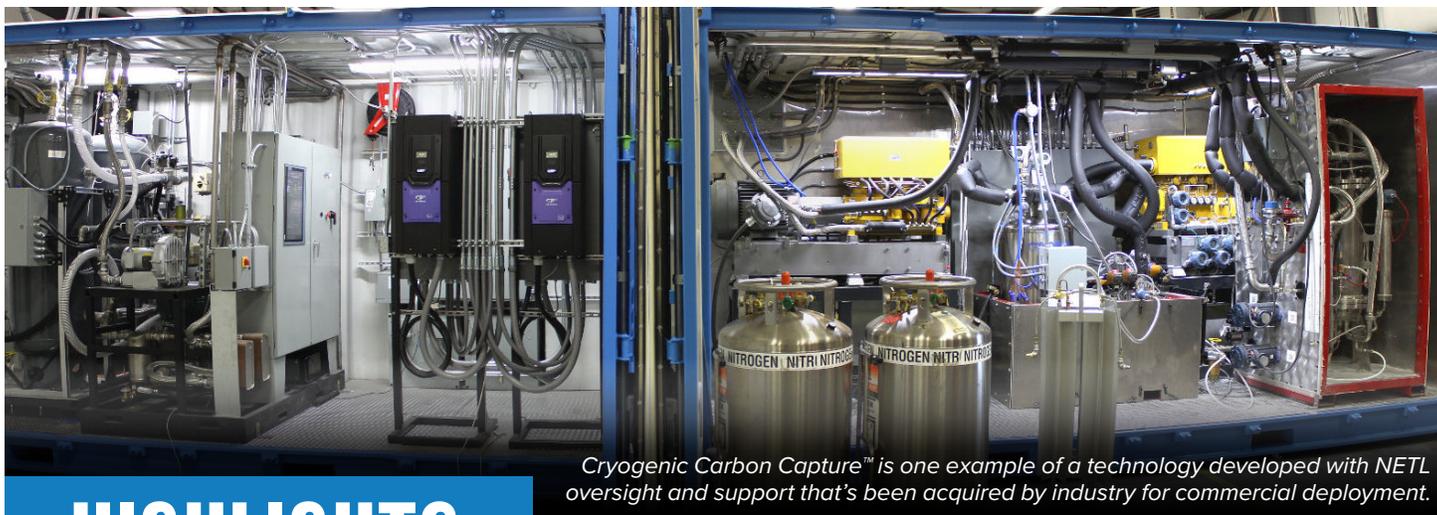


CARBON CAPTURE NEWSLETTER



Cryogenic Carbon Capture™ is one example of a technology developed with NETL oversight and support that's been acquired by industry for commercial deployment.

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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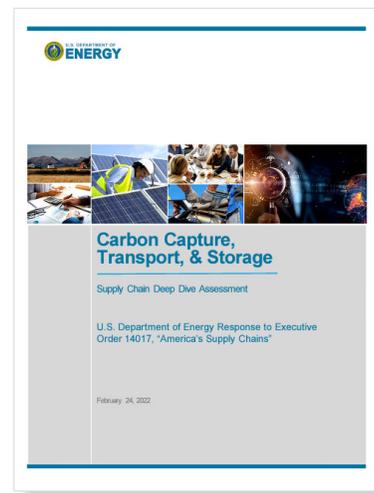
NETL Drives Commercialization of Carbon Capture Technologies

Several innovative technologies developed with support, expertise, and strategic guidance provided by NETL have been licensed for use in next-generation commercial applications to capture CO₂ from power and industrial plants to lower atmospheric emissions of greenhouse gases (GHGs). Cryogenic Carbon Capture™ (CCC), acquired by Chart Industries for commercial deployment, is one example of a technology developed with NETL oversight and financial assistance. An advanced solvent to capture CO₂ from point sources at fossil-fueled power plants, as well as from steel and cement manufacturing sites, is another recent example of a technology developed with NETL project governance that has been licensed for commercial deployment. In December 2021, Honeywell and the Texas Carbon Management Program at the University of Texas at Austin announced a licensing agreement to leverage the technology in which CO₂ is absorbed into an amine solvent and then sent to a stripper where CO₂ is separated from the solvent. The CO₂ is then compressed for geological storage or converted for other purposes.

Interagency News and Updates

NETL CCS Report Sees Major Job Growth Potential and No Significant Supply Chain Risks

A buildout of America’s evolving carbon capture and storage (CCS) technologies offers noteworthy job growth potential with no significant supply chain risks, according to an NETL-authored report released by U.S. Secretary of Energy Jennifer M. Granholm. The report, titled “Carbon Capture, Transport and Storage, Supply Chain Review,” was conducted by NETL to assess potential supply chain bottlenecks to CCS implementation. NETL researchers conducted a supply chain risk analysis by comparing raw material estimates against domestic and global production to search for opportunities and vulnerabilities. A major reason for the low risk to the supply chain is because CCS infrastructure can be supplied by components made in the United States. The report also concluded that a CCS industry build-out could result in creation of up to 1.8 million jobs—largely in the Midwest, Appalachian, and southern states—through construction, operation, and maintenance of capture, pipeline, and storage sites.



DOE has Launched Its Clean Energy Corps

DOE announced the launch of its Clean Energy Corps, which is made up of staff from more than a dozen offices across DOE who will work together to research, develop, demonstrate, and deploy solutions to climate change. DOE announced that the Clean Energy Corps is ready to recruit an additional 1,000 employees using a special hiring authority included in the BIL to help implement BIL’s historic infusion of funding and accelerate the nation’s drive to a clean energy future. The Clean Energy Corps’

[new hiring portal](#) will help streamline the application process for industry veterans, experienced technical experts, and the next generation of clean energy leaders it seeks to attract.



DOE Optimizes Structure to Implement Clean Energy Investments from BIL

DOE announced an organizational realignment to ensure that the department has the structure needed to effectively implement the clean energy investments in President Biden’s Bipartisan Infrastructure Law (BIL) and the Energy Act of 2020. The new organizational structure establishes two Under Secretaries: one focused on fundamental science and clean energy innovation and the other focused on deploying clean infrastructure. The BIL and the Energy Act of 2020 provide more than \$60 billion, primarily for new major clean energy demonstration and deployment programs, and more than triples DOE’s annual funding for energy programs, including significantly expanded R&D and entirely new demonstration and deployment missions.

Interagency News and Updates (continued)

CEQ Issues New Guidance to Responsibly Develop CCUS

The White House Council on Environmental Quality (CEQ) delivered new guidance to federal agencies to help ensure that the advancement of carbon capture, utilization, and storage (CCUS) technologies is done in a responsible manner that incorporates the input of communities and reflects the best available science. The CCUS guidance underscores the importance of incorporating environmental justice and equity considerations early into the review and deployment of CCUS projects to protect overburdened communities from direct, indirect, and cumulative effects. The guidance reiterates the need to develop robust tribal consultation and stakeholder engagement plans and to conduct regular engagement. Members of the public may submit comments on the guidance at <https://www.federalregister.gov/d/2022-03205> (Docket ID: CEQ-2022-0001) until March 18, 2022. The full CCUS guidance can be read [HERE](#).

DOE Announces Funding to Advance Carbon Capture Technologies for Natural Gas Power and Industrial Sectors

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) announced up to \$96 million in federal funding for projects that will develop point-source carbon capture technologies for natural gas power plant and industrial applications capable of capturing at least 95% of carbon dioxide (CO₂) emissions generated. This funding opportunity, administered through the National Energy Technology Laboratory (NETL), will support projects to develop and test transformational carbon capture materials, equipment, processes, or a combination thereof for applications in natural gas combined cycle (NGCC) power generation and the industrial sector. Projects will be selected under four areas of interest: (1) Carbon Capture Research and Development (R&D): Laboratory-Scale Testing of Highly Efficient Materials for NGCC Plants, (2) Engineering-Scale Testing of Transformational Post-Combustion Carbon Capture Technologies for NGCC Power Plants, (3) Engineering-Scale Testing of Transformational Carbon Capture Technologies for Industrial Plants and Waste-to-Energy Plants, and (4) Front-End Engineering Design Studies for Carbon Capture Systems at Existing (Retrofit) Domestic Industrial Facilities and NGCC Power Plants.



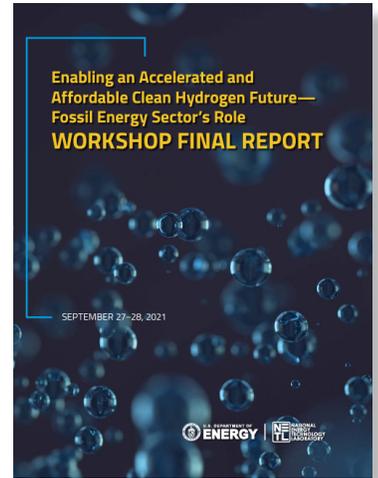
DOE Announces Funding to Reduce Climate Impacts of Energy Technologies and Manufacturing

DOE announced \$150 million in open funding for research projects focused on increasing efficiency and curbing carbon emissions from energy technologies and manufacturing. Funding will support an array of research topics in basic chemical and materials research, including new clean energy approaches that are inspired by energy-efficient biological processes. This funding will also support research underpinning DOE's Energy Earthshots Initiatives, including the Hydrogen Shot, which aims to decrease the cost of producing hydrogen; the Long-Duration Storage Shot, which seeks to reduce the cost and increase the duration of grid-scale energy storage; and the Carbon Negative Shot, which targets the decrease of costs to remove and durably store CO₂ from the atmosphere. The FOA can be found [here](#).

Interagency News and Updates (continued)

Fossil Energy’s Role in Accelerating a Clean, Affordable Hydrogen Future Outlined in New Report

NETL and the Gas Technology Institute (GTI) hosted a two-day workshop in September 2021 to gather and share ideas on how to validate and advance the role of the fossil energy sector as an economic means to rapidly deploy hydrogen as a pathway to rapid decarbonization of energy systems. The NETL report, “[Enabling an Accelerated and Affordable Clean Hydrogen Future – Fossil Energy Sector’s Role: Workshop Final Report](#),” encapsulates public and private sector input and key themes associated with fossil energy’s role in enabling an accelerated and affordable clean hydrogen future. NETL Director Brian Anderson, FECM Principal Deputy Assistant Secretary Jennifer Wilcox, and NETL Research and Innovation Center (RIC) Director Bryan Morreale facilitated the exchange of ideas at the workshop to leverage the nation’s fossil energy industries in creating clean hydrogen for decarbonization of the nation’s economy. More than 90 persons participated from 45 different organizations representing research, power generation, public utilities, natural gas production, natural gas pipeline and distribution, steel production, specialty gas supply, manufacturing, technology development, federal and state governments, and the legal community.



DOE Announces Funding for Small Business R&D

DOE announced \$125 million for small businesses pursuing clean energy R&D projects. The projects range from grid modernization and carbon removal to renewable energy and energy storage. This funding is administered by DOE’s Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs, which were established to encourage participation of diverse communities in technological innovation, as well as to increase technology transfer between research institutions and small businesses. This funding opportunity is open to small businesses that have previously received DOE SBIR or STTR grants to provide additional opportunities to compete for funding to develop working prototypes of their discoveries. More details on this funding opportunity can be found [here](#).

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U.S. and International Events

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

The fourth installation of the CCUS Gordon Research Conference series, to be held Apr. 3–8, 2022, in Ventura, California, will examine the following questions: (1) can the United States decarbonize safely, and with a variety of approaches appropriate for the variety 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? Several DOE, NETL, and other national laboratory personnel will be speaking and/or leading discussion panels.

U.S. and International Events (continued)

Appalachian Hydrogen & Carbon Capture Conference

The Appalachian Hydrogen & Carbon Capture Conference, to be held Apr. 21, 2022, in Pittsburgh, Pennsylvania, will explore challenges in hydrogen and carbon capture in the Appalachian region. Register online for an in-person or virtual ticket.



ARPA-E Energy Innovation Summit

The 2022 Advanced Research Projects Agency-Energy (ARPA-E) Energy Innovation Summit has been rescheduled for May 23–25, 2022, at Gaylord Rockies Resort and Convention Center in Denver, Colorado. This annual conference and technology showcase brings together experts from different technical disciplines and professional communities to discuss America’s energy challenges. 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.

ASME’s Turbomachinery Technical Conference & 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) will be held June 26–30, 2022, at Princeton University, New Jersey. ICCDU-22 is a global meeting place for chemists, engineers, and environmental policy planners to discuss the latest developments in the field of CO₂ capture and utilization.

CEM13/MI7

The 13th Clean Energy Ministerial (CEM) and the ministerial for Mission Innovation (MI)—a collective effort by the public and private sector to rapidly create the net-zero economy that leaves no community behind—will be held Sept. 22–23, 2022, in Pittsburgh, Pennsylvania. CEM is a platform for members to help shape the global clean energy agenda and advance the deployment of specific clean energy technologies and solutions.



Carbon Capture Technology Expo North America

The Carbon Capture Technology Expo North America is a two-day event to be held June 14-15, 2022, in Houston, Texas. The event will bring together more than 100 international speakers and over 400 delegates to debate and discuss the latest technologies and solutions, strategies, innovations, current and future regulations, by-products and strategies for captured CO₂ and the latest and next-generation techniques and models to help foster a sustainable, cost-effective and resource-efficient CCUS sector.

16th Greenhouse Gas Control Technologies Conference

The 16th Greenhouse Gas Control Technologies (GHGT) Conference, to be held Oct. 23–27, 2022, in Lyon, France, has established itself as the principal international conference on GHG mitigation technologies, especially CCS. 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.

Business and Industry News

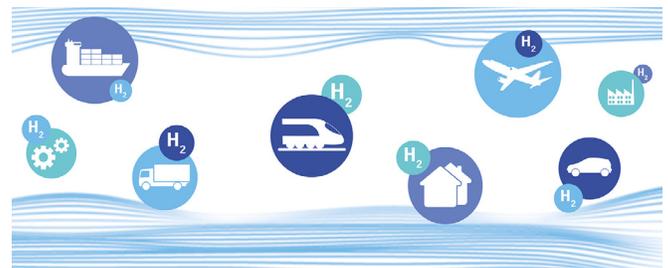
Secretary of Energy Jennifer Granholm Addressed CERAWeek in Houston

U.S. Secretary of Energy Jennifer M. Granholm addressed delegates at the 40th annual CERAWeek by IHS Markit, Mar. 7–11, 2022, in Houston, Texas. Secretary Granholm joined the world's energy industry leaders, experts, and government officials and policymakers, as well as leaders from the technology, financial, and industrial communities addressing this year's conference. Watch on demand video highlights [here](#).



NETL, Partners Rolling Out Open Hydrogen Initiative

GTI and S&P Global Platts launched the Open Hydrogen Initiative (OHI), a new collaboration focused on bringing industry within the hydrogen marketplace together to provide further transparency into the environmental impact of hydrogen production and help unlock its full potential as an important driver of energy transitions. As part of this initiative, GTI has invited NETL to participate in the effort because of NETL's



deep expertise and capabilities in life cycle analysis. OHI's mission is to create objective, credible, peer-reviewed, transparent, and open-sourced tools that allow participants from across the hydrogen value chain to assess the carbon intensity of hydrogen at the asset level. The creation and adoption of these technical protocols will help build and harmonize the hydrogen market, contextualize climate solutions, advance transparency, and support global trade in low-carbon hydrogen.

DOE Selects CORMETECH to Develop Carbon Capture Tech for Natural Gas Plants

American engineering company CORMETECH has been selected by DOE to further test and develop a new, lower-cost technology to capture CO₂ from the flue gas of NGCC plants. The announcement forms part of DOE's award of \$45 million in funding for 12 projects to advance point source CCS technologies. The aim of the project is to capture at least 95% of CO₂ emissions and other harmful gases generated from natural gas power and industrial facilities.

FECM Awards Funding for GE-Led Carbon Capture Technology Integration Project

FECM will award \$5,771,670 in federal funding to GE Gas Power's front-end engineering design (FEED) study, titled "Retrofittable Advanced Combined Cycle Integration for Flexible Decarbonized Generation," following successful completion of the award negotiation phase. This funding is focused on CCUS for power generation applications with a goal of commercial deployment by 2030. GE Gas Power will work with Southern Company, Linde, BASF, and Kiewit to develop a detailed plan for integrating carbon capture technologies with an NGCC plant to capture approximately 95% of CO₂ emissions generated.

Publications

New sterically hindered polyvinylamine-containing membranes for CO₂ capture from flue gas

TING-YU CHEN, XUEPENG DENG, LI-CHIANG LIN, W.S. WINSTON HO, JOURNAL OF MEMBRANE SCIENCE, VOLUME 645, MAR. 5, 2022. (SUBSCRIPTION MAY BE REQUIRED.)



Thin-film composite membranes based on hyperbranched poly(ethylene oxide) for CO₂/N₂ separation

GENGYI ZHANG, THIEN N. TRAN, LIANG HUANG, ERDA DENG, ADRIENNE BLEVINS, WENJI GUO, YIFU DING, HAIQING LIN, JOURNAL OF MEMBRANE SCIENCE, VOLUME 644, FEB. 15, 2022. (SUBSCRIPTION MAY BE REQUIRED.)

Diversifying Databases of Metal Organic Frameworks for High-Throughput Computational Screening

SAURADEEP MAJUMDAR, SEYED MOHAMAD MOOSAVI, KEVIN MAIK JABLONKA, DANIELE ONGARI, BEREND SMIT, ACS APPLIED MATERIALS AND INTERFACES, VOLUME 31, ISSUE 51, DEC. 15, 2021.



Investigation of chemical stabilities and contact angle of 3D printed polymers with CO₂ capture solvents to enhance absorber performance

MOUSHUMI SARMA, KEEMIA ABAD, DUNGUYEN, SAMANTHA RUELAS, KUNLEI LIU, JESSE THOMPSON, INTERNATIONAL JOURNAL OF GREENHOUSE GAS CONTROL, VOLUME 111, OCT. 20, 2021. (SUBSCRIPTION MAY BE REQUIRED.)

Linear relationships for modeling CO₂ absorption in aqueous alkanolamine solutions in a thermodynamically consistent way

XIAOSHUAI YUAN, CHIN FENG NG, HEATHER NIKOLIC, KUNLEI LIU, AIChE JOURNAL, JAN. 25, 2022. (SUBSCRIPTION MAY BE REQUIRED.)

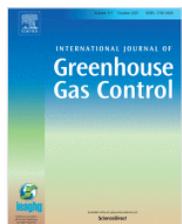


CO₂ absorption intensification using three-dimensional printed dynamic polarity packing in a bench-scale integrated CO₂ capture system

MIN XIAO, MOUSHUMI SARMA, JESSE THOMPSON, DU NGUYEN, SAMANTHA RUELAS, KUNLEI LIU, AIChE JOURNAL, JAN. 4, 2022. (SUBSCRIPTION MAY BE REQUIRED.)

Pilot plant results with the piperazine advanced stripper at NGCC conditions

GARY T. ROCHELLE, KOREDE AKINPELUMI, TIANYU GAO, CHING-TING LIU, ATHREYA SURESH BABU, YUYING WU, INTERNATIONAL JOURNAL OF GREENHOUSE GAS CONTROL, VOLUME 113, JANUARY 2022. (SUBSCRIPTION MAY BE REQUIRED.)



Ce stabilized Ni–SrO as a catalytic phase transition sorbent for integrated CO₂ capture and CH₄ reforming

HAIMING GU, YUNFEI GAO, SHERAFGHAN IFTIKHARA, FANXING LI, JOURNAL OF MATERIALS CHEMISTRY, VOLUME 10, ISSUE 6, FEB. 8, 2022. (SUBSCRIPTION MAY BE REQUIRED.)

Migration-assisted, moisture gradient process for ultrafast, continuous CO₂ capture from dilute sources at ambient conditions

ADITYA PRAJAPATI, ROHAN SARTAPE, TOMÁS ROJAS, NAVEEN K. DANDU, PRATIK DHAKAL, AMEY S. THORAT, JIAHAN XIE, IVAN BESSA, MIGUEL T. GALANTE, MARCIO H. S. ANDRADE, ROBERT T. SOMICH, MÁRCIO V. REBOUÇAS, GUS T. HUTRAS, NATHÁLIA DINIZ, ANH T. NGO, JINDAL SHAH, MEENESH R. SINGH, ENERGY & ENVIRONMENTAL SCIENCE, VOLUME 15, ISSUE 2, FEB. 16, 2022. (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) 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

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

CUSTOMER SERVICE: 1-800-553-7681

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