

SEPTEMBER 2023

# CARBON CAPTURE NEWSLETTER



## 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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## NCCC Announces First DAC Testing

The U.S. Department of Energy's (DOE) National Carbon Capture Center (NCCC) completed its first direct air capture (DAC) onsite test, in collaboration with Southern States Energy Board (SSEB) and Aircapture. SSEB, Aircapture, and other team members in the DAC Recovery of Energy for Carbon Capture, Utilization, and Storage (CCUS) Partnership are working together to scale up and demonstrate a modular and scalable atmospheric carbon dioxide removal system. The technology employs solid-amine adsorption-desorption contactor technology in integrated field units that produce a carbon dioxide (CO<sub>2</sub>) stream of at least 95% purity using low-grade waste heat. The NCCC is assisting with commercially relevant field testing after design, construction, and initial testing by Aircapture. The project's technology demonstration involves using specialized equipment that pulls in ambient air, removes CO<sub>2</sub> molecules, and subsequently isolates and concentrates them for storage or conversion into valuable products. Funded with support from DOE's Office of Fossil Energy and Carbon Management (FECM) and National Energy Technology Laboratory (NETL), the experiments at the NCCC involve evaluating the efficiency and effectiveness of the DAC system, exploring different capture materials, and optimizing CO<sub>2</sub> extraction and storage processes.

# Interagency News and Updates

## FECM/NETL Carbon Management Research Project Review Meeting Held



2023 FECM / NETL  
**Carbon Management**  
Research Project Review Meeting

The FECM/NETL Carbon Management Project Review Meeting was held Aug. 28–Sept. 1, 2023, in Pittsburgh, Pennsylvania. The meeting shared knowledge and insights from the following FECM research and development (R&D) programs: Point Source Carbon Capture (PSCC), carbon dioxide removal (CDR), Carbon Conversion, and Carbon Transport and Storage (CTS). Proceedings should be [posted](#) in mid-September 2023.

## National University Alliance Wraps Up a Successful Seven-Year Collaboration with NETL

The University Coalition for Basic and Applied Fossil Energy Research and Development is preparing to conclude a seven-year effort, which resulted in more than \$16 million of federal funding awarded to 43 research projects that significantly advanced energy research, including clean energy projects focused on developing carbon management technologies. Collaboration with NETL was a major part of each project. NETL staff supported each project by offering consultation, technical guidance, sample analysis, sample preparation, and more. NETL also provided internships for the universities and made NETL's innovative facilities available to coalition participants, with researchers also co-mentoring students and co-authoring journal articles and conference papers. Participants authored a total of 53 journal articles, with 33% co-authored by NETL researchers and 267 papers, presentations, and posters for workshops and conferences, with 19% of the conference papers co-authored by NETL staff.

## NETL and AI Partner Enhance Energy Modeling Techniques

NETL, in partnership with a California-based leading artificial intelligence (AI) hardware manufacturer—is embracing new, efficient computer architecture that can accelerate research project simulations to make a clean energy economy a reality. Working in conjunction with Cerebras, who designed the revolutionary wafer-scale engine to tackle tough AI problems, NETL developed the Wafer-scale engine Field equation Application programming interface (WFA). The WFA is enabling newer, more efficient means of generating simulation modeling data that will produce results faster while reducing the amount of energy consumed.



## NETL Discusses DAC Center, Other Technologies at Clean Energy Conference



NETL researchers leading the development of innovative technologies to mitigate climate change shared their knowledge and expertise with engineers and scientists from five continents at the 47th International Technical Conference on Clean Energy, held July 23–27, 2023. NETL's Ronald Breault, Ph.D., Thermal Science Team supervisor and conference co-chair led several presentations, including sessions on efforts to advance DAC—technology that was also the focus of a presentation by NETL's Dave Luebke, DAC technical director, and Jim Hoffman, a researcher on NETL's Reaction Engineering Team.

# Interagency News and Updates (continued)

## NETL, Other National Labs Explore Innovative Pathways to Produce Carbon-Negative H<sub>2</sub>

Researchers from NETL, the National Renewable Energy Laboratory (NREL), and the Lawrence Livermore National Laboratory met with industry and academic representatives on June 22–23, 2023, to discuss pathways to carbon-negative hydrogen (H<sub>2</sub>) production. Nathan Weiland, a senior fellow at NETL, outlined analyses performed by NETL to support alternate methods of producing carbon-neutral or carbon-negative H<sub>2</sub>. He also explained how the research is aligned with DOE's Hydrogen Shot, an initiative launched in June 2021 to reduce the cost of clean H<sub>2</sub> by 80% to \$1 per 1 kilogram in 1 decade ("111") as well as the newly announced Clean Fuels & Products Shot, which aims to reduce greenhouse gas (GHG) emissions from the fuel and chemical industry at least 85% by 2035.

## NETL Discovers Potential Sources of PGMs as Part of a Process for CDR

The discovery of platinum group minerals (PGMs) was a byproduct of research at NETL in Albany, Oregon, the home for mineral processing R&D. The federally funded research focused on pulling critical minerals (CMs) from ultramafic rocks before they are subjected to enhanced mineralization or natural weathering. Researchers believe that enhanced mineralization can help stabilize and store CO<sub>2</sub>. The samples NETL examined came from the Twin Sisters mine in Washington's Whatcom County. Owners of the mine provided NETL with access to the raw resources to test NETL mineralization and CMs technologies. Eion Carbon, a CDR company that focuses on enhanced rock weathering, and NETL are working together in a cooperative R&D agreement to advance technology to remove CMs while preserving the mineral carbonation potential of olivine from the mine.



*NETL researchers led by Jon Yang, Ph.D., discovered platinum group minerals — extremely rare mineral commodities used in industrial applications and consumer products — in samples from the Twin Sisters olivine mine in Whatcom County, Washington.*

## DOE Selects Nine Organizations That Will Implement Regional Onsite Energy Technical Assistance Partnerships to Decarbonize America's Industrial Sector

DOE's Industrial Efficiency and Decarbonization Office announced the selection of nine organizations—eight regional and one national—that will establish a network of Technical Assistance Partnerships to help industrial facilities and other large energy users increase the adoption of onsite energy technologies. The organizations will receive up to \$23 million in federal funding for multi-year technical assistance activities to accelerate the integration and deployment of clean energy technologies to drive U.S. industrial decarbonization, productivity, and competitiveness.

# Interagency News and Updates (continued)

## Decarbonizing America's Industrial Sector Fact Sheet Released

A new DOE fact sheet available includes the following topics: Building a Net-Zero Economy Made in America, DOE's Industrial Decarbonization Roadmap, Investments Across the Innovation Pipeline, Technologies for Industrial Emissions Reduction Development (TIEReD) Program, and Technical Assistance and Workforce Development.



## U.S. and India Advance Partnership on Clean Energy

U.S. Secretary of Energy Jennifer M. Granholm and Indian Minister of Petroleum and Natural Gas Hardeep Singh Puri held the third ministerial meeting of the U.S.-India Strategic Clean Energy Partnership (SCEP), launched in September 2021. During the meeting, the sides noted the growing importance of bilateral energy cooperation between the countries while underscoring the critical importance of bilateral clean energy engagement and SCEP's achievements in strengthening energy security, creating opportunities for clean energy innovation, addressing climate change, and creating employment generation opportunities.

## DOE Announces Funding for Small Business R&D Grants

DOE announced \$72 million in funding for small businesses to pursue scientific, clean energy, and climate research, development, and demonstration projects. The funding will support 296 projects across 44 states and addresses multiple topic areas, such as renewable energy, nuclear energy, cybersecurity, advanced materials and manufacturing, microelectronics, and AI. DOE's Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) awards aim to transform science and technology breakthroughs into viable products and services that can be utilized by the American people and across all sectors of the nation's economy.



## DOE Announces Funding Toward Four Lab-Led Energy Projects Supporting Carbon Management and Resource Sustainability

FECM and the Office of Technology Transitions (OTT) announced more than \$5 million for

**Technology Commercialization Fund** |  **OTT** |  Office of Technology Transitions

four projects selected from the Base Annual Appropriations Technology Commercialization Fund (TCF). With this funding, industry and DOE national laboratories will partner to advance lab-developed technologies toward commercialization in technology areas supported by FECM, including carbon management, CM production, and methane mitigation, as part of DOE's efforts to achieve a clean energy and industrial economy. TCF aims to bolster America's energy competitiveness and security by accelerating commercialization and shepherding critical energy technologies from the lab to the market. Within DOE, OTT is charged with managing TCF in its role of leading policy and programs related to technology commercialization.



# Interagency News and Updates (continued)

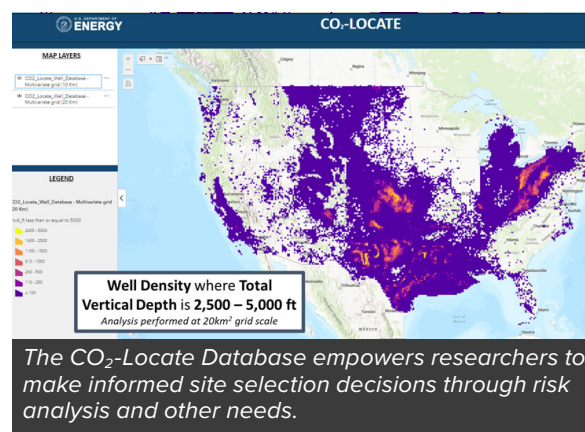
## DOE Invests Funding for Regional Projects to Accelerate U.S. Carbon Capture, Transport, and Storage Technology Deployment

DOE announced 16 projects across 14 states are set to receive \$23.4 million to provide locally tailored technical assistance and enhanced stakeholder engagement around carbon management technologies. The projects, to be managed by NETL and housed at both universities and private sector companies, aim to connect carbon management developers with local communities to foster collaboration and education toward the advancement of commercial deployment of carbon capture, transport, and storage technologies across the United States.



## NETL CO<sub>2</sub>-Locate Tool to Enhance CCS Projects

Now published on NETL's Energy Data eXchange® (EDX), CO<sub>2</sub>-Locate is one of several innovative products developed with funding from the Bipartisan Infrastructure Law (BIL). CO<sub>2</sub>-Locate database is a centralized platform that allows users to quickly and accurately obtain the data they need regarding geologic carbon capture and storage (CCS). Designed to support more efficient and effective CCS site selection, risk analysis, and other key stakeholders needs, CO<sub>2</sub>-Locate includes the start of an integrated national well dataset, representing open-source wellbore data from disparate state and federal entities.



*The CO<sub>2</sub>-Locate Database empowers researchers to make informed site selection decisions through risk analysis and other needs.*

The database also provides summary spatio-temporal statistics and offers data-driven insights into potential opportunities and risks while delivering beneficial insights through an intuitive web map.

## NETL Innovation Efficiently Converts CO<sub>2</sub> Into Acetate for Use in a Variety of Popular Products

As an alternative that is more efficient than photosynthesis, NETL researchers/inventors Daniel E. Ross, Djuna Gulliver, and Samuel Flett developed a biocatalyst approach to convert CO<sub>2</sub> into acetate—used in a wide range of products such as tool handles, eyeglass frames, and as a component of many medical and food industry products. Biocatalysts are natural substances that use enzymes from biological sources to improve the rate of chemical reactions. Other processes for CO<sub>2</sub> conversion using biocatalysts have been developed, but the biocatalyst developed at NETL has a unique adaptability to feedstocks and resistance to contamination challenges, making it a promising target for large-scale deployment. NETL has filed for a patent on the technology.



*NETL researchers, left to right, Sam Flett, Djuna Gulliver and Dan Ross at work in their lab where they developed a biocatalyst with 99% efficiency to convert carbon dioxide into acetate — an ingredient used in many products like cleaning supplies and textiles.*

# Interagency News and Updates (continued)

## Opportunity for Chemicals and Fuels from CO<sub>2</sub>: Researchers Assess Roadblocks for Industrial Deployment of CO<sub>2</sub> Electrolysis

In a [perspective](#) published in *Joule*, NREL and collaborating authors holistically review the status of CO<sub>2</sub> electrolysis technology and its potential to reduce carbon emissions in future energy systems. The study thoroughly analyzes how each component—catalysts, membranes, and reactors—and each integration pathway affects the economic feasibility of CO<sub>2</sub> electrolysis. The authors find that the source of waste CO<sub>2</sub> is highly relevant to whether electrolysis could be cost-competitive. Another major finding is that renewable electricity could take CO<sub>2</sub> electrolysis a long way toward cost competitiveness. By selectively taking advantage of variable electricity from wind and solar resources, CO<sub>2</sub> electrolysis could benefit from low-cost electricity while also providing a flexible load.

## NETL May Expand BIL-Funded FEED Studies for CO<sub>2</sub> Transport

FECM is implementing BIL Section 40303, which authorizes a total of \$100 million for the five-year period encompassing fiscal years 2022 through 2026 for the Carbon Capture Technology Program's Front-End Engineering and Design (FEED) Program for CO<sub>2</sub> transport projects. Federal funding for the CO<sub>2</sub> transport FEED studies is being provided through Funding Opportunity Announcement (FOA) DE-FOA-0002730. NETL expects that applications submitted to the amended FOA will be similar in form and function to applications submitted to the original FOA; however, specific application instructions and requirements for each non-pipeline transport mode will be included in the amended FOA if it is released. Interested parties are encouraged to closely monitor the NETL webpage for DE-FOA-0002730 for future modifications associated with this FOA.



## FECM's Engagement Home Page

FECM fosters and leverages connections with international and domestic partners; collaborates within DOE and the broader U.S. government; supports community, tribal, and stakeholder engagement; and encourages public-private partnerships to assist in meeting the Biden-Harris administration's climate goals. FECM's Engagement page includes links to upcoming events, news and blogs, and other resources.

## PSCC and CDR Interactive Project Map

The PSCC and CDR interactive project map contains information for active and inactive projects managed under NETL's [PSCC](#) and [CDR](#) Programs. The map data can be filtered to view specific information related to projects with certain criteria, such as the PSCC or CDR approach, technology, ending scale, application type, and key technology.

## Apply to Review FECM Funding Opportunity Applications

FECM is looking for a diverse pool of individuals to review the equity, justice, jobs, and community engagement sections of funding opportunity applications. To apply to review, send a resume to [SCI\\_FECM@NETL.DOE.GOV](mailto:SCI_FECM@NETL.DOE.GOV). Reviewers should have academic, subject matter, and/or practitioner experience in at least one of the following areas: diversity, equity, inclusion, and accessibility; community and stakeholder engagement; workforce development and quality jobs; and/or environmental justice.

# Interagency News and Updates (continued)

## DOE STEM Portal

DOE is building pathways for a diverse workforce to pursue science, technology, engineering, and math (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.

## 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. In the next few years, the BIL will stand 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.



# PRIZES

## NETL Providing Technical Expertise for DAC Prize Competitions

NETL will provide technical support and expertise to award the [American-Made DAC Prizes](#), a series of interconnected competitions offering up to \$115 million to advance CDR technologies from hard-to-decarbonize sectors of the U.S. economy. Funded by FECM, the DAC Pre-Commercial Prizes offer up to \$15 million split among two competitions: the DAC Energy Program for Innovation Clusters (EPIC) Incubator Prize and the DAC Pre-Commercial Technology Prize. Together, the DAC prizes are designed to strengthen the country's energy prosperity and advance just and sustainable decarbonization efforts.

### DAC Pre-Commercial Technology Prize

The [DAC Pre-Commercial Technology Prize](#) awards up to \$3.2 million in cash prizes and \$800,000 in technical assistance vouchers to teams that identify a critical need in the DAC industry, develop a solution to address this gap, and test the idea to a degree of scale. It focuses on the steps of ideation and entrepreneurship needed to prepare technologies and businesses for commercialization. The deadline to [apply](#) for the first phase is Sept. 29, 2023.

### DAC Pre-Commercial EPIC Prize

The DAC Pre-Commercial EPIC Prize awards up to \$3.7 million in cash prizes to incubator teams that submit creative and impactful plans to support entrepreneurs and innovators in the DAC space and create meaningful community engagement. It aims to support both emerging and established DAC incubators and accelerators in implementing those plans to develop strong clusters, resources, and connections for energy startups and entrepreneurs. The challenge is closed but can still be followed for further updates.

### DAC Commercial Prize

The DAC Commercial Prize awards cash prizes to teams that already have a technology that can capture CO<sub>2</sub> and scale it up to achieve a removal target. Teams will win increasingly larger prizes as they successfully scale up their DAC technologies over the course of four phases. Each phase requires compounding progress of the team's DAC technology development. Further details on the prize are forthcoming.

## DOE's MAKE IT Prize Now Open for Submission

DOE is opening the Manufacture of Advanced Key Energy Infrastructure Technologies (MAKE IT) Prize for submissions. The prize was developed by OTT in partnership with the Office of Clean Energy Demonstrations and Office of Energy Efficiency and Renewable Energy and aims to catalyze supply chain domestic manufacturing of critical clean energy technologies. The prize makes approximately \$30 million available across two tracks. The [Facilities Track](#) will award teams that demonstrate the ability to be "shovel-ready" to build a clean energy manufacturing facility on the fastest timeline and with the most effective approach. The [Strategies Track](#) will award teams who most effectively develop strategies to enable vibrant manufacturing activity in their communities.



# U.S. and International Events

## North America CCS & Hydrogen Decarbonisation Summit

The North America CCUS & Hydrogen Decarbonisation Summit, to be held Sept. 12–13, 2023, in Chicago, Illinois, will assess and review opportunities within the North American Energy Sector and review H<sub>2</sub> roadmaps set out by different states. The summit will also focus on the implementation of CCS and CCUS within industrial operations and how H<sub>2</sub> can decarbonize industry and transport.

## Industry Transition 2023

Industry Transition 2023, to be held Sept. 12–13, 2023, in Pittsburgh, Pennsylvania, unites executive leaders from mining, metals, chemicals, transportation, and other hard-to-abate industries to accelerate deep decarbonization, forge new cross-sector coalitions, and roll-out the next wave of net-zero contracts. The two-day conference will provide executives, decision-makers, and their implementation teams an opportunity to capitalize on the next frontier of decarbonization with a series of executive receptions, bi-laterals, and in-depth roundtables to engender meaningful progress on the path to net zero.

## Carbon Capture Canada

Carbon Capture Canada, to be held Sept. 12–14, 2023, in Alberta, Canada, showcases Canada's opportunity for carbon capture, underground storage, and technology innovation. The event includes a three-day convention, with a two-day business conference, expanded tradeshow floor, and in-person tour of CCUS projects.

## Decarb Infra Invest 2023

Decarb Infra Invest 2023, to be held Sept. 19–21, 2023, in Pittsburgh, Pennsylvania, will welcome more than 30 speakers and 200 attendees from project developers, industrials, investors, and government representatives to identify and tackle the core challenges in advancing CCUS and H<sub>2</sub> projects for decarbonization by exploring different business models, partnerships, and financing structures for large-scale projects and assessing the benefits and challenges of developing industrial hub and cluster projects at scale.

## PCCC-7

The 7th International Energy Agency Greenhouse Gas R&D Program Post-Combustion Capture Conference (PCCC-7) will be in person, Sept. 25–27, 2023, in Pittsburgh, Pennsylvania. The conference format will consist of a two-stream program for oral presentations, a poster session, and a small exhibition area. NETL and DOE will co-host PCCC-7, bringing together post-combustion capture experts to share knowledge, findings, and expertise. An optional tour of NETL's Pittsburgh facility will be offered Sept. 28, 2023.

## 2023 International Pittsburgh Coal Conference

The 2023 International Pittsburgh Coal Conference, to be held Oct. 4–6, 2023, in Istanbul, Turkey, is an outgrowth of a series of conferences spanning more than three decades, dealing with coal utilization, both in the United States and internationally. The conference will provide opportunity for in-depth and focused exchange of technical information and policy issues among representatives from industry, government, and academia throughout the world.

# U.S. and International Events (continued)

## Carbon Capture Summit USA 2023

The Carbon Capture Summit USA 2023, to be held Oct. 23–24, 2023, in Houston, Texas, will explore next-generation technologies for CCUS and transportation to meet net-zero emissions targets. The key focus for 2023 will be “working in collaboration with Industry” by sharing expertise, building capacity, and providing advice and support so that CCUS can play an integral role in reducing carbon emissions. Government agencies, global corporations, research bodies, and non-government organizations committed to learning and adopting CCUS technologies will participate in this event.

## American Carbon Capture, Utilization and Storage Forum

The American Carbon Capture, Utilization and Storage Forum, to be held Oct. 25–26, 2023, in Houston, Texas, will provide a platform to explore the benefits and challenges of developing available CCS solutions. The forum will cover the latest technological developments, ongoing and upcoming projects, and market forecasts of growing CCS project trends.

## 2023 AIChE Annual Meeting

The 2023 American Institute of Chemical Engineers (AIChE) Annual Meeting, to be held Nov. 5–10, 2023, in Orlando, Florida, is an educational forum for chemical engineers interested in innovation and professional growth. Academic and industry experts will cover a wide range of topics relevant to cutting-edge research, new technologies, and emerging growth.

## 2023 NCCC & Expo

The 2023 National Carbon Capture Conference (NCCC) & Expo 2023, to be held Nov. 7–8, 2023, in Des Moines, Iowa, is a two-day event 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.

## Appalachian Hydrogen & Carbon Capture Conference 2023

The Appalachian Hydrogen & Carbon Capture Conference, to be held Nov. 30, 2023, in Canonsburg, Pennsylvania, will feature several speakers who collaborate closely with DOE and understand the workings of both the government and the oil and gas industry.

## UNFCCC COP 28

The 2023 United Nations Climate Change Conference (UNFCCC), to be held Nov. 30–Dec. 12, 2023, in Dubai, United Arab Emirates, will comprise the 28th meeting of the Conference of the Parties (COP 28); the fifth meeting of the COP serving as the Meeting of the Parties to the Paris Agreement; the 18th meeting of the COP serving as the Meeting of the Parties to the Kyoto Protocol; the 59th meeting of the Subsidiary Body for Implementation; and the 59th meeting of the Subsidiary Body for Scientific and Technological Advice.

# Business and Industry News

## Koch Modular Celebrates Launch of Project Enterprise Carbon Capture System

Project Enterprise, Koch Modular's carbon capture demonstration system, harnesses a carbon capture solvent developed by ION Clean Energy. The project employs a three-step process to achieve its desired results. Initially, the hot flue gases are cooled, facilitating the subsequent absorption of CO<sub>2</sub> from the flue gas using ION's transformative ICE-31 solvent. Next, the solvent is regenerated in a state-of-the-art distillation column, allowing the captured CO<sub>2</sub> to be stripped from the solvent and collected as a valuable distilled product. Project Enterprise, jointly funded by DOE, ION Clean Energy, and Calpine, is a pivotal step in showcasing the capabilities of carbon capture technology.



*Carbon Capture Demonstration Scale System (Project Enterprise) installed at Calpine's Los Medanos Energy Center in Pittsburg, CA. (Photo: Business Wire)*

## Carbon Capture Pilot Project Launched in East Bay (video)

Calpine unveiled its first-ever carbon capture demonstration pilot at its Pittsburg Los Medanos Energy Center power plant in California. The pilot project will test recent technology that could capture nearly all the plant's carbon emissions, cost-effectively reducing GHG emissions. Under the process, CO<sub>2</sub>-rich gas moves into an absorption tower where a liquid solvent will bind with it, allowing the gas to be cleaned and released and the CO<sub>2</sub> piped out for subsurface storage.

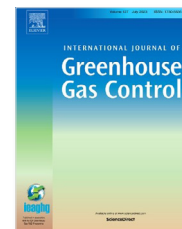
## Black & Veatch's IgniteX Climate Tech Accelerator Program Announces 2023 Participants

Black & Veatch selected seven participants to take part in its 12-week IgniteX Climate Tech Accelerator program, which provides funding and support to companies on the forefront of climate technology. The seven startups, selected from a pool of 118 applicants, included those that specialize in areas such as AI technology, carbon capture and reduction, and sustainable nutrition. IgniteX empowers startups offering scalable climate solutions for critical infrastructure. The seven selected program participants will partner with Black & Veatch subject matter leaders to co-develop, pilot, and market their recent technologies. They will receive mentorship, access to the company's vast industry network, product testing opportunities, pitch development coaching, and investor introductions.

# Publications

## Performance of hydrophobic physical solvents for pre-combustion CO<sub>2</sub> capture at a pilot scale coal gasification facility

KATHRYN H. SMITH, HUSAIN E. ASHKANANI, ROBERT L. THOMPSON, JEFFREY T. CULP, LEI HONG, MIKE SWANSON, JOSHUA STANISLOWSKI, WEI SHI, BADIE I. MORSI, KEVIN RESNIK, DAVID P. HOPKINSON, NICHOLAS S. SIEFERT, INTERNATIONAL JOURNAL OF GREENHOUSE GAS CONTROL, VOLUME 124, MARCH 2023. (SUBSCRIPTION MAY BE REQUIRED.)



## Direct air capture of CO<sub>2</sub>: from insights into the current and emerging approaches to future opportunities

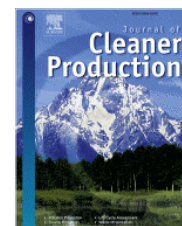
MUHAMMAD ZEESHAN, MICHELLE K. KIDDER, EMILY PENTZER, RACHEL B. GETMAN, BURCU GURKAN, FRONTIERS IN SUSTAINABILITY: SUSTAINABLE CHEMICAL PROCESS DESIGN, VOLUME 4, JUNE 15, 2023.

## Computational Study of Mixing Solid Materials for CO<sub>2</sub> Capture Technology

YUHUA DUAN, PRESENTED AT AMERICAN PHYSICAL SOCIETY (APS) MARCH MEETING, LAS VEGAS, NEVADA, MARCH 5, 2023.

## Energy-effective and low-cost carbon capture from point-sources enabled by water-lean solvents

YUAN JIANG, PAUL M. MATHIAS, RICHARD F. ZHENG, CHARLIES J. FREEMAN, DUSHYANT BARPAGA, DEEPIKA MALHOTRA, PHILLIP K. KOECH, ANDY ZWOSTER, DAVID J. HELDEBRANT. JOURNAL OF CLEANER PRODUCTION, VOLUME 388, FEBRUARY 15, 2023. (SUBSCRIPTION MAY BE REQUIRED.)



## Determination of the regeneration energy of direct air capture solvents/sorbents using calorimetric methods

ABISHEK KASTURI, GYOUNG GUG JANG, DIANA STAMBERGA, RADU CUSTELCEAN, SOTIRA YIACOUMI, COSTAS TSOURIS, SEPARATION AND PURIFICATION TECHNOLOGY, VOLUME 310, APRIL 1, 2023. (SUBSCRIPTION MAY BE REQUIRED.)

## Micropatterning of alumina tubular membranes via laser carving for enhanced direct air capture

JINWEN WANG, XIN GAO, AYOKUNLE OMOSEBI, FENG ZHU, JESSE THOMPSON, ARON PATRICK, KUNLEI LIU. APPLIED CERAMIC TECHNOLOGY, VOLUME 20, ISSUE 5, SEPTEMBER/OCTOBER 2023. (SUBSCRIPTION MAY BE REQUIRED.)



## About DOE Carbon Capture:

DOE/NETL is developing the next generation of advanced CO<sub>2</sub> capture technologies through NETL's Point Source Carbon Capture Program (PSCC) and advancing a diverse set of CDR approaches to directly remove CO<sub>2</sub> 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

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

## Contact Us

### DOE Carbon Capture contacts:

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Amishi Claros, Acting Director, CO<sub>2</sub> Removal and Conversion, 202.586.1888

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

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541-967-5892

3610 Collins Ferry Road  
**Morgantown, WV** 26507-0880  
304-285-4764

626 Cochran Mill Road  
**Pittsburgh, PA** 15236-0940  
412-386-4687

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

**CUSTOMER SERVICE:** 1-800-553-7681

[www.netl.doe.gov](http://www.netl.doe.gov)

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## Get Social with Us

There are several ways to join the conversation and connect with NETL's Carbon Capture activities:

### Disclaimer

This project was funded by the United States Department of Energy, National Energy Technology Laboratory, in part, through a site support contract. Neither the United States Government nor any agency thereof, nor any of their employees, nor the support contractor, nor any of their employees, makes any warranty, express or implied, or assumes any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product, or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof.