficiency and cost effectiveness of technologies that can pull CO₂ from ambient air and help reduce greenhouse gas levels in Earth's atmosphere. NETL has been instrumental in advancing research to capture CO₂ from the flue gas streams produced by power plants and other industries and store it permanently and safely in deep underground complexes and geologic reservoirs or use it as a feedstock to produce higher-value products such as chemicals and plastics. As the technology gains traction, researchers have undertaken techno-economic analyses and case studies to ensure that researchers advancing DAC innovations are pursuing optimal routes for success. Using advanced process software modeling, simulation, and optimization techniques, the NETL team generates process material and energy balances, which enable equipment sizing and cost estimating. While researchers are at work refining and developing DAC technologies, information from these analyses ensure that they are applying their skills to the most worthwhile tasks to keep their research on a successful path toward commercialization.



President's FY22 Budget Sent to Congress

The U.S. Department of Energy's (DOE) Fiscal Year 2022 (FY22) budget makes historic investments that will help the country build back better and lay the foundation to build a clean energy economy and ensure the U.S. reaches net-zero carbon emissions by 2050. The budget complements the historic American Jobs Plan that President Biden put forward prioritizing research, clean energy, and other foundations of our country's strength, in addition to mission-critical initiatives at DOE, including the following: (1) Deliver Historic Funding Levels for National Labs and Universities for Energy and Climate Research and Innovation; (2) Spur Innovation and Job Creation by Developing and Deploying Clean Energy Technologies; (3) Secure Record Funding for Nuclear Energy and Advanced Nuclear to Achieve Climate Goals; (4) Rein in Emissions from Fossil Energy with Investment in New Technologies; (5) Strengthen the Nation's Energy Security and Resiliency; and (6) Sustain Support for U.S. Nuclear Security.

NETL and IWG Highlight Avenues to Decarbonized Energy and Jobs in West Virginia

NETL Director Brian Anderson, executive director of Biden Administration's Interagency Working Group (IWG) on Coal and Power Plant Communities and Economic Revitalization, joined members of industry, academia, and government agencies to address decarbonized energy and job opportunities for the state of West Virginia during the "Getting to Zero" virtual panel, hosted June 2–3, 2021. The roundtable event featured two sessions: the first, "Investment Barriers and Opportunities," explored ways for West Virginia to leverage its unique strengths, the critical role infrastructure will play in drawing employers to the state, and the role policy can play to support those efforts; the second, "Industry Manufacturing in a Low-Carbon Economy," examined how the low-carbon transition affects the market landscape for industrial and manufacturing companies, as well as implications for the region's workforce.



Interagency News and Updates (continued)

NETL Director Delivers Keynote on Transition to a Decarbonized Future

National Energy Technology Laboratory (NETL) Director Brian Anderson discussed “Paving the Way to a Decarbonized Energy Future” during his [keynote address](#) at the Board on Earth Sciences and Resources (BESR) Spring 2021 Meeting: Energy and Resources Needs for a Nation in Transition, which was held May 10, 2021. In his address, Dr. Anderson highlighted NETL’s highly successful record of technological achievements to transition the United States to an environmentally sustainable and prosperous energy future. He also outlined the critical role NETL scientists and engineers will play to address the Biden Administration’s ambitious climate goals of a carbon emissions-free power sector by 2035 and a net-zero emissions economy by 2050.

NETL Welcomes Acting Assistant Secretary for FECM and Chief of Staff

FECM welcomed its new Principal Deputy Assistant Secretary (PDAS), Dr. Jennifer Wilcox, who is also Acting Assistant Secretary for Fossil Energy and Carbon Management (FECM), along with Chief of Staff, Dr. Shuchi Talati. Dr. Wilcox graduated from Wellesley College with a B.A. in mathematics. She earned her M.A. in chemistry and her Ph.D. in chemical engineering from the University of Arizona. Dr. Wilcox was the author of the first textbook on carbon capture, *Carbon Capture*, published in 2012. She also co-edited [Carbon Dioxide Remover \(CDR\) Primer](#), published in 2021. Dr. Talati earned her B.S. in environmental



Dr. Jennifer Wilcox



Dr. Shuchi Talati

engineering from Northwestern University, her M.A. in climate and society from Columbia University, and her Ph.D. in engineering and public policy from Carnegie Mellon University. Dr. Talati was the 2017–2018 Congressional Science Fellow for both the American Association for the Advancement of Science and American Institute of Physics. During her fellowship, she worked on climate and energy issues as a staffer in the U.S. Senate. Before that, she worked at environmental non-profit organizations, including Carbon180 and the Union of Concerned Scientists, where she focused on climate and energy policies.

Acting Assistant Secretary for FECM Speaks at Several Conferences

DOE’s Acting Assistant Secretary for FECM, Dr. Jennifer Wilcox, spoke at several important conferences in recent months. Conferences included:

- The [15th Annual International Virtual Conference on Greenhouse Gas Control Technologies \(GHGT-15\)](#) on Mar. 16, 2021.
- The [12th Annual Clean Energy Ministerial \(CEM\) Meeting](#) on June 1, 2021.
- The [Carbon Utilization Research Council’s \(CURC\) briefing “Getting to Net-Zero with Carbon Capture and Removal Technologies”](#) on Apr. 30, 2021.
- The U.S. Chamber of Commerce Global Energy Institute *Energy Innovates* video series installment “[How the U.S. Can Reduce Its Carbon Use](#)” on Apr. 22, 2021.

Please refer to the above links for further information.

FECM Chief of Staff Speaks on CCS

On May 21, 2021, FECM Chief of Staff Dr. Shuchi Talati gave opening remarks at a Global CCS Institute webinar. It was the final installment in a three-part series, “The Carbon Capture and Storage 101 Webinars: CCS Policy for a Net-Zero Future,” focused on CCS and the policies needed to deploy more carbon capture projects globally. Dr. Talati discussed the vital role that DOE plays to implement CCS and other carbon capture technologies in order to meet the Biden Administration’s goal of net-zero emissions by 2050.

U.S. and International Events

2021 Carbon Management and Oil and Gas Research Project Review Meeting

The U.S. Department of Energy (DOE)/National Energy Technology Laboratory's (NETL) 2021 Carbon Management and Oil and Gas Research Project Review Meeting will be held in Aug. 2021. The month-long meeting will see projects presented from DOE/NETL's Carbon Capture, Carbon Storage, Oil and Gas, and Carbon Utilization Programs. Registration information is available at: <https://netl.doe.gov/events/21CMOG>

International Pittsburgh Coal Conference

The 2021 International Pittsburgh Coal Conference (PCC), sponsored by the University of Pittsburgh, Swanson School of Engineering, will be held virtually



**INTERNATIONAL PITTSBURGH
COAL CONFERENCE**
University of Pittsburgh · Swanson School of Engineering

Sept. 20–23, 2021. The annual event is focused on all aspects of coal, energy, and the environment. It aims at fulfilling the ultimate goal of efficient and effective use of coal while protecting the environment. The PCC provides a unique opportunity for in-depth and focused exchange of technical information and policy issues among representatives from industry, government, and academia throughout the world.

Global Energy Show Exhibition & Conference

The Global Energy Show Exhibition & Conference, to be held Sept. 21–23, 2021, in Calgary, Canada, brings buyers, sellers, stakeholders, partners, young professionals, and the public together to share knowledge and fuel innovation in the energy landscape. The platform allows for collaboration from all energy sources to showcase innovation and technology that combats the dilemma of matching the increasing energy demand with the need for a transition to a lower-carbon economy.

IEAGHG 6th Post-Combustion Capture Conference

The IEAGHG 6th Annual Post-Combustion Capture Conference will be held in the United Kingdom Oct. 19–21, 2021. The event will gather post-combustion capture experts to share their knowledge, findings, and expertise.



PCCC-6
Post-Combustion Capture Conference

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RESEARCH CENTRE

Carbon Capture Technology Conference and Expo

The Carbon Capture Technology Conference and Expo is a two-day event to be held Oct. 20–21, 2021, in Stuttgart Messe, Germany. Experts from around the world will discuss the latest advances in new technology for carbon capture, storage, and transport, as well as unique ways of utilizing carbon dioxide (CO₂) to produce net-zero fuels and for other manufacturing processes.

Gordon Research Conference: Permanently Removing CO₂ from Our Emissions and Atmosphere

The fourth installation of the CCUS Gordon Research Conference series, to be held Oct. 24–29, 2021, in Waterville Valley, New Hampshire, will examine the following questions: (1) Can the United States decarbonize safely and with a variety of approaches appropriate for the assortment of power and industrial challenges? and (2) Can the United States develop methods to clean up the atmosphere in time to keep within reasonable temperature limits?

Business and Industry News

Carbon Capture Technologies Improving

NETL works with various partners including industry, universities, and other organizations. From its recent experiences, it estimates that trapping, shipping, and storing CO₂ will eventually create “tens of thousands of jobs.” The work will often use similar skills to those required by fossil fuel industries, including coal-fired power plants and other sectors that have been hit hard by job losses. NETL partner Technology Centre Mongstad is located adjacent to an oil refinery in Mongstad, Norway, with access to flue gas supplied by the on-site combined heat and power plant or the refinery catalytic cracker. NETL is currently testing four U.S. carbon capture processes there.



Technologies Tested at NCCC Selected for Large-Scale Pilot Demonstration

Two carbon capture technologies developed through testing at NETL's National Carbon Capture Center (NCCC) have been selected by DOE to advance to large-scale pilot demonstrations. The technology developers—Linde/BASF and Membrane Technology and Research (MTR) Inc.—were recently awarded federal funding under Phase III (construction/operation) of funding opportunity announcement DE-FOA-0001788, Fossil Fuel Large-Scale Pilots. In these Phase III projects, carbon capture pilot plants of approximately 10 megawatts-electric (MWe) will be constructed and operated with a slipstream of flue gas from a full-scale power plant. Results from the pilot demonstrations may be applicable to capture technologies employed at a variety of power plants and industrial facilities, including natural gas, waste biomass, and others.



Illinois Utility Working with University on DOE-Funded Carbon Capture Research Project

City Water, Light and Power (CWLP) of Springfield, Illinois, will play host to a DOE-supported pilot project led by the University of Illinois. A 10-megawatt (MW) carbon capture system capturing CO₂ from flue gas emitted from CWLP's Unit 4 is the centerpiece of the research effort. Construction is set to begin in June 2021 with operations by 2025.

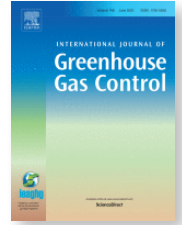
CAER Grant Uses Acoustic Technology to Reduce CO₂ Capture Cost

A University of Kentucky Center for Applied Energy Research (CAER) team received a grant to develop a novel, acoustic-assisted process that would make capturing CO₂ from coal-fired power plants and industrial facilities significantly less expensive. The grant was funded by the University Coalition for Fossil Energy Research (UCFER), a DOE-supported program. CAER's CO₂ system employs an absorption column and utilizes solvents to capture CO₂. Essentially, the solvent absorbs the CO₂, allowing the system to extract and remove the CO₂ from the combustion flue gas at a fossil fuel-based energy production plant.

Publications

Effect of Power Plant Capacity on the CAPEX, OPEX, and LCOE of the CO₂ Capture Process in Pre-Combustion Applications

HUSAIN E. ASHKANANI, RUI WANG, WEI SHI, NICHOLAS S. SIEFERT, ROBERT L. THOMPSON, KATHRYN SMITH, JANICE A. STECKEL, ISAAC K. GAMWO, DAVID HOPKINSON, KEVIN RESNIK, BADIE I. MORSI, INTERNATIONAL JOURNAL OF GREENHOUSE GAS CONTROL, VOLUME 109, JULY 2021. (SUBSCRIPTION MAY BE REQUIRED.)

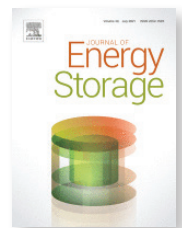


Design of Graphene/Ionic Liquid Composites for Carbon Capture

SONG WANG, SHANNON M. MAHURIN, SHENG DAI, DE-EN JIANG, ACS APPL. MATER. INTERFACES, VOLUME 13, ISSUE 15, APRIL 2021. (SUBSCRIPTION MAY BE REQUIRED.)

Pumping gaseous CO₂ into a high-pressure, constant-volume storage cylinder: A thermodynamics analysis

TRAN X. PHUOC, MEHRDAD MASSOUDI, JOURNAL OF ENERGY STORAGE, VOLUME 40, AUGUST 2021. (SUBSCRIPTION MAY BE REQUIRED.)



Research Activities of CO₂ Capture and Utilization Technologies at the Wyoming Integrated Test Center

WILLIAM MORRIS, JASON BEGGER, PROCEEDINGS OF THE 15TH GREENHOUSE GAS CONTROL TECHNOLOGIES CONFERENCE, MARCH 15–18 2021.

Recent Cryogenic Carbon Capture™ Field Test Results

DAVID FRANKMAN, STEPHANIE BURT, ETHAN BEVEN, DALLIN PARKINSON, CHRISTOPHER WAGSTAFF, WILLIAM ROBERTS, LARRY BAXTER, PROCEEDINGS OF THE 15TH GREENHOUSE GAS CONTROL TECHNOLOGIES CONFERENCE, MARCH 15–18 2021.

NCCC Fact Sheets

NATIONAL CARBON CAPTURE CENTER, FACT SHEETS: GENERAL OVERVIEW, TECHNICAL OVERVIEW, BENEFITS OF MEMBERSHIP, NATURAL GAS TESTING, CARBON UTILIZATION, DIRECT AIR CAPTURE.



Global Energy Review 2021

INTERNATIONAL ENERGY AGENCY, GLOBAL ENERGY REVIEW 2021: FLAGSHIP REPORT, APRIL 2021.



About DOE's Carbon Capture Program

NETL's Carbon Capture Program is developing the next generation of advanced carbon dioxide (CO₂) 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 CO₂ 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
- CCSI²
- Systems Analysis
- Conference Proceedings
- Accomplishments Posters
- Fossil Energy Techlines

Contact Us

DOE Carbon Capture contacts:

Dan Hancu, NETL Technology Manager, 412.386.7363
Lynn Brickett, DOE Program Manager, 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 Cochran's 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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