JANUARY 2021

GARBON CAPTURE NEWSLETTER

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



The newsletter is compiled by the

National Energy Technology Laboratory to provide information on recent activities and publications

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related to carbon capture.

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U.S. DEPARTMENT OF

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DOE Coal FIRST Initiative Invests in Net-Zero Carbon Electricity and Hydrogen Plants

The U.S. Department of Energy's (DOE) Office of Fossil Energy (FE) selected four projects for cost-shared research and development (R&D) under a Funding Opportunity Announcement (FOA) that supports Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative) concepts. DOE's early-stage research for the Coal FIRST Initiative supports the development of 21st century electricity and hydrogen energy plants that have net-zero carbon emissions. These plants will be fueled by coal, natural gas, biomass, and waste plastics and incorporate carbon capture, utilization, and storage (CCUS) technologies. The Coal FIRST energy plant concept projects (receiving approximately \$80 million in federal funding) will complete (1) design development, (2) host-site evaluation and environmental information volume, (3) investment case analysis, and (4) a system integration design study to advance the design of an engineering-scale prototype. The National Energy Technology Laboratory (NETL) will manage the selected projects.

Interagency News and Updates

DOE/NETL Carbon Capture Program Intends to Issue DAC FOA

DOE/NETL intends to issue an FOA, DE-FOA-0002402, on behalf of FE. The FOA is anticipated to be issued in January 2021 and supports DOE's Carbon Capture Program by developing lower-cost, scalable technologies for carbon dioxide (CO₂) capture from air. Projects under this FOA are expected to fall under two Areas of Interest (AOIs)—AOI 1: "Bench-Scale Testing of Structured Material Systems or Component Designs for Optimized Direct Air Capture," and AOI 2: "Initial Engineering Design of Carbon Capture Utilization and Storage Systems for Direct Air Capture." The case study host sites in AOI 2 are expected to be located exclusively in the United States. Additional details can be found at: FedConnect.net and Grants.gov.

NETL Inventions Win 2020 TechConnect Innovation Award

NETL inventions to separate CO₂ from post-combustion flue gases and remove contaminants from water sources won a 2020 TechConnect Innovation Award for their ability to contribute to a more sustainable environment while providing potential economic benefits. Researchers David Hopkinson, Victor Kusuma and Surendar Venna earned the award for their development of Crosslinked Polymer Blend Membranes for CO₂ Separation, which builds upon previous work to capture greenhouse gases from the nation's power plant fleet. The TechConnect Innovation Awards also recognized Brian Kail, McMahan Gray, Walter Wilfong and Qiuming Wang for their invention which can remediate the effects of industries like dye and textiles on local water supplies.

Crosslinked Polymer Blend Membranes for CO₂ Separation

This video highlights NETL's cost-effective development of a crosslinked polymer blend membrane (which recently won a 2020 TechConnect Innovation Award) and announces NETL's search for partners to test and scale-up the membrane for commercial applications.

Non-Aqueous MARS Process for Carbon Capture

This video highlights NETL's Non-Aqueous Microwave-Accelerated Regeneration of Slurry (MARS) process for carbon capture and announces the process is now available for licensing.

Tri-Lab Initiative Leads Innovation in Novel Hybrid Energy Systems

Researchers from DOE's three applied energy laboratories—Idaho National Laboratory (INL), National Renewable Energy Laboratory (NREL), and NETL—co-authored a paper on integrated energy systems recently published in Joule. The effort outlines novel concepts to simultaneously leverage diverse energy generators—including renewable, nuclear, and fossil with carbon capture—to provide power, heat, mobility and other energy services. The historic collaboration between the nation's Nuclear Energy, Renewable Energy, and Fossil Energy labs aims to address a grand national challenge from an objective, holistic perspective.

Advanced Membranes Lower the Cost of Carbon Capture

NETL uses high throughput computational algorithms to design mixed matrix membranes with the highest reported properties to enable large-scale carbon capture. These membranes are now being scaled-up for demonstration at the DOE-sponsored National Carbon Capture Center (NCCC).

Interagency News and Updates (continued)

NETL Researchers Honored by AIChE

Two researchers at NETL were recognized for achievements and contributions in their fields during the 2020 annual meeting of the American Institute of Chemical Engineers (AIChE), held virtually November 16–20, 2020. Madhava Syamlal, Ph.D., senior fellow, Computational Sciences and Engineering (and the founding technical director of the Carbon Capture Simulation Initiative) is the recipient of the Elsevier Particle Technology Forum Award for Lifetime Achievements. Isaac Gamwo, Ph.D., a research chemical engineer on NETL's Reaction Engineering Team, received the AIChE Minority Affairs Committee's Eminent Chemical Engineers Award.



Cell Reports Physical Science Journal Announces Best of 2020 Collection

The *Best of 2020* list is a collection of 23 articles, curated by the editors at Cell Reports Physical Science, an open access journal from Cell Press, showcasing research from across the physical sciences. The Best of 2020 list includes the NETL paper, "Dual-Layer MOF Composite Membranes with Tuned Interface Interaction for Postcombustion Carbon Dioxide Separation."

NETL's Carbon Storage Newsletter Available for Subscription

Published monthly, NETL's Carbon Storage Newsletter provides information on recent activities and publications related to carbon storage. It covers domestic, international, public sector, and private sector news. Subscription information is available online.

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U.S. and International Events

15th International Conference on Carbon Dioxide Capture and Storage Technologies and Applications

The 15th International Conference on Carbon Dioxide Capture and Storage Technologies and Applications (to be held February 18–19, 2021, in Rome, Italy) aims to bring together leading academic scientists, researchers, and research scholars to exchange and share their experiences and research results on all aspects of CO_2 capture and storage technologies and applications. It also provides a premier interdisciplinary platform for researchers, practitioners, and educators to present and discuss the most recent innovations, trends, and concerns, as well as practical challenges encountered and solutions adopted in the fields of CO_2 capture and storage technologies and applications.

15th International Greenhouse Gas Control Technologies Conference

The International Energy Agency Greenhouse Gas R&D Programme (IEAGHG) is the guardian of the Greenhouse Gas Control Technologies (GHGT) conference series and has signed an agreement with Khalifa University for the university to host the 15th International Greenhouse Gas Control Technologies Conference (GHGT-15) in Abu Dhabi. Due to the ongoing global pandemic, the conference will be held as a virtual event with the revised dates of March 15–18, 2021.

U.S. and International Events (continued)

Westminster Energy, Environment & Transport Forum

The Westminster Energy, Environment & Transport Forum, titled "Next steps for carbon capture, usage and storage in the UK - market development, regulation, and the low-carbon economic recovery policy agenda," will be held virtually March 16, 2021. The forum will discuss the next steps for developing the CCUS market in the United Kingdom (UK). Expected speakers and attendees will include senior government and regulatory officials, as well representatives from power generation, energy retail, heat production and energy networks, heavy industry, construction and infrastructure firms, science and innovation platforms, investors, legal and consultancy groups, environmental and sustainability groups, and researchers in academia and higher education.

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

The fourth installation of the CCUS Gordon Research Conference series, to be held May 30–June 4, 2021, in Waterville Valley, New Hampshire, will examine the following questions: (1) can the U.S. decarbonize safely, and with a variety of approaches appropriate for the variety of power and industrial challenges; and (2) can the U.S. develop methods to clean up the atmosphere in time to keep within reasonable temperature limits?

Carbon Capture Technology Conference & Expo

The Carbon Capture Technology Conference & Expo is a two-day event to be held June 9–10, 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 CO_2 to produce net-zero fuels and for other manufacturing processes.



Business and Industry News

DOE/NETL Awards Funding for Carbon Capture Project

DOE-NETL is reportedly expected to provide funding to the Ohio State University (OSU) project "Engineering Scale Design and Testing of Transformational Membrane Technology for CO_2 Capture," which will advance OSU's patented membrane technology from successful bench-scale projects. The project seeks to achieve DOE's Transformational Carbon Capture performance goal of CO_2 capture with 95% CO_2 purity at a cost of \$30 per ton or less. GTI and OSU will jointly lead the project, overseeing design and testing of the CO_2 capture system. By employing a facilitated transport mechanism for CO_2 separation, the membrane can achieve high selectivity and high permeance for CO_2 separation from flue gas, resulting in the potential for low capture cost.

Leveraging the Latest CCUS Technologies to Transform Emissions into Profit

To jump-start the commercialization of CCUS technologies, in September 2019, DOE awarded \$110 million in federal funding for carbon capture R&D projects. Half of the funding is earmarked for projects designed to accelerate the progression of existing carbon capture technologies and the development and refinement of new innovations. By empowering a variety of large-scale CCUS pilot and demonstration projects, DOE expects to build the knowledge base needed to test and further prove these technologies at commercial scale.



Publications

NCCC Fact Sheets

THE FOLLOWING FACT SHEETS ARE AVAILABLE FROM THE DOE-SPONSORED NCCC: TECHNICAL OVERVIEW, GENERAL OVERVIEW, BENEFITS OF MEMBERSHIP, NATURAL GAS TESTING, CARBON UTILIZATION, DIRECT AIR CAPTURE.



Multi-input, Multi-output Hybrid Energy Systems

DOUGLAS J. ARENT, SHANNON M. BRAGG-SITTON, DAVID C. MILLER, THOMAS J. TARKA, JILL A. ENGEL-COX, RICHARD D. BOARDMAN, PETER C. BALASH, MARK F. RUTH, JORDAN COX, DAVID J. GARFIELD, JOULE, IN PRESS, DECEMBER 1, 2020. (SUBSCRIPTION MAY BE REQUIRED.)

Cooperative carbon capture and steam regeneration with tetraamine-appended metal–organic frameworks

EUGENE J. KIM, REBECCA L. SIEGELMAN, HENRY Z. H. JIANG, ALEXANDER C. FORSE, JUNG-HOON LEE, JEFFREY D. MARTELL, PHILLIP J. MILNER, JOSEPH M. FALKOWSKI, JEFFREY B. NEATON, JEFFREY A. REIMER, SIMON C. WESTON, JEFFREY R. LONG, SCIENCE, VOLUME 369, ISSUE 6502, PP. 392-396, JULY 24, 2020. (SUBSCRIPTION MAY BE REQUIRED.)

Custom Formulation of Multicomponent Mixed-Matrix Membranes for Efficient Post-combustion Carbon Capture

SAMEH K. ELSAIDI, SURENDAR VENNA, ALI K. SEKIZKARDES, JANICE A. STECKEL, MONA H. MOHAMED, JAMES BAKER, JOHN BALTRUS, DAVID HOPKINSON, CELL REPORTS PHYSICAL SCIENCE, VOLUME 1, ISSUE 7, 100113, JULY 22, 2020. (SUBSCRIPTION MAY BE REQUIRED.)

Dual-Layer MOF Composite Membranes with Tuned Interface Interaction for Postcombustion Carbon Dioxide Separation

SAMEH K. ELSAIDI, SURENDAR VENNA, MONA H. MOHAMED, MICHAEL J. GIPPLE, DAVID P. HOPKINSON, CELL REPORTS PHYSICAL SCIENCE, VOLUME 1, ISSUE 5, 100059, MAY 20, 2020. (SUBSCRIPTION MAY BE REQUIRED.)

Development of a framework for sequential Bayesian design of experiments: Application to a pilot-scale solvent-based CO₂ capture process

JOSHUA C. MORGAN, ANDERSON SOARES CHINEN, CHRISTINE ANDERSON-COOK, CHARLES TONG, JOHN CARROLL, CHIRANJIB SAHA, BENJAMIN OMELL, DEBANGSU BHATTACHARYYA, MICHAEL MATUSZEWSKI, K. SHAM BHAT, DAVID C. MILLER, APPLIED ENERGY, VOLUME 262, 114533, MARCH 15, 2020. (SUBSCRIPTION MAY BE REQUIRED.)

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) Fossil Energy Program 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 success of this research will enable cost-effective implementation of carbon capture technologies that can be applied to the existing fleet of fossil fuel-fired plants, new plants, industrial facilities, and the removal of CO_2 from the atmosphere. Cost-competitive carbon capture technologies have the potential to support the fossil sector while advancing U.S. leadership in high efficiency, low-emission generation technologies.

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

Carbon Capture Infographics contain visual representations of the program and its associated technologies. These are designed to help convey program highlights in a compact and shareable form. Check out the latest!



Contact Us

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

CUSTOMER SERVICE: 1-800-553-7681

www.netl.doe.gov

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