NETL'S CARBON TRANSPORT AND STORAGE NEWSLETTER

ANNUAL INDEX

FISCAL YEAR (FY) 2024

October 2023 – September 2024

U.S. Department of ENERGY | NETL NATIONAL ENERGY TECHNOLOGY LABORATORY

NETL'S CARBON TRANSPORT AND STORAGE NEWSLETTER

ANNUAL INDEX – FY 2024

This Annual Index is a compilation of the National Energy Technology Laboratory's (NETL) monthly Carbon Transport and Storage Newsletters (CTSNs) published in fiscal year 2024 (October 2023 to September 2024). The CTSN is produced by NETL to provide information on activities and publications related to carbon transport and storage. It covers domestic, international, public sector and private sector news. Duplicative stories have been removed; stories/news are included verbatim from the respective time of publication. Note all links were active at the time of publication.

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A comprehensive archive of the CTSN is available on the NETL website.

DOE/FECM/NETL HIGHLIGHTS

October 2023 (Vol. 23 No. 10)

DOE NOI to Fund CO_2 Transportation System

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) issued a notice of intent (NOI) to provide funding for expanding carbon dioxide (CO_2) transportation infrastructure to help reduce CO_2 emissions throughout the United States. Made available through the Bipartisan Infrastructure Law (BIL), the funding will support DOE's CO_2 Transportation Infrastructure Finance and Innovation (CIFIA) Future Growth Grants Program. Carbon capture projects in the United States are predicted to capture and store 65 million metric tons of CO_2 per year by 2030, 250 million metric tons per year by 2035, and 450 million metric tons per year by 2040. If issued, this Funding Opportunity Announcement (FOA) will provide CIFIA Future Growth Grants to provide financial assistance for developing and building extra CO_2 transport capacity up front that will become available for future carbon capture and direct air capture (DAC) facilities as they are developed and for additional CO_2 storage and/or conversion sites as they become operable.

From *energy.gov*. August 2023.

NETL, Partners Develop Technology to Help Realize Effective Carbon Storage

DOE's National Energy Technology Laboratory (NETL) and partner organizations successfully developed and demonstrated a suite of technologies that can help realize effective geologic carbon storage, hydrogen storage, and geothermal projects, as well as reduce wellbore integrity risks. NETL collaborated with the Illinois State Geological Survey, Intelligent Optical Systems, the University of California at Los Angeles, the University of Pittsburgh, and Carnegie Mellon University to perform an integrated research and development (R&D) effort to create a suite of complementary, multi-functional embedded sensor technologies for real-time subsurface monitoring of wellbore integrity. The effort is in response to needs identified within the Subsurface Science, Technology, Engineering, and Research and Development (SubTER) crosscut initiative.

From *NETL*. August 2023.

DOE/NETL Regional Initiatives Building on RCSP Initiative

Four DOE/NETL-funded Regional Initiatives (RIs) are working to identify and address challenges facing stakeholders for commercial deployment of carbon capture, utilization, and storage (CCUS). DOE's regional CCUS effort began with the Regional Carbon Sequestration Partnerships (RCSP) Initiative, which ran from 2003 through 2019. To build on the RCSPs, DOE competitively selected four R&D projects under the FY19 FOA titled "Regional Initiative to Accelerate CCUS Deployment." The four R&D projects, known as the RIs, provide a broad range of technical, procedural, and outreach assistance to CCUS efforts throughout the United States. Together, focusing on CCUS deployment in the United States, the RIs have published more than 300 abstracts, papers, and posters on RI efforts and accomplishments related to CCUS deployment; participated in more than 400 presentations and panel sessions throughout the Nation; conducted or hosted more than 100 CCUS workshops, webinars, and technical educational series with a variety of targeted audiences throughout the Nation; and participated in hundreds of collaborative discussions and meetings with project developers, state/federal agencies, and other interested parties involved in CCUS deployment within their respective regions.

From *NETL*. September 2023.

DOE Announces Funding for CO_2 Transport Networks

DOE/FECM announced funding to support the transport of CO_2 captured from industrial and power generation facilities, as well as from legacy CO_2 emissions captured directly from the atmosphere, to locations for geologic storage or conversion to useful products. The FOA will support front-end engineering and design (FEED) studies for regional CO_2 transport networks to transport captured CO_2 from key sources to centralized locations. The projects will focus on carbon transport costs, transport network configurations, and technical and commercial considerations that support broad efforts to develop and deploy carbon capture, conversion, and storage at commercial scale. Responses are due for this FOA by November 16, 2023.

From *energy.gov*. September 2023.

DOE Announces Funding for CO_2-EOR Combined with Carbon Storage

DOE/FECM announced funding to evaluate the potential of using CO_2 for enhanced oil recovery (EOR) in unconventional reservoirs combined with carbon storage. The research targeted through this funding will help to accelerate carbon storage operations in depleted domestic oilfields, repurposing existing infrastructure in support of the Biden-Harris administration's decarbonization goals. Through scientific research carried out using a field laboratory, projects awarded this funding will inject CO_2 under various scenarios, measure the volumes of incremental oil produced and CO_2 stored, and evaluate the conditions under which oil wells in depleted unconventional reservoirs can be transitioned to carbon storage wells in a manner that economically yields a reduction in carbon emissions. Responses are due for this FOA by December 13, 2023.

From *NETL*. September 2023.

November 2023 (Vol. 23 No. 11)

NETL Oversees Research to Protect Caprock Integrity at Carbon Storage Sites

An experiment, completed through the U.S. Department of Energy's (DOE) Lawrence Berkeley National Laboratory and its partners, is expected to generate insights into the behavior of faults and other seismic activity when carbon dioxide (CO_2) is injected into geologic formations for storage. Completed at the Mont Terri Underground Research Laboratory in Switzerland, the experiment involved injecting water mixed with CO_2 into a subsurface fault for approximately five hours. The injection caused a controlled CO_2-induced fault slip to determine its impact on the caprock that prevents CO_2 leakage. The novel geophysical field data collected during the injection will provide significant information about fault slip and strain related to CO_2 injection and the effect that CO_2-induced fault activation has on storage reservoir caprocks. The National Energy Technology Laboratory (NETL) provided oversight.

From *NETL*. September 2023.

December 2023 (Vol. 23 No 12)

DOE Announces Funding to Support CO_2 Storage

The U.S. Department of Energy (DOE) announced funding to support 16 selected projects across 12 states that will reduce carbon dioxide (CO_2) emissions and bolster the nation's carbon management industry. The projects, funded by the Bipartisan Infrastructure Law (BIL), will expand the CO_2 storage infrastructure needed to reduce CO_2 emissions from industrial operations and power plants, as well as from legacy emissions in the atmosphere. The projects were selected for negotiation to support the development of new and expanded large-scale, commercial carbon storage projects, each with the capacity to securely store 50 or more million metric tons of CO_2 over a 30-year period. All projects will support the *Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative*, managed by DOE's Office of Fossil Energy and Carbon Management (FECM).

From *NETL*. November 2023.

DOE Releases Toolkit to Assess Induced Seismicity at CO_2 Storage Sites

A forecasting toolkit developed jointly by a pair of DOE initiatives and funded, in part, through the BIL will help operators of underground CO_2 storage sites assess the likelihood and magnitude of seismic activity that could arise from commercial-scale injection. The *Operational FoRecastIng Of INduced Seismicity toolkit (ORION)* is an open-source, observation-based toolkit designed to forecast how potential induced seismic hazards may evolve in response to CO_2 injection. The toolkit incorporates details on proposed injection operations and information on the seismic history at the site to forecast magnitude and frequency of potential induced seismic activity over time. This information can then be used to inform operational decisions and foster communication between stakeholders. ORION can also be used to explore the effectiveness of proposed mitigation strategies that aim to reduce the frequency and/or magnitude of potential induced seismic activity.

From *NETL*. September 2023.

DOE Announces Funding to Accelerate mCDR Capture and Storage

DOE announced funding for 11 projects across eight states to accelerate the development of marine carbon dioxide removal (mCDR) via capture and storage technologies. Funded through DOE's *Sensing Exports of Anthropogenic Carbon Through Ocean Observation (SEA-CO_2) Program*, the projects will support novel efforts to measure, report, and validate mCDR and identify cost-effective and energy-efficient carbon removal solutions. Advancing innovative approaches like mCDR to reduce greenhouse gas (GHG) emissions is critical to the Biden administration's efforts to achieve a net-zero emissions economy by 2050. The projects will be managed by DOE's *Advanced Research Projects Agency-Energy (ARPA-E)*.

From *energy.gov*. October 2023.

January 2024 (Vol. 24 No. 1)

DOE Announces Funding to Support CO_2 Transport and Storage

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) announced federal funding for projects that will help advance commercial-scale carbon capture, transport, and storage throughout the United States to reduce carbon dioxide (CO_2) emissions from industrial operations and power plants as well as legacy emissions in the atmosphere. Specifically, the funding will provide technical, informational, and educational assistance to stakeholders involved in DOE and private sector-based carbon transport and storage projects located throughout the nation, as well as to communities impacted by these projects. The application deadline for this *funding opportunity announcement (FOA)* is January 30, 2024.

From *energy.gov*. December 2023.

NETL Research Suggests Tailored, Regional Approach for CCS

National Energy Technology Laboratory (NETL) researchers explored variables associated with transporting and storing CO_2 in *the Central United States*. Dividing the region into three impact areas, they found that geographic differences had significant impacts on costs and provided a framework to evaluate them. In the research, each impact area provided the means to design a carbon capture and storage (CCS) network that could connect different source types at hypothetical locations with geologic storage reservoirs through either a (1) dedicated pipeline connecting a single source to a single storage reservoir site or (2) trunkline network consisting of pipeline segments and hubs connecting multiple sources to multiple storage reservoir sites. The analysis resulted in the evaluation of more than 100 integrated source-to-sink matching scenarios, and the results highlighted the significance of the location and type of the CO_2 source, capture rate of a CO_2 source, quality of the saline storage reservoir, and distance between source and sink on overall costs. A *poster* and *presentation* on this topic are also available.

From *NETL*. December 2023.

DOE Re-Opens Funding Opportunity to Expand National CO_2 Storage Infrastructure

DOE-FECM announced the third opening of a five-year *funding opportunity* available through President Biden's *Investing in America agenda* to support the transport and storage of CO_2 captured from industrial and power generation facilities, as well as from legacy CO_2 emissions removed directly from the atmosphere. Projects selected under the Bipartisan Infrastructure Law's (BIL) Storage Validation and Testing Program will develop new and expanded carbon storage projects through FECM's *Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative*, each with the capacity to store 50 or more million metric tons of CO_2 over a 30-year period. Multiple openings of this FOA allow for the continuous development of commercial-scale carbon storage infrastructure, with projects focusing on feasibility determination, detailed site characterization, planning, permitting, and construction stages of project development.

From *energy.gov*. December 2023.

NETL Online Information Hub Connects CCUS Community

Developed by NETL researchers in coordination with DOE-FECM, *Carbon Matchmaker*, an online information hub, connects users across the carbon capture, utilization, and storage (CCUS) community and carbon dioxide removal (CDR) supply chains, helping to achieve net-zero greenhouse gas (GHG) emissions through strong public-private partnerships in a just and sustainable way. Carbon Matchmaker aligns with goals and initiatives included in the BIL, which directs more than $12 billion for carbon management research, development, and demonstration over five years. Organizations across the CCUS and CDR supply chains (i.e., providers of services, materials, equipment and tools) interested in being included, may do so, via the *Carbon Matchmaker Self-Identification Form*.

From *NETL*. November 2023.

February 2024 (Vol. 24 No. 2)

DOE Announces Funding for Carbon Capture, Transport, and Storage

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) announced federal funding for nine projects that will advance carbon dioxide (CO_2) capture technologies and help establish the foundation for a successful carbon transport and storage industry in the United States. Some projects selected under this funding opportunity announcement (FOA) will focus on developing lower-cost, highly efficient technologies that will capture CO_2 from power and industrial facilities for geologic carbon storage or conversion into long-lasting products. This will include carbon capture in the cement, steel, and glass industries, as well as natural gas power plants. Others will focus on accelerating the deployment of multi-modal transport of CO_2 through the creation of transportation hubs. DOE's National Energy Technology Laboratory (NETL) will manage the *selected projects*.

From *energy.gov*. December 2023.

March 2024 (Vol. 24 No. 3)

DOE RFI Seeks Input on Industrial Demonstration and Deployment of Carbon Capture, Conversion, Storage Technologies

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) released a Request for Information (RFI) that seeks input to assist DOE in the planning of priorities and initiatives to catalyze the development, demonstration, and deployment of carbon capture, utilization, and storage (CCUS) for industrial decarbonization. Specifically, the RFI seeks input from key partners (both domestic and international) on what is needed to support the commercial viability of CCUS for industrial systems to support the energy transition, eliminate greenhouse gas (GHG) emissions, produce clean energy, create well-paying union jobs, and enable a net-zero carbon emissions economy by 2050, all while prioritizing environmental equity and support for underserved communities. The information collected will also inform indicators of success for projects, programs, and the larger DOE portfolio. This plan will supplement the material included in the DOE report *Pathways to Commercial Liftoff: Industrial Decarbonization* and support the administration's goal of decarbonizing the economy by 2050. *Responses to the RFI are due March 14, 2024*.

From *energy.gov*. January 2024.

April 2024 (Vol. 24 No. 4)

DOE Announces Funding to Advance CO_2 Capture and Storage, Conversion Technologies

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) announced additional funding to support two carbon management priorities: the conversion of carbon dioxide (CO_2) into environmentally responsible and economically valuable products and the development of lower-cost, highly efficient technologies to capture CO_2 from industrial sources and power plants for storage or conversion. Projects selected under *this funding opportunity announcement (FOA)* will focus on two areas: (1) technologies that utilize CO_2 from sources such as industrial and power generation facilities, as well as from legacy CO_2 emissions captured directly from the atmosphere, to produce value-added products while simultaneously reducing CO_2 emissions; and (2) lower-cost, highly efficient technologies for carbon capture from industrial facilities and power plants for secure geologic carbon storage or conversion into long-lasting products such as synthetic aggregates, building materials, and concrete. Responses are due April 29, 2024.

From *energy.gov*. February 2024.

May 2024 (Vol. 24 No. 5)

NETL's EDX Releases Catalog of U.S. Prospective Subsurface Storage Reservoir Sealing Formations

Researchers at the National Energy Technology Laboratory (NETL) recently published a new dataset, the *Catalog of U.S. Prospective Subsurface Storage Reservoir Sealing Formations*, that aggregates prospective seal units for potential storage resources within the United States for geologic carbon storage in both onshore and offshore basins. The catalog lists prospective seals by unit name, along with associated data and resources that are available—including lithology, position concerning the reservoir (primary, secondary, intraformational, etc.), and age (geologic period)—for prospective domestic geologic storage resources. The catalog is the result of a significant effort to aggregate disparate data resources into a single dataset that guides users to understand what prospective seal units exist in deep sedimentary basins. The dataset can be explored further on NETL's *Energy Data eXchange® (EDX)* and *EDX disCO₂ver*—NETL's carbon storage-centric virtual data collaboration and curation platform. EDX is the U.S. Department of Energy (DOE) Office of Fossil Energy and Carbon Management's (FECM) virtual library and data laboratory built to find, connect, curate, use, and re-use data to advance fossil energy and environmental research and development (R&D).

From *NETL*. April 2024.

June 2024 (Vol. 24 No. 6)

DOE Re-Opens Funding Opportunity for Co2 Transport Networks to Manage Carbon Emissions

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) announced funding to support the transport of carbon dioxide (CO_2) to locations for geologic storage or conversion to useful products. The CO_2—captured from industrial and power generation facilities, as well as from legacy CO_2 emissions captured directly from the atmosphere—may be transported by any mode of transport, such as pipelines, rail, trucks, barges, or ships (including any combination of transport modes). The third opening of this funding opportunity announcement (FOA) will support front-end engineering design (FEED) studies for regional CO_2 transport networks to safely transport captured CO_2

from key sources to centralized locations. Selected projects will focus on carbon transport costs, transport network configurations, and technical and commercial considerations that enable industrial-scale deployment of carbon capture, conversion, and storage. The *application deadline for this FOA* is July 9, 2024.

From *energy.gov.*

DOE Announces Funding to Help Expand CO_2 Transport Infrastructure

DOE-FECM announced available funding for projects that will help expand CO_2 transportation infrastructure to support the reduction of CO_2 emissions across the United States. The *Carbon Dioxide Transportation Infrastructure Finance and Innovation Future Growth Grants* FOA will provide future growth grants under DOE's Carbon Dioxide Transportation Infrastructure Finance and Innovation Program, made available through the Bipartisan Infrastructure Law. Future growth grants are intended to provide financial assistance for designing, developing, and building CO_2 transport capacity up front that will be available for future carbon capture and direct air capture (DAC) facilities as they are developed and for additional CO_2 storage and/or conversion sites as they come into operation. Under this FOA, the transport system—which may include pipelines, rail, trucks, barges and/or ships—must connect, either directly or indirectly, two or more CO_2 emitting sources to one or more conversion sites or secure geologic storage facilities.

From *energy.gov*. May 2024.

DOE Announces Investments to Design CO_2 Transport Systems

DOE announced funding to help connect sources of CO_2 to secure geologic storage locations in the northwest, Northern Great Plains, and southeast regions of the United States. The four selected projects, funded by the Bipartisan Infrastructure Law, will support FEED studies for regional transport networks to safely transport captured CO_2 from key sources to centralized locations for storage. The projects will focus on carbon transport costs, transport network configurations, and technical and commercial considerations to enable industrial-scale deployment of carbon capture and storage (CCS). The National Energy Technology Laboratory (NETL), under the purview of DOE-FECM, will manage *the selected projects*.

From *energy.gov*. April 2024.

DOE Selects Projects to Evaluate Potential for EOR with Geologic Storage in Unconventional Reservoirs

DOE-FECM announced the selection of two projects to receive funding to evaluate the potential of oil and gas production and geologic storage of CO_2 from unconventional reservoirs through CO_2 enhanced oil recovery (CO_2-EOR). The projects will help evaluate the feasibility for permanent storage of CO_2 in depleted unconventional shale oil and gas reservoirs, repurposing existing infrastructure. The two selected projects will focus on examining the effectiveness of CO_2-EOR with the geologic storage process when applied to low-permeability, tight-oil unconventional reservoirs, as well as understand the potential to safely store CO_2 in these complex systems. In conjunction with this testing, the projects will collect critical data on how CO_2-EOR and carbon storage can be co-optimized with the goal of reducing the carbon footprint of the incremental oil produced. NETL, under the purview of DOE-FECM, will manage the *selected projects*.

From *energy.gov*. April 2024.

July 2024 (Vol. 24 No. 7)

[Duplicate story removed.]

August 2024 (Vol. 24 No. 8)

2024 FECM/NETL Carbon Management Research Project Review Meeting

Some of the nation's top scientists and engineers will gather in Pittsburgh, Pennsylvania, beginning August 5, 2024, for the 2024 Office of Fossil Energy and Carbon Management (FECM)/National Energy Technology Laboratory (NETL) Carbon Management Research Project Review Meeting to discuss climate change mitigation research and share updates on their efforts to advance innovative solutions for a sustainable energy future. Results from more than 150 research projects sponsored by the U.S. Department of Energy's (DOE) FECM will be discussed during the five-day meeting, with all sessions open to the public. Presenters from research universities, government laboratories and agencies, electric utilities, research organizations, and industry will share their findings from projects advancing a broad range of carbon management initiatives, including the safe storage of greenhouse gas (GHG) in the subsurface; conversion of carbon dioxide (CO_2) into value-added products; and the development of novel materials to capture CO_2 from power plants, difficult-to-decarbonize industries, and ambient air. The meeting provides attendees a chance to share in the knowledge and insights gained by more than 150 DOE-sponsored research and development (R&D) projects from the following programs: *Point-Source Carbon Capture (PSCC)*, *Carbon Dioxide Removal (CDR)*, *Carbon Conversion*, and *Carbon Transport and Storage*. Following the meeting, presentations will be made available on the *NETL Conference Proceedings* page.

From *NETL*. July 2024.

September 2024 (Vol. 24 No. 9)

DOE Expands Portfolio of Carbon Management Technologies to Reduce CO_2 Emissions

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) announced the availability of additional funding to advance diverse carbon management approaches that reduce carbon dioxide (CO_2) emissions. The funding will support the development of technologies that capture CO_2 from industrial and power generation sources or directly from the atmosphere and transport it either for geologic storage or conversion into valuable products such as fuels and chemicals. The sixth opening of FECM's Carbon Management funding opportunity announcement will support the following areas of interest: Reactive Carbon Capture Approaches for Point-Source Capture or Atmospheric Capture with Integrated Conversion to Useful Products; Engineering-Scale Testing of Transformational Carbon Capture Technologies for Natural Gas Combined Cycle (NGCC) Power Plants; Engineering-Scale Testing of Transformational Carbon Capture Technologies in Portable Systems at Industrial Plants; Preliminary Front-End Engineering Design (Pre-FEED) Studies for Carbon Capture Systems at Existing (Retrofit) Domestic NGCC Power Plant; Pre-FEED Studies for Carbon Capture Systems at Hydrogen Production Facilities Using Coal, Mixed Coal/Biomass, or Natural Gas Feedstock; and Enhancing CO_2 Transport Infrastructure (ECO_2 Transport): Pre-FEED Studies for Multimodal CO_2 Transfer Facilities. *The application deadline is October 14, 2024*.

From *energy.gov*. August 2024.

DOE Announces Funding to Advance CO_2 Capture, Transport and Storage across US

DOE/FECM announced the selection of nine university and industry-led projects to receive federal funding to advance commercial-scale carbon capture, transport, and storage throughout the United States. These regional partnership projects will accelerate the understanding of specific geologic basins to enable the permanent storage of CO_2 emissions from industrial operations and power plants, as well as from legacy emissions in the atmosphere. The partnerships will provide technical, informational, and educational assistance to interested parties involved in DOE and private sector-based carbon transport and storage projects located throughout the country, as well as to communities where those projects are located.

From *energy.gov*. August 2024.

DOE Announces Principles to Guide Excellence and Accountability in Carbon Management

DOE/FECM announced the release of the final Responsible Carbon Management Initiative Principles under its Responsible Carbon Management Initiative (RCMI). With this announcement, DOE embarks on the pilot phase of the RCMI, which aims to encourage and recognize project developers and others in industry pursuing the highest levels of safety, environmental stewardship, accountability, community engagement, and societal benefits in carbon management projects. "Carbon management" encompasses the suite of technologies used to reduce emissions by capturing, transporting, converting, and storing CO_2, as well as removing it directly from the atmosphere.

From *energy.gov*. August 2024.

PROJECT AND BUSINESS DEVELOPMENTS

October 2023 (Vol. 23 No. 10)

CCS Solutions Company Receives License Award for CCS Project

CCS solutions company Carbon Catalyst Limited (CCL) received a license award enabling them to advance a CO_2 storage project in the United Kingdom (UK). The award will enable CCL to partner with Perenco UK (PUK) to store captured CO_2 in PUK's Leman gas field and other adjacent storage reservoirs within the carbon storage license. With an estimated storage capacity of approximately 1 billion metric tons of CO_2, PUK's Poseidon CCS project aims to connect a wide range of emitters across East Anglia, London, and the wider southeastern part of the UK to the offshore Poseidon geologic storage sites.

From *gasworld*. August 2023.

Korean Government Launches CCS R&D Project

The Korean government began R&D for a CCS project in the Ulleung Basin in the East Sea. The Ulleung Basin—an oceanic basin located where the East Sea meets the Korea Strait—was classified as a promising area for CCS in 2021 via a joint study by the Ministry of Trade, Industry, and Energy and the Ministry of Oceans and Fisheries. The carbon storage potential of the Ulleung Basin is estimated to be approximately 193 million tons.

From Business Korea. August 2023.

Porthos CCS Project Green Lit

The Netherlands' highest court ruled that construction of the planned Porthos CCS project can proceed. The project is expected to reduce the country's annual CO_2 emissions by approximately 2% for a period of 15 years from 2026. Under the project, CO_2 released by refineries and chemical plants operated by Shell, Exxon Mobil, and Air Liquide and Air Products would be transported to empty gas fields under the North Sea.

From *Reuters*. August 2023.

Partnership to Study Carbon Storage Feasibility in Canada

Carbon removal project developer Deep Sky and carbon capture removal solutions provider Svante Technologies Inc. are partnering to evaluate the feasibility of storing CO_2 in Southern Québec. The two companies will fund research to study the potential to capture, transport, and store CO_2 and have engaged with carbon management consulting firm Sproule to complete the geologic subsurface research.

From *Business Wire*. August 2023.

Norway Awards CO_2 Storage License in North Sea

The Norwegian Ministry of Petroleum and Energy awarded Sval Energi AS, Storegga Norge AS, and Neptune Energy Norge AS a license to store CO_2 in the North Sea. The carbon storage license, called Trudvang, is located east of the Sleipner East field in the North Sea and, according to Neptune Energy, has the potential to store up to 9 million metric tons of CO_2 annually for at least 25 years, with analysis indicating the storage potential could be even higher. The Trudvang project involves capturing CO_2 from several emission sources in North-West Europe and transporting it to export terminals. From there, the CO_2 would be transported to the Trudvang location for injection into and storage under the seabed.

From *Offshore Engineer*. August 2023.

Partnership To Develop CCS Offering in Northern Europe

Höegh LNG and Aker BP entered a strategic partnership to develop a fully comprehensive CCS offering for industrial CO_2 emitters in Northern Europe. The agreement aims to establish a strong value chain for CCS on the Norwegian Continental Shelf that includes gathering, transporting, and injecting CO_2 for storage in subsea reservoirs.

From *Höegh LNG News Release*. September 2023.

Equinor Joins CCS Project

Equinor acquired a 25% interest in the Bayou Bend CCS project along the Gulf Coast in southeastern Texas. The Bayou Bend CCS project has nearly 140,000 gross acres of pore space for CO_2 storage, including approximately 40,000 gross acres offshore near Beaumont and Port Arthur, Texas. Bayou Bend is a joint venture among Chevron, through its Chevron New Energies division; Talos Energy, through its Talos Low Carbon Solutions division; and Equinor.

From *Offshore Magazine*. August 2023.

November 2023 (Vol. 23 No. 11)

Deep Learning Tool to Ensure Safe Carbon Storage Developed in NETL-Sponsored Project

With NETL support, Zanskar Geothermal and Minerals Inc. concluded a project that developed a deep learning tool for subsurface monitoring that could help ensure the safe storage of CO_2 at geologic sites. The tool was trained on distributed acoustic sensing measurements using convolutional neural networks. This deep-learning approach resulted in a data filter that has better computational efficiency and an improved signal-to-noise ratio relative to other commonly applied filters. This project was funded with a Phase I award through the Small Business Innovation Research (SBIR) Program, which encourages domestic small businesses to engage in federal research and development (R&D) with the potential for commercialization. The technology could be further developed into a real-time monitoring tool, and this project was recently selected for an SBIR Phase II award, where researchers will develop a seismic monitoring workflow that could be deployed at carbon storage sites.

From *NETL*. September 2023.

Licenses Awarded for Carbon Storage in UK North Sea

The North Sea Transition Authority (NSTA) announced a total of 14 companies have accepted 21 licenses for carbon storage in depleted oil and gas reservoirs and saline formations in the North Sea. Combined, the locations have the potential to store approximately 30 million metric tons of CO_2 per year by 2030. The NSTA will assess the response and quality of opportunities in the locations across the United Kingdom (UK) before deciding when to run a second round of their carbon storage licensing process. (The NTSA estimates that as many as 100 storage licenses will be needed to meet the requirements for reaching net-zero.)

From *Offshore Engineer*. September 2023.

Floating Carbon Storage, Injection Unit Receives Approval

The American Bureau of Shipping awarded Approval in Principle for Bumi Armada's design for a floating carbon storage and injection unit. Bumi Armada's concept is a floating terminal capable of storing and injecting liquified carbon dioxide (LCO_2) into depleted oil and gas fields or aquifers. The unit can receive LCO_2 from various sources, such as electricity generation, manufacturing, and construction.

From *World Oil*. September 2023.

Successful Completion of Carbon Storage Pilot Plant

Canada Nickel Company announced the successful completion of its carbon storage pilot plant, confirming the feasibility study design parameters. In addition, its novel carbon storage process—In-Process Carbonation—was successfully applied to a material from a third-party company.

From *Canada Nickel Company News Release*. October 2023.

More CO_2 Storage Spaced Approved for Project Tundra

The North Dakota Industrial Commission approved a permit for the state's sixth CO_2 storage facility, which is expected to be capable of storing 123 million metric tons of CO_2 over 20 years. The facility will be operated by Dakota Carbon Center West, a subsidiary of Minnkota Power Cooperative, and provides extra CO_2 storage space for Project Tundra, the cooperative's planned project that will capture emissions from the coal-fired Milton R. Young Station in Oliver County, North Dakota.

From *The Bismarck Tribune*. October 2023.

Carbon Storage Survey Project Completed

Shearwater GeoServices completed a carbon storage survey project for TotalEnergies in the Danish North Sea. The survey covered a CO_2 geological storage license awarded to the operator in February 2023.

From *Offshore Magazine*. September 2023.

December 2023 (Vol. 23 No 12)

Application Filed for Proposed CO_2 Pipeline Project in Illinois

One Earth Sequestration LLC filed an application with the Illinois Commerce Commission (ICC) seeking a Certificate of Authority to Construct and Operate a pipeline to transport and store CO_2 produced by its ethanol plant in Gibson City, Illinois. The pipeline would be part of a proposed CCS project that consists of a CO_2 capture, dehydration, and compression facility, along with three CO_2 injection wells and three monitoring wells, according to application materials filed with the ICC.

From *Ethanol Produce Magazine*. October 2023.

FPSO Piloting Post-Combustion CCS Plant

Malaysian floater specialist Yinson Production and operator Azule Energy are piloting an offshore CCS plant onboard the Agogo floating production, storage, and offloading (FPSO) vessel, offshore Angola. Carbon Circle Holding—a carbon removal and energy engineering, procurement, and construction company—has been selected to design and construct the CCS plant.

From *Upstream Online*. October 2023.

Large-Scale CCS Project Announced in California

California energy production company Aera Energy announced the launch of its large-scale CCS project, CarbonFrontier. Once operational in the late 2020s, CarbonFrontier is expected to capture up to 1.6 million metric tons of CO_2 per year from Aera's operations for storage at its Belridge oil field. The project will be continuously monitored with oversight by local, state, and federal regulatory entities, including the California Air Resources Board (CARB) and the U.S. Environmental Protection Agency (EPA).

From *Yahoo*. October 2023.

Installed Apparatus Enables Advanced CCUS Studies and Experiments

The Oil and Natural Gas Corporation's (ONGC) Institute of Reservoir Studies (IRS) in Ahmedabad installed and commissioned a CO_2 Core Flood Apparatus addition to its Injection and CCUS Laboratory. The apparatus is designed to replicate underground reservoir conditions, allowing for physical simulation and assessment of CO_2 behavior in reservoir rocks, quantifying incremental oil recovery, and evaluating storage potential.

From *Tech Observer*. October 2023.

Bellona Europa Launches Project Focusing on CCS

Bellona Europa, part of the Oslo-based Bellona Foundation, launched its Ports2Decarb project, which is a collaboration with ports to leverage their potential as hubs for industrial decarbonization in Europe, with a focus on CCS solutions. Selected ports in the Baltic and North Sea regions are envisioned as hubs for deploying CCS technologies, primarily aimed at sectors such as chemicals, steel, and cement.

From *Carbon Herald*. October 2023.

Aker Carbon Capture Awarded Pre-FEED Contract

Aker Carbon Capture signed a pre-front-end engineering design (pre-FEED) contract to implement carbon capture at several power plants throughout Europe. The contract will assess the optimal CO_2 capture and compression, as well as the heat recovery potential and heat integration solutions for the applicable plants, reducing the total heating and cooling demands related to capturing and conditioning the CO_2. Combined, the planned capture capacity for all the applicable sites could reach up to 14 million metric tons of CO_2 per year.

From *Aker Carbon Capture*. October 2023.

Porthos Announces FID Large-Scale CCS Project

Porthos, a joint venture between the Port of Rotterdam Authority, Gasunie, and EBN, announced its final investment decision (FID) for the development of a large-scale CO_2 transport and storage system in the Netherlands. With construction set to commence in 2024, Porthos is expected to be operational by 2026. Porthos will support the decarbonisation of the Rotterdam port area and, once complete, aims to store 2.5 million metric tons of CO_2 per year for 15 years, contributing to the Netherland's ambition to reach climate neutrality by 2050.

From *Global CCS Institute*. October 2023.

Italy's Eni, Britain Agree on Terms for CCS Project

Italy's Eni reached an agreement with Britain's government on the terms and conditions for providing services in one of the CCS projects under development in the country. Eni is the CO_2 transport and storage operator of the British *HyNet North West* consortium, which aims to transform one of Britain's most energy-intensive industrial districts into a low-carbon industrial cluster thanks to CCS. HyNet North West is expected to be operational by the middle of the decade, with a storage capacity of approximately 4.5 million metric tons of CO_2 per year in the first phase.

From *Reuters*. October 2023.

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DAC Facility Opens in California

Heirloom Carbon Technologies unveiled a direct air capture (DAC) facility in California that has the potential to capture up to 1,000 tons (~907 metric tons) of CO_2 per year for eventual storage. The facility has been operational for nearly 1,000 hours and has been actively capturing atmospheric CO_2, which will be stored in concrete through a *partnership with CarbonCure Technologies*.

From *Heirloom Carbon News Release*. November 2023.

Injection Begins at Texas CCS Project

Energy companies BKV and EnLink Midstream announced that a CO_2 injection at a CCS facility in Texas was completed ahead of schedule. The *Barnett Zero CCS facility*, to be used as a prototype for future projects, is expected to achieve an average storage rate of up to 210,000 metric tons of CO_2 equivalent per year. EnLink will transport natural gas produced by BKV in the Barnett shale in North Texas to its Bridgeport processing plant, where CO_2 will be compressed and stored underground in a nearby well.

From *Reuters*. November 2023.

Research Funding Awarded to UK CCS Projects

The UK Carbon Capture and Storage Research Community Network+ (UKCCSRC) awarded funding to 13 projects, several of which focus on the knowledge and technical developments required for CO_2 storage. The funding comes from the UKCCSRC's *Flexible Funding 2023* call and support from the UK's Engineering and Physical Sciences Research Council.

From *Carbon Capture Journal*. November 2023.

Companies Partner on BECCS Project

Evero Energy Group Limited and Mitsubishi Heavy Industries are partnering on Evero's *Ince Bioenergy with Carbon Capture and Storage (InBECCS)* project, which is expected to be operational in 2029. The InBECCS project will be retrofitted on Evero's Ince Bio Power site, a waste wood-to-energy facility located in the northwest of England, close to the Hynet industrial cluster. The project is expected to generate up to 250,000 metric tons of engineered carbon removals per year.

From *Mitsubishi Heavy Industries Press Release*. November 2023.

Companies to Collaborate on Cross-Border CCS

Santos and Korean energy company SK E&S *signed a memorandum of understanding (MOU)* to collaborate on carbon solutions. Under the MOU, the companies will develop a low-carbon hub in Darwin in the Northern Territory (following a CO_2 storage permit award). Santos and SK E&S will also collaborate on securing additional CO_2 storage, including the Bayu-Undan field, and develop a transboundary business model to aggregate and transport CO_2 from Korea to Australia for underground storage.

From *Carbon Capture Journal*. November 2023.

Indonesia, US to Explore CCS Investment

Indonesia's state energy company Pertamina and U.S. oil company Exxon Mobil agreed to carry out further evaluations for investments in CCS facilities using two underground basins in the Java Sea. According to a statement by Pertamina, the CCS hub with Exxon has the potential to store at least 3 gigatonnes of CO_2 released by industries in Indonesia and the rest of the region.

From *Reuters*. November 2023.

Partnership to Store CO_2 in Louisiana

CapturePoint LLC announced a partnership with Southwestern Energy Company to dedicate CO_2 from its Haynesville natural gas processing plant for storage in the *Central Louisiana Regional Carbon Storage Hub (CENLA Hub)*. The initiative aims to store captured CO_2 underground in suitable geologic formations in Rapides and Vernon Parishes.

From *businesswire*. November 2023.

Additional CCS Acreage Secured in Australia

Santos and joint venture partner Beach Energy secured additional carbon storage acreage in Australia by being awarded a Gas Storage Retention license southwest of Moomba. Under the license, the joint venture is authorized to carry out activities to establish the nature and extent of natural reservoirs, test the reservoirs for storage of CO_2, and establish the commercial feasibility of CO_2 storage and storage techniques. The license area is near Santos' Moomba CCS project, which is on track for startup in 2024 and is expected to store up to 1.7 million metric tons of CO_2 per year.

From *World Oil*. November 2023.

CO_2 From Dutch Plant to be Stored Under Norway Seabed

Yara, a fertilizer company, signed a binding agreement to capture CO_2 emissions from its Dutch ammonia plant and transport it to the Norwegian North Sea for storage beneath the seabed. The CO_2 will be liquefied and shipped from the Sluiskil plant by Northern Lights, TotalEnergies, and Shell. The CCS plant will begin operations in 2025 with the potential to reduce CO_2 emissions by 800,000 metric tons over 15 years. According to the company, the project is expected to be one of the first that transports CO_2 from one nation and across borders for storage by another.

From *Reuters*. November 2023.

Japanese, Malaysian Companies to Develop CCS Project

Japanese companies have agreed to develop a CCS project with Malaysian energy firm Petronas by the end of 2028. Japan Petroleum Exploration Company is developing the CCS project with JGC Holdings Corp and K Line, as well as state-controlled Petronas. The companies plan to start the front-end engineering design in 2024 with the goal of injecting and storing CO_2 from Japan and Malaysia in depleted oil and gas fields off the Malaysian coast.

From *Reuters*. November 2023.

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Wyoming Grants Three Carbon Storage Permits

The Wyoming Department of Environmental Quality (DEQ) issued three Class VI permits to construct wells for underground CO_2 storage to Frontier Carbon Solutions. The Wyoming Legislature worked with DEQ to develop a program granting the state primacy to review and approve Class VI permits through EPA's Underground Injection Control Program. Frontier Carbon Solutions was awarded the *permits to construct three wells* west of Green River, Wyoming, which are part of the *Sweetwater Carbon Storage Hub*.

From *Wyoming DEQ*. December 2023.

EPA Releases Draft Class VI Permits for CO_2 Injection and Storage in California

EPA released draft Class VI permits for underground CO_2 injection and storage in *Carbon TerraVault's (CTV)* 26-R reservoir located within the CTV I CCS vault at the Elk Hills Oil Field in Kern County, California. These are California's first draft permits for underground CO_2 storage wells as well as the first draft permits utilizing a depleted oil and natural gas field in the United States. The 26-R reservoir has an expected CO_2 injection rate of 1.46 million metric tons per year and a total estimated capacity of up to 38 million metric tons. CTV I has a total estimated storage capacity of up to 46 million metric tons. The draft EPA permits *are available for public review*.

From *California Resources Corporation*. December 2023.

Companies Sign MOU to Explore CCS

PTT Global Chemical Public Company Limited (GC) signed a memorandum of understanding (MOU) with Mitsubishi Heavy Industries Asia Pacific to jointly study the technologies required to develop a large-scale petrochemical complex. The collaboration will involve the study of solutions that use low-carbon fuels such as hydrogen and ammonia, as well as CCS technologies. The four-year MOU includes two main objectives: to (1) compare the feasibility of using hydrogen and ammonia as fuels for gas turbines as well as CCS technologies to reduce CO_2 emissions from power generators, and (2) assess how CCS technologies can best be applied and optimized for the steam-methane reforming process.

From *PR Newswire*. December 2023.

CCS Value Chain Between Japan and Australia to be Explored

Australia-based Woodside Energy signed a non-binding MOU with four Japanese companies to explore the potential of a CCS value chain between Japan and Australia. Woodside, Sumitomo Corporation, JFE Steel Corporation, Sumitomo Osaka Cement Co. Ltd, and Kawasaki Kisen Kaisha Ltd aim to study the capture, storage, and transportation of CO_2 emissions from the Setouchi and Shikoku regions of Japan and the injection and storage of the CO_2 at Australian storage sites.

From *Gas World*. December 2023.

Large-Scale CCS Project Reaches FEED Stage

A feasibility study for a large-scale Dutch CO_2 storage project was completed, and it has progressed to the front-end engineering design (FEED) phase. As part of the *Aramis* CO_2 transport and storage initiative in the Dutch part of the North Sea, the L10CCS project will store up to 5 million metric tons of CO_2 annually in depleted gas fields. The FEED phase is expected to be completed in the second half of 2024, with a project Final Investment Decision anticipated in 2025. The timeline of the L10CCS project is fully aligned with the Aramis project timeline and is planned to be connected and operational as of Day 1 of the opening of the CO_2 transport system, now planned for 2028.

From *Carbon Capture Journa*l. December 2023.

ExxonMobil, FuelCell Energy to Build CCS Pilot Plant

ExxonMobil Corp. announced plans to build a pilot plant to test a CCS technology developed by FuelCell Energy Inc. The technology, according to FuelCell Energy, can decrease CO_2 output while also producing heat and electricity. ExxonMobil affiliate Esso Nederland BV (Breda, Netherlands) plans to build the pilot plant at its Rotterdam Manufacturing Complex—an integrated refining and petrochemical site. The pilot plant will receive funding from the Innovation Fund of the European Climate Infrastructure and Environment Executive Agency.

From *Waste Today Magazine*. December 2023.

Companies Sign LOI to Build Carbon Storage Tanks

Value Carbon and Evos signed a Letter of Intent (LOI) to construct two storage tanks with an adjacent CO_2 facility for the purification, liquefaction, and storage of CO_2, complete with the necessary infrastructure to facilitate the loading and discharging of trucks and barges to harness growth potential. The Evos terminal in Rotterdam is proximal to the Rotterdam Shortsea Terminal in the Eemhaven and deep-sea terminals at the Maasvlakte—strategically positioned next to CO_2 infrastructure, with ready access to essential steam and electricity supplies. The project is planned for completion in the first half of 2026.

From *Value Carbon Press Release*. December 2023.

CCS Plant Planned in Sweden

A Swedish energy company signed an LOI with the city of Helsingborg to establish a CCS plant with a plan to go net zero. Öresundskraft plans to establish a CCS facility at the Filborna district heating plant, slated to be operational by 2027. The CCS technology at Filborna will enable the efficient capture and geologic storage of both fossil and biogenic CO_2.

From *Carbon Capture Journal*. December 2023.

Trial to Help Better Understand CCUS Launched

NSG Group's Pilkington U.K., a supplier of architectural glass, announced it has successfully launched a carbon capture trial at its St. Helens, U.K., site. The trial is part of C-Capture's national project, XLR8 CCS–Accelerating the Deployment of a Low-Cost Carbon Capture Solution for Hard-to-Abate Industries. According to officials, the project aims to prove the ability of C-Capture's carbon capture technology to remove CO_2 from the flue gas emissions of industrial sources in three industries that are difficult to decarbonize but committed to reducing carbon levels (cement, energy, and waste industries). The funding is part of the Carbon Capture, Utilization, and Storage (CCUS) Innovation 2.0 Program aimed at accelerating the deployment of next-generation CCUS technology in the U.K.

From *U.S. Glass Magazine*. December 2023.

March 2024 (Vol. 24 No. 3)

EPA Approves Permits to Begin Construction of CO_2 Injection, Storage Wells

The U.S. Environmental Protection Agency (EPA) issued permits that allow Wabash Carbon Services LLC to construct two wells for the eventual injection and storage of CO_2 underground in Indiana. EPA determined that the wells meet all requirements for initial approval, including stringent safety measures. Once the wells are constructed, the applicant will require separate approval from EPA before underground injection of CO_2 can begin. The underground injection wells will be used to store CO_2 that has been captured from nearby fertilizer production.

From *EPA News Release*. January 2024.

Class VI Injection Well Permit Application Submitted to EPA

Carbon America submitted a Class VI CO_2 Injection Well permit application to store CO_2 produced by two ethanol plants in northeastern Colorado. If approved, the injection well will store up to 350,000 metric tons per year of CO_2 that is produced annually at the Yuma and Sterling Ethanol Plants in northeastern Colorado. The *CCS projects* will help the state meet its emissions reduction goals to reduce statewide emissions by 50% by 2030, and 90% by 2050, while supporting the ethanol plants and the regional agricultural industry.

From *Business Wire*. January 2024.

Oil India to Develop CCS Project

State-backed Oil India plans to develop a CCS project, storing CO_2 emissions from its Rajasthan natural gas field in nearby dry wells, according to a report. Preliminary studies have been conducted, and Oil India will develop a comprehensive feasibility report outlining the processes for carbon capture, transportation, storage, and monitoring.

From *Offshore Technology*. January 2024.

BECCS Plan Approved

The UK government approved British power plant operator Drax's planning application to convert two of its biomass units to bioenergy with carbon capture and storage (BECCS) technology. The Drax power station currently has four biomass generating units and produces approximately 4% of Britain's power and 9% of its renewable electricity.

From *Reuters*. January 2024.

Collaboration to Explore Carbon Storage Potential

The University of Wyoming's Enhanced Oil Recovery Institute (EORI), in collaboration with Crescent Energy Co. to explore carbon storage potential, assisted with the drilling and coring of a research well in Natrona County, Wyoming. The well was drilled and cored through the First Wall Creek sand as part of a project jointly funded by DOE and Crescent Energy to investigate the existence of a residual oil zone below the productive interval of the formation. EORI and Crescent Energy will determine if CO_2 can be used to economically recover residual oil from that zone and ultimately store CO_2.

From *University of Wyoming*. January 2024.

Thailand CCS Project Advancing

Thailand's national upstream company PTTEP is teaming with Japan's Inpex to conduct a study on carbon storage potential in the northern Gulf of Thailand under an international collaboration between the Thai Department of Mineral Fuels and the Japan Organization for Metals and Energy Security. The study will lay a foundation for the potential development of a CCS hub in the kingdom's Eastern Economic Corridor.

From *Upstream Online*. January 2024.

Malaysian CCS Project Awards Offshore Contract

Oil and gas industry services provider McDermott was awarded an offshore contract for the Kasawari CCS project in Malaysia. Under the contract's terms, McDermott's responsibilities include transporting and installing a pipeline, a CCS platform jacket, and a bridge that will connect to the existing central processing platform. Upon completion, the project is expected to have the capacity to abate 3.3 million metric tons of CO_2 flaring emissions annually.

From *Offshore Technology*. January 2024.

Industrial Large-Scale CCUS Plant Announced in Austria

MCI Carbon announced an industrial large-scale CCUS plant in Austria that will capture and convert approximately 50,000 metric tons of CO_2 per year to construction materials, according to the company. The firm's process combines captured CO_2 with a mineral feedstock—usually industrial waste such as steel slag, mine tailings, or raw quarried minerals—to produce carbonates and silicates. These carbon-negative mineral value products are direct inputs to building materials and other products.

From *Institution of Mechanical Engineers*. January 2024.

Companies to Conduct Feasibility Study on Bulk Carrier CCS

As part of a Joint Development Project, DNV and SDTR Marine will collaborate on a techno-economic analysis of CCS implementation aboard bulk carrier merchant ships. The study aims to evaluate the economic viability of different fuel and technology approaches under various fuel and CO_2 price scenarios. The model considers future decarbonization mandates and Singapore-based SDTR Marine's emissions targets.

From *Carbon Capture Journal*. January 2024.

Waste-to-Energy Plant to Integrate CCS

A Norwegian clean energy development company signed an agreement with the City of Edmonton in Alberta, Canada to create an industrial-scale waste-to-energy facility that will integrate CCS into its process. Slated to begin in early 2027, the facility will convert residential waste into green electricity and industrial heat.

From *CBC*. January 2024.

April 2024 (Vol. 24 No. 4)

EnLink, ExxonMobil Collaborate on CCS

EnLink Midstream and ExxonMobil are collaborating to explore CCS opportunities along the Gulf Coast. The initiative aims to extend beyond the southeast Louisiana Mississippi River Corridor and into several other areas, addressing one of the highest concentrations of industrial CO_2 emissions in the United States. According to U.S. Environmental Protection Agency findings, the Gulf Coast region generates more than 215 million metric tons of CO_2 per year.

From *Offshore Technology*. February 2024.

Singapore, Indonesia to Collaborate on CCS

Singapore and Indonesia signed a letter of intent to collaborate on cross-border CCS, with work underway for a legally binding agreement to enable the transport and storage of CO_2 between both countries. Earlier this year, Indonesia issued a presidential regulation to allow CCS operators to set aside 30% of their storage capacity for imported CO_2. Singapore aims to achieve net zero by 2050 through low-carbon technological pathways like hydrogen and CCS.

From *S&P Global*. February 2024.

Companies Agree to Subsurface CO_2 Storage Exploration

Weyerhaeuser and Lapis Energy signed a two-year exploration agreement for subsurface CO_2 storage in Arkansas, Louisiana, and Mississippi. The agreement covers 187,500 acres and spans five potential storage sites, including two that were previously identified by Weyerhaeuser as prospective opportunities for CCS development. Under the agreement, Lapis will determine the storage potential of each site; upon successful completion of the technical and commercial assessments, Lapis will have the option to move sites into full-scale development agreements and complete the work required to permit, build, and operate permanent CO_2 storage sites serving large-scale industrial sources.

From *PR Newswire*. February 2024.

Seatrium Secures Full-Scale CCS Retrofit

Seatrium—a Singapore-based shipbuilding group—secured a turnkey CCS retrofit contract from Norwegian shipowner Solvang ASA. The initiative involves the retrofitting of a 7-megawatt (MW) Wärtsilä CCS system onto Solvang's ethylene carrier, the Clipper Eris. The system is expected to capture 70% of CO_2 emissions from the main engine by using amine cleaning technology. The project will involve the entire value chain for handling CO_2, including liquefaction and storage onboard the vessel.

From *Offshore Energy*. February 2024.

Planning Documents Filed for CCS Project

Planning documents were filed for a gas turbine and CCS project in Stallingborough, close to the South Humber Bank Power Station in Lincolnshire, England. The proposed development is expected to consist of one combined cycle gas turbine plant. Carbon emissions from burning gas will be captured, compressed, and transported via pipeline for storage beneath the seabed.

From *BBC.com*. February 2024.

Funding Secured for CCS Project in South Australia

Santos has secured funding for their share of the Moomba CCS project in South Australia. The project, the first phase of which is 80% complete, will have the capacity to store up to 1.7 million metric tons of CO_2 per year (with actual volumes depending on the availability of CO_2 for storage). Santos has also recently signed a series of agreements with international third parties to evaluate the potential to capture, transport, and store their emissions at Moomba.

From *Santos News Release*. February 2024.

May 2024 (Vol. 24 No. 5)

Provisional Offshore Contracts Awarded for North Sea Teesside CO_2 Development

The Northern Endurance Partnership and Net Zero Teesside Power joint venture awarded Saipem a letter of intent for offshore construction operations in the southern UK North Sea. The two projects involve the development of CO_2 offshore transportation and storage facilities for the East Coast Cluster in Teesside, northeast England.

From *Offshore Magazine*. March 2024.

Companies to Collaborate on Cost-Effective CCUS in Cement Industry

ABB and Captimise are extending their collaboration to drive the adoption of cost-effective CCUS technologies in the cement industry. The two companies will develop screening, feasibility, and front-end engineering design (FEED) studies. The initiative will support cement producers in identifying suitable and cost-efficient carbon capture technologies covering their full carbon chain, from capture to storage and utilization.

From *Carbon Herald*. March 2024.

TotalEnergies to Acquire CCS Business

French firm TotalEnergies agreed to acquire Talos Energy Inc.'s entire CCS business, Talos Low Carbon Solutions LLC. The sale includes three projects along the U.S. Gulf Coast—Bayou Bend CCS LLC (a 25% share), Harvest Bend CCS LLC in Louisiana (a 65% operated interest), and Coastal Bend CCS LLC in Texas (a 50% interest). The Bayou Bend project is a carbon transportation and storage solution for industrial emitters located in the Houston Ship Channel and Beaumont–Port Arthur region on the Texas Gulf Coast (which lies near TotalEnergies' Port Arthur refinery and petrochemicals assets in La Porte).

From *Oil & Gas Journal*. March 2024.

MOU to Evaluate Feasibility of CCS Value Chain

JX Nippon Oil & Gas Exploration Corporation and Chevron New Energies signed a memorandum of understanding (MOU) that provides a framework to evaluate the export of CO_2 from Japan to CCS projects located in Australia and other countries in the Asia-Pacific region. The main objective of the MOU is to evaluate the feasibility of the CCS value chain, including the capture of CO_2 released from industries located in Japan, and transportation by ship from Japan to Chevron's GHG storage portfolio in Australia. The collaboration will also explore the opportunity to develop suitable transboundary policies and the potential development of CO_2 storage sites in other countries in the Asia-Pacific region.

From *Chevron News Release*. March 2024.

MOU to Explore CO_2 Transport, Storage Options

Drax Group, Viking CCS (a Humber-based CO_2 transportation and storage network led by Harbour Energy), and BP signed an MOU to assess options to transport and store CO_2 in the Humber region. The companies will work together on an early pipeline study to explore options that could connect Drax Power Station to the depleted Viking gas fields in the southern North Sea. Once operational, and subject to a final investment decision, the Viking CCS cluster could capture and store up to 10 million metric tons of CO_2 per year by 2030 and up to 15 million metric tons by 2035.

From *Biomass Magazine*. March 2024.

Liverpool Bay CO_2 Storage Pipeline Wins Planning Consent

The UK government greenlit plans for a pipeline to transport CO_2 captured from heavy industry in North West England and Wales to be stored under the seabed in Liverpool Bay. The HyNet CO_2 pipeline was granted a Development Consent Order by the Planning Inspectorate, allowing for the construction, operation, and maintenance of both new and repurposed gas pipelines and associated infrastructure in the region to transport the captured CO_2 for storage in Eni's depleted fossil gas reservoirs. Eni's transport and storage system at HyNet is expected to have enough capacity for 4.5 million metric tons of CO_2 per year in its first phase, with the potential for this to increase to up to 10 million metric tons per year after 2030.

From *BusinessGreen*. March 2024.

Capsol Signs Preliminary License for Swiss CCS Plant

Capsol Technologies signed a preliminary license agreement for the use of its CapsolEoP® carbon capture solution at KVA Linth's waste-to-energy plant in Switzerland. The plant will have a carbon capture potential of more than 120,000 metric tons of CO_2 per year. As part of the preliminary license agreement, Capsol will provide the carbon capture plant design to support KVA Linth in making its technology decision.

From *Carbon Capture Journal*. March 2024.

Pre-FEED Award Includes CO_2 Storage

Aker Carbon Capture was awarded a pre-FEED for Statkraft's Heimdal waste-to-energy plant. The pre-FEED covers CO_2 capture, compression, purification, liquefaction, and temporary storage of CO_2 at the Heimdal waste-to-energy plant. From Heimdal, the liquid CO_2 will be transported by truck to an export terminal with subsequent ship transport to permanent storage.

From *PR Newswire*. April 2024.

June 2024 (Vol. 24 No. 6)

Climeworks to Study DAC+S in Norway

Climeworks was awarded funding in the framework of Enova's "Preliminary Study Carbon Capture 2030" to study large-scale DAC+S in Norway. Enova aims to help companies that want to capture large amounts of CO_2 to get closer to an investment decision for capture plants, with the goal of operation by 2030.

From *Climeworks Press Release*. April 2024.

Denmark Awards Funds for CCS Projects

Denmark's government awarded financial support to three CCS projects. The Danish Energy Agency entered into contracts with BioCirc CO_2, Bioman, and Carbon Capture Scotland. The projects are expected to develop and mature the CCS value chain in the Scandinavian nation, with all the CO_2 planned to be stored in Denmark.

From *Upstream*. April 2024.

CCS Partnership Formed in Kenya

DAC firm RepAir and carbon storage company Cella launched a partnership aimed at creating dedicated value chains for extracting CO_2 from the atmosphere and storing it underground through in situ mineralization. RepAir's proprietary DAC solution is projected to capture carbon at approximately $50 per ton at the gigaton scale, The storage agreement will streamline the sale of high-quality carbon credits to off-takers, enabling corporations to meet evolving environmental, social, and governance standards; manage offsets; and advance toward net-zero goals. The DAC unit and CO_2 storage facility will be adjacently located to Cella's initial demonstration project in the Kenyan Rift Valley, and the project, co-located with geothermal energy production, is set to operate solely on renewable energy sources.

From *PR Newswire*. April 2024.

Saudi Arabia, EU to Collaborate on CCUS

Saudi Arabia and the European Union (EU) are collaborating on a proposed MOU aimed at accelerating private investment in renewable energy, improving electricity interconnections, and integrating renewable sources into the electricity grid. The proposed collaboration will also extend to the hydrogen sector and clean technologies, including CCUS.

From *Saudi Gazette*. April 2024.

Offshore Geologic Survey Conducted at Bayou Bend CCS

Bayou Bend CCS LLC commissioned subsea specialist Sulmara to conduct an archaeological and geohazard assessment of the proposed Bayou Bend pipeline route from the landfall to the future offshore platform locations, which has the potential to reduce emissions from regional industrial facilities by storing CO_2 underground. Sulmara utilized an electric WAM-V 16 uncrewed surface vessel for the offshore data acquisition to help significantly lower the overall carbon footprint of the assessment by reducing the number of diesel-burning vessels offshore, as well as shortening the time required to conduct the survey.

From *Sulmara News*. April 2024.

FEED Contract Awarded for CCUS Project

MHI-LCSC, a part of Mitsubishi Heavy Industries Ltd. (MHI) Group, and Kiewit were awarded a FEED contract for a carbon capture technology, which utilizes MHI's proprietary Advanced KM CDR Process™, at Heidelberg Materials North America's Edmonton, Alberta, CCUS project. Heidelberg Materials North America will be commissioning a full-scale net-zero cement plant at its Edmonton location by adding CCUS technology to an already state-of-the-art facility. The plant could eventually capture and store an estimated 1 million metric tons of CO_2 each year. Subject to finalization of federal and provincial funding agreements, the company anticipates the final investment decision to be taken in 2024.

From *Heidelberg Materials*. April 2024.

FEED Contract Awarded for CCS Project

Technip Energies was awarded a FEED contract from Viridor for the CCS project at an existing waste-to-energy facility in Runcorn, United Kingdom (UK). Technip Energies will provide a detailed design as part of the FEED study, incorporating the Canopy by T.EN™ solution supported by Shell CANSOLV CO_2 capture technology. The solution is a key component of Technip Energies' Capture.Now™, which is their strategic CCUS platform that encompasses various technologies and solutions.

From *Carbon Herald*. April 2024.

Mpumalanga CCS Pilot Project Completed

A CCS pilot project has been completed at a site in Leandra, Mpumalanga, in eastern South Africa. The pilot was developed by the Council for Geoscience and was co-financed by the government and the World Bank. Financing was awarded because of the site's proximity to the integrated energy and chemical company *Sasol* and its synthetic fuel plant in Secunda, both large sources of CO_2 emissions. Several reports on the geology and engineering design requirements are being compiled before the project proceeds to the construction phase.

From *Mail & Guardian*. April 2024.

Plans Outlined for New UK CCS Projects

Independent hydrocarbon producer Perenco outlined plans for two new UK CCS projects. The company is currently in the appraisal phase, assessing the risks and practicalities of commercial-scale carbon storage. Both projects—Poseidon and Orion—are based on Perenco-operated gas fields in the southern North Sea. According to company officials, Orion, with an expected startup date in 2031, will have an ultimate storage capacity of around 126 million metric tons of CO_2; Poseidon, with an expected start date in 2030, is expected to have a capacity of 935 million metric tons of CO_2.

From *Energy Voice*. April 2024.

UK Company Invests in CCS Technology

UK energy company enfinium announced plans to invest in CCS technology at the Parc Adfer waste-to-energy facility in Deeside, North Wales. Since more than half of the waste processed at the facility is organic, installing CCS technology would enable the plant to take more CO_2 out of the atmosphere than it produces. The proposal has been put forward for grant support from the UK government as part of the expansion of their "Track-1" carbon capture program. The captured carbon will be transported using the pipeline network currently being developed in the region for the HyNet carbon capture cluster.

From *enfinium News Release*. April 2024.

July 2024 (Vol. 24 No. 7)

Texas Requesting Proposals for Carbon Storage Leases

Texas plans to put 1.13 million acres of state waters and bays along the Gulf of Mexico up for bid, targeting parties interested in CCS projects. A total of 13 zones will be opened for bidding as outlined in a *request for proposal (RFP)* from the Texas General Land Office and the School Land Board.

From *Carbon Herald*. June 2024.

EU CCUS Project Breaks Ground

Holcim broke ground on an EU-approved carbon capture, utilization and storage (CCUS) project in Obourg, Belgium. The *GO4ZERO* cement plant, engineered to produce approximately 2 million metric tons of cement per year by 2029, aims to store more than 1 million metric tons of CO_2 per year.

From *Holcim Media Release*. May 2024.

Geologic Feasibility of CCS Project Confirmed

Corn ethanol producer FS Agrisolutions reported that tests proved the geologic feasibility of its project to inject CO_2 into the soil in Lucas do Rio Verde. The tests showed that it is feasible for the company to inject all its current carbon emissions at the plant into the soil in a net form for 30 years, which would result in the storage of 12 million tons of CO_2, after which new tests will be needed to verify the feasibility of continuing with the activity. The studies identified a layer of sealing rock with characteristics compatible with the maintenance of the gas in the subsoil, as well as a lower layer of porous rock with characteristics suitable for storing carbon gas in liquid form. Other geologic characteristics, such as those related to soil salinity, were also verified accordingly.

From *Globorural*. June 2024.

Worley Selected to Support Bayou Bend CCS Project

Worley will design and evaluate CO_2 gathering, handling, and storage facilities for the Bayou Bend CCS joint venture located along the Gulf Coast in Southeast Texas. Bayou Bend is a joint venture owned by Chevron, Equinor, and TotalEnergies. The Bayou Bend project includes a CO_2 storage footprint of nearly 140,000 acres of pore space.

From *Carbon Capture Journal*. May 2024.

ADNOC Delivers Bulk Shipment of CCS-Enabled Low-Carbon Ammonia to Japan

ADNOC delivered a certified bulk commercial shipment of low-carbon ammonia enabled by CCS to Mitsui & Co. Ltd. for use in clean-power generation in Japan. The shipment, produced by Fertiglobe, builds on previous demonstration cargos delivered by ADNOC to customers in Asia and Germany. The cargo, sourced from Fertil—Fertiglobe's facility located in the Ruwais Industrial City, Abu Dhabi—will see the CO_2 captured and stored in a CO_2 injection well in a carbonate saline aquifer.

From *ADNOC News Release*. May 2024.

CCUS EPC Contract Awarded

Technip Energies and Turner Industries were awarded an engineering, procurement, and construction (EPC) contract by ExxonMobil Low Carbon Solutions Onshore Storage. The contract covers the delivery of a CCUS system that could condition, compress, and transport— for eventual storage—up to 800,000 metric tons of CO_2 per year from a manufacturing plant located in Louisiana and owned by Nucor Corporation. Technip Energies will oversee the engineering and procurement while Turner Industries will be responsible for construction.

From *Gasworld*. June 2024.

FEED Study Completed at Saudi Arabian CCS Hub

Wood—an engineering and consulting company—completed the front-end engineering design (FEED) scope for the first phase of Aramco's Accelerated Carbon Capture and Sequestration (ACCS) project in Saudi Arabia. The first phase of the ACCS project intends to capture carbon emissions from Aramco gas plant facilities near Jubail, on the east coast of Saudi Arabia, as well as from third-party emitters.

From *Offshore Energy Magazine*. June 2024.

Partnership to Equip CCS Solution on LCO_2 Carriers

ERMA FIRST, a Greek company specializing in ballast water treatment, entered into a letter of intent with ship management company Capital Gas and Babcock, an engineering company from the UK, to equip its CCS solution on four new liquified carbon dioxide (LCO_2) carriers. The ERMA FIRST CCS Solution will be placed on four LCO_2 carriers that are due for delivery by South Korean shipbuilder Hyundai Mipo Dockyard in 2026.

From *Carbon Herald*. June 2024.

Collaboration to Enable CCS Value Chains Across Southeast Asia

DNV and PETRONAS CCS Ventures signed a master price agreement for the certification of CO_2 storage sites and associated facilities for CCS projects in Malaysia. This agreement builds on a memorandum of understanding between DNV and PETRONAS in 2022, during which strategic working groups delved into topics relevant to CCS.

From *DNV News Release*. June 2024.

August 2024 (Vol. 24 No. 8)

Alberta Cleantech Firm Announces Second CCS Project

A Calgary, Alberta-based cleantech firm *announced* a final investment decision (FID) to proceed with its second CCS project. The Entropy Inc. project will capture emissions from parent company Advantage Energy's Glacier Gas Plant in northwest Alberta. The facility is expected to be operational by the second quarter of 2026 and will be able to capture 160,000 metric tons of CO_2 per year.

From *Calgary Herald*. July 2024.

Shell to Build CCS Projects in Canada

Shell Canada announced a FID to proceed with the Atlas Carbon Storage Hub. The first phase of Atlas will provide underground storage for CO_2 captured by the Polaris project — a carbon capture project in Alberta, Canada, designed to capture approximately 650,000 metric tons of CO_2 annually from the Shell-owned Scotford refinery and chemicals complex. The CO_2 emissions captured by Polaris will be sent to two storage wells at the Atlas Hub via pipeline, where it will be stored underground in the Basal Cambrian Sands.

From *Carbon Capture Journal*. June 2024.

Indonesia to Implement CCS/CCUS Projects

Indonesia is transforming its energy sector with the potential implementation of 15 CCS and CCUS projects planned to be operational by 2030, according to the Indonesia Ministry of Energy and Mineral Resources. The country boasts a vast potential for carbon storage resources, and the government is focusing on two specific basins — the Sunda Asri basins and Bintuni basins — to be utilized as CCS hubs in East Asia and Australia. To assist in the advancement of these decarbonization technologies, the government has initiated a range of measures that include setting up a CCS/CCUS National Center of Excellence in collaboration with research organizations and academic institutions, enhancing global partnerships within the CCS/CCUS industry, and creating additional regulations and policies.

From *Carbon Herald*. July 2024.

EnEarth Applies for CO_2 Storage License

EnEarth, part of the Energean Group, formally submitted an application to the Hellenic Hydrocarbons and Energy Resources Management Company for a CO_2 storage license at Prinos, Kavala, NE Greece. As detailed in the application submitted for approval, the storage capacity of the first phase of the project will be up to 1 million metric tons of CO_2 per year. Once fully developed, the project's storage capacity could reach 3 million metric tons of CO_2 per year.

From *Carbon Capture Journal*. July 2024.

Companies to Collaborate on Offshore Power Generation Concept with CCS

SBM Offshore — an Oil industry company — and Ocean-Power — an energy solutions development company — signed a memorandum of understanding with the intent to collaborate on a floating power generation hub with CCS. The partnership aims to assess the technical feasibility and commercial readiness to collaborate on the concept, exclusive to the Norwegian Continental Shelf and United Kingdom Continental Shelf.

From *SBM Offshore News Release*. July 2024.

Investments in Canadian CCS Projects

The Canadian Growth Fund has agreed to shoulder half of the capital for planned CCS projects by oil-sands producer Strathcona Resources Ltd. The CCS projects would be built on Strathcona's steam-assisted gravity drainage oil-sands facilities in the provinces of Alberta and Saskatchewan. Calgary, Alberta-based Strathcona expects the projects to capture up to two million metric tons of CO_2 a year. Strathcona expects the first project to be in Saskatchewan, where the provincial government awarded it subsurface CO_2 storage rights earlier this year.

From *Rigzone*. July 2024.

September 2024 (Vol. 24 No. 9)

ExxonMobil, CF Industries Sign CCS Deal

Energy company ExxonMobil entered into a CCS agreement with ammonia producer CF Industries. Exxon will transport and store up to 500,000 metric tons per year of the CO_2 captured from CF Industries' complex in Yazoo City, Mississippi, which makes nitrogen products for agricultural fertilizer. The project will enable CF Industries to reduce the site's CO_2 emissions by up to approximately 50% and is expected to start in 2028, Exxon said in a statement.

From *Reuters*. July 2024.

Companies to Evaluate Integration of CCUS

Methanol producer Methanex Corporation and CCS specialist Entropy will evaluate the integration of CCUS technology at Methanex's Medicine Hat site in Alberta, Canada. A pre-FEED study will look at the feasibility of leveraging Entropy's modular post-combustion carbon capture technology at the site. The aim is for the project to support both the storage and utilization of CO_2. The pre-FEED study will also evaluate the economic viability of the project, including access to pore space, carbon offtake agreements, municipal alignment, and funding from both provincial and federal carbon reduction programs.

From *Gasworld*. July 2024.

French CO_2 Capture, Transport Project Moves to Pre-FEED Stage

France's main gas transmission operator, GRTgaz, and Elengy, the country's liquefied natural gas terminal operator, launched feasibility studies for their proposed Grand Ouest CO_2 ($GOCO_2$) project aiming to capture and transport industrial CO_2 emissions from French Pays de la Loire and Grand Ouest regions. The goal of $GOCO_2$, which was launched in July 2023 as part of the French government's CCUS strategy, is to develop an investment program to capture the CO_2 released by industrial sites for pipeline transport to the Saint-Nazaire maritime export terminal, where it will be stored in permanent geologic structures. The estimated capacity will be 2.6 million metric tons of CO_2 annually by 2030, which can be expanded up to 4 million metric tons per year by 2050.

From *Offshore-Energy*. July 2024.

Partnership to Explore Feasibility of Liquid CO_2 Storage Facility

Energy company Uniper is turning to a partnership between Navigator Gas and Bumi Armada — known as Bluestreak CO_2 — as the next phase of a project to capture, recycle and store CO_2 released from one of the company's UK-based power plants. Under an agreement signed with Uniper for its natural gas-powered Isle of Grain power plant, Bluestreak CO_2 will explore the feasibility of implementing a jetty-moored floating liquid CO_2 storage facility that would support a fleet of liquid CO_2 shuttle tankers. The vessels would be capable of loading from the facility and delivering the stored CO_2 to either a floating carbon and storage unit or a unit that also has the capability to inject the CO_2 into offshore storage aquifers and or depleted oil and gas reservoirs.

From *Maritime-Executive*. July 2024.

FEED Contract Awarded for US Gulf Coast Plant

The SLB and Aker Carbon Capture joint venture announced a contract award by its partner $CO_2$80 Solutions for the FEED of a large-scale carbon capture plant at a pulp and paper mill on the U.S. Gulf Coast. The project, which aims to remove 800,000 metric tons of carbon emissions annually, will also deliver permanent, verifiable and affordable carbon dioxide removal (CDR) credits.

From *Aker Carbon Capture*. August 2024.

FEED Contract Awarded for CCS Project

TotalEnergies EP Nederland awarded Petrofac a FEED contract for a CO_2 injection platform as part of the Aramis CCS project in the Netherlands. The project involves the decommissioning of topsides and the installation of a new repurposed platform connecting to the Aramis CO_2 distribution network. The CO_2 will be stored in depleted offshore gas fields under the North Sea and will be based on an "open access" philosophy so that other industrial customers and storage fields can be added incrementally to the system.

From *Offshore Engineer*. August 2024.

BP to Advance CCUS in Indonesia

BP signed a cooperation agreement with the Bandung Institute of Technology (ITB) to advance the R&D of CCUS in Indonesia. The agreement covers feasibility studies that aim to support the Tangguh CCUS project and the development of the Tangguh CCS hub and marks the implementation of the memorandum of understanding that the parties signed last October. In addition to the feasibility studies, the six-year agreement also details support for infrastructure for the ITB Centre of Excellence for CCS and CCUS.

From *Upstream Online*. August 2024.

LEGISLATION AND POLICY

October 2023 (Vol. 23 No. 10)

Denmark To Allocate Funds for CCS

Denmark announced plans to allocate state aid over 15 years for projects to capture and store 2.3 million metric tons of CO_2 emissions per year. The country has a target of reaching net-zero carbon emissions in 2045; according to the country's climate and energy ministry, CCS is expected to help reduce at least 3.2 million metric tons of Denmark's CO_2 emissions by 2030.

From *Reuters*. August 2023.

Proposed Canadian Legislation for CCUS

The Canadian Department of Finance released draft legislation for several investment tax credits, including one that addresses the Investment Tax Credit for CCUS. First announced in the 2022 Canadian Federal Budget and further expanded upon in the 2023 Budget, the CCUS tax credit has varying rates of refund, which are based on the different types of projects encompassed in the CCUS framework.

From *Lexology*. August 2023.

November 2023 (Vol. 23 No. 11)

CDR R&D Act Introduced in US House

Legislation to boost investment in research, development, and deployment of different CDR technologies was introduced in the U.S. House of Representatives. The Carbon Dioxide Removal Research and Development Act of 2023 would support 10-year cross-agency R&D and incorporate diverse and innovative technologies, including direct air capture, biological carbon removal, and ocean-based carbon removal. The funding would also establish a National Science Foundation research program to ensure that CDR developments are guided by the best available science and data.

From *Carbon Herald*. September 2023.

Climate Disclosure Bill Signed in California

A climate bill that passed the California state legislature and was signed by the governor requires major companies to publicly disclose their greenhouse gas (GHG) emissions. Under the law, approximately 5,000 companies will be required to report the amount of GHGs directly released into the atmosphere by their operations, as well as the amount of indirect emissions released, such as from employee travel, waste disposal, and supply chains.

From *The Hill*. October 2023.

December 2023 (Vol. 23 No 12)

Taiwan Unveils Regulations to Reach Net-Zero

The Ministry of Environment (MOE) announced regulations governing how entities can produce carbon credits or offset their emissions as part of Taiwan's bid to reach its net-zero target. The Climate Change Response Act, a framework law, was promulgated in February 2023, with the MOE stating then that detailed subsidiary regulations would be announced before the end of the year. Three regulations on emission registration and verification were announced earlier in 2023, while those related to the carbon fee—the rate and who will have to pay it—are slated to be announced in December.

From *Focus Taiwan*. October 2023.

Bulletin Provides Clarity on Small-Scale and Remote Carbon Storage in Alberta

The Government of Alberta released the *Mineral Rights Information Bulletin 2023-01* t to provide clarity on the business requirements and best practices for applying for Small-Scale and Remote (SSR) Carbon Sequestration Tenure. The bulletin covers the applications, rent and issuance fees, pore space agreements, pore space unit agreements, and other regulatory guidance. The government stated that SSR Carbon Sequestration Tenures are applicable in the following situations: for storing carbon emissions that are released too far from a hub, when hub infrastructure may be delayed, or when a hub is not ready to accept the volume of CO_2 from an emitter; where carbon storage would be less than 200,000 metric tons of CO_2 annually; in application for waste gas disposal, such as sour gas or acid gas, which emit from oil and gas facilities and needs to be disposed of; or to store carbon emissions from facilities testing carbon capture approaches.

From *Dentons*. October 2023.

Indonesia Regulation to Allow Cross Border Carbon Storage

Potential regulations in Indonesia will allow CCS for more industries and allow GHGs from abroad to be stored in the country, according to government officials. Indonesia's existing regulatory framework for implementing CCS and CCUS currently only applies to the oil and gas sector. Under the new regulation, businesses such as cement and metal industries will also be permitted to store CO_2 they captured to CCS and CCUS facilities.

From *Reuters*. October 2023.

January 2024 (Vol. 24 No. 1)

Introduced Legislation to Coordinate Federal Soil Carbon Storage Efforts

The U.S. House of Representatives introduced bipartisan legislation to empower the federal government to support interagency work around soil carbon storage research and monitoring. The *Coordination for Soil Carbon Research and Monitoring Act* (1) establishes an Interagency Committee on Soil Carbon Research led by the White House Office of Science and Technology Policy; (2) directs the committee to develop a cross-agency strategic plan for federal research, development, and deployment regarding soil carbon storage sampling and measurement methodologies, measurement and monitoring technologies, and community needs; (3) establishes working groups to coordinate soil carbon research priorities; and (4) requires regular reporting to Congress on soil carbon storage research and monitoring activities.

From *Congresswoman Jennifer McClellan Press Release*. November 2023.

US, China to Collaborate on Large-Scale CCUS

The United States and China will each advance at least five large-scale cooperative CCUS projects by 2030, according to a statement jointly released by both governments. Among other announcements, the *Sunnylands Statement on Enhancing Cooperation to Address the Climate Crisis* also stated that the two countries will operationalize the Working Group on Enhancing Climate Action in the 2020s to engage in dialogue and cooperation.

From *S&P Global*. November 2023.

Parliament of Australia Passes Law Enabling Offshore CO_2 Storage

The Parliament of Australia passed amendments to the legislation required to aid injection and transportation of CO_2 in Australian waters. The amendments to Environment Protection (Sea Dumping) Act 1981 ensure compliance with London Protocol obligations, enabling permits for offshore CO_2 capture, transportation, and storage in Australian waters.

From *Gas World*. November 2023.

EU Governments to Auction 244 Million Carbon Permits

European governments will auction 244 million EU carbon permits from January to August 2024 under the *EU ETS*, the European Commission announced. The EU ETS requires manufacturers, power companies, and airlines to pay for each metric ton of CO_2 they release as part of Europe's efforts to meet its climate targets. The number of permits member states will sell from September to December 2024 will be published on July 31, 2024, the Commission said.

From *Reuters*. November 2023.

EU Approves Climate Policies

The European Parliament approved the Carbon Removal Certification Framework (CRCF) and the Net-Zero Industry Act (NZIA) in support of scaling up CDR capacity in the EU. Regarding the CRCF, four distinct types of certified units were introduced: carbon removal, carbon storage in products, carbon farming storage, and carbon farming emissions reduction. Regarding the NZIA, carbon removal was added to the list of net-zero technologies supported by the act, and CO_2 capture, infrastructure, and storage projects are now recognized as "Net-Zero Strategic Projects."

From *Carbon Herald*. November 2023.

February 2024 (Vol. 24 No. 2)

EPA Grants Louisiana Authority Over CO_2 Injection and Storage

State primacy was formally granted by the EPA to Louisiana in the permitting and regulation of wells and projects involving the underground storage of CO_2. Permitting of such wells and operations (i.e., Class VI permits) is generally directly regulated by EPA; however, EPA can grant primary regulatory authority to individual states that develop a regulatory framework that matches or exceeds EPA's Class VI standards, as is now the case in Louisiana's Office of Conservation.

From *State of Louisiana Department of Energy and Natural Resources*. December 2023.

Ontario Government Opening Land for CO_2 Storage Demonstrations

The Ontario government is enabling industries to begin testing and demonstrating small-scale underground carbon storage projects on private land. The government said it is taking a measured and phased approach to enabling and regulating geologic carbon storage to provide clarity for businesses to plan and invest in Ontario while ensuring safe and responsible development. This will include looking at other Canadian jurisdictions where carbon storage projects already exist and exploring options to access underground space that is used for carbon storage. Work on a framework to enable the development of large commercial projects is underway.

From *Carbon Capture* Journal. December 2023.

Alberta Program Designed to Encourage CCUS Projects

The Government of Alberta introduced the *Alberta Carbon Capture Incentive Program* (ACCI) to incentivize the development and implementation of carbon capture technologies. The ACCI is designed to encourage CCUS projects in the province and aligns with Alberta's commitment to achieving emissions reduction targets outlined in *Alberta's Climate Leadership Plan*.

From *Mondaq*. December 2023.

Thailand Draft's Amendment to Regulate Carbon Storage

The Department of Mineral Fuels in Thailand has been developing a legal framework to accommodate CCS-related activities that aims to introduce the concept of "carbon business" as a regulated activity. The Draft Petroleum Act defines "carbon business" as "an exploration for a carbon storage site or a storage of carbon in a carbon storage site."

From *Baker McKenzie*. December 2023.

March 2024 (Vol. 24 No. 3)

European Commission Adopts Industrial Carbon Management Communication

The European Union's (EU) European Commission adopted an *Industrial Carbon Management Communication* that provides details on how CO_2 capture, storage, and/or utilization technologies could contribute to reducing emissions by 90% by 2040 and reaching climate neutrality by 2050. The Communication identifies a set of actions to be taken at the EU and national levels to enable the deployment of these technologies and the necessary infrastructure to establish a single market for CO_2 in Europe in the decades ahead. The Commission will start preparatory work on a possible future CO_2 transport and storage regulatory package and also assess the volumes of CO_2 that need to be removed directly from the atmosphere (industrial carbon removals) to meet EU emissions reduction targets.

From *European Commission Press Release*. February 2024.

CDR Legislation Introduced in US Congress

Updated legislation that would invest in CDR technologies to help address potential climate change was reintroduced in the U.S. House and Senate. The *Carbon Dioxide Removal Leadership Act of 2024* would direct DOE to (1) procure an increasing amount of technology-based CDR, culminating in the removal of 10 million net metric tons of CO_2 on a life cycle basis starting in FY 2035; (2) establish standards, in coordination with other agencies, for the monitoring, reporting, and verification of carbon removal procured; and (3) submit a report, also in consultation with other agencies, one year after the bill would pass examining options for a federal CDR offtake program. The bill would also support a diverse portfolio of viable CDR projects; prioritize projects that deliver economic opportunity to areas likely to be impacted by the transition away from fossil fuels; and require a report, starting in 2027 and every two years thereafter, on the progress toward meeting procurement targets.

From *World Resources Institute*. January 2023.

Soil Health Legislation Introduced; Promotes Carbon Storage

Legislation to improve soil health on farms and support sustainable alternatives to annual agriculture was introduced. The Innovative Practices for Soil Health Act improves federal conservation programs to ensure they are better able to support farmers who incorporate perennial systems and agroforestry into their operations. Perennial and agroforestry systems require less soil disturbance, improving soil structure, preventing erosion, increasing ecosystem nutrient retention, and promoting carbon storage.

From *Mid Hudson News*. January 2024.

April 2024 (Vol. 24 No. 4)

Germany Plans to Enable Underground Storage of CO_2 at Offshore Sites

According to government officials, Germany plans to enable underground carbon storage at offshore sites. The proposed "Carbon Management Strategy," which has not yet been developed into detailed legislation, foresees enabling the transport of CO_2 and its storage under the sea in Germany's exclusive economic zone, except in marine conservation areas. The country aims to reduce its emissions to net zero by 2045.

From *The Associated Press*. February 2024.

Announcement of Acreage for CO_2 Storage on Norwegian Continental Shelf

The Norwegian Ministry of Energy announced two areas in the North Sea for applications related to CO_2 injection and storage on the Norwegian continental shelf. Awards in such areas are a prerequisite for large-scale CCS. The application deadline is April 24, 2024.

From *Norwegian Ministry of Energy Press Release*. March 2024.

May 2024 (Vol. 24 No. 5)

Bill to Promote, Expand CCS

A bill to expand the Colorado Energy and Carbon Management Commission's (ECMC) ability to regulate and promote CCS is being considered by the Colorado General Assembly. *HB24-1346* expands the authority of ECMC to regulate facilities that use equipment to capture significant quantities of CO_2 directly from the ambient air (DAC), as well as the underground storage of CO_2 in pore space (geologic storage operations).

From *JD Supra*. March 2024.

Guidance to Aid North Sea Industry in Managing CO_2 Storage Sites

UK regulator North Sea Transition Authority (NSTA) published two sets of guidance expected to help the industry prepare for carbon storage injection. The *Guidance for Measurement of Carbon Dioxide for Carbon Storage Permit Applications* provides licensees with information on NSTA expectations regarding the proper measurement of CO_2 being injected into a storage site and suggestions on how that can be achieved. The *Guidance on the Content of an Offshore Carbon Storage Permit Application* provides clarity on determining the extent of a subsurface storage site and focuses licensees on the area they must manage to prevent/detect leakage.

From *Offshore Energy*. April 2024.

June 2024 (Vol. 24 No. 6)

PA Senate Approves CCUS Framework

The Pennsylvania State Senate approved legislation that would establish the framework for potential CCUS. *Senate Bill 831* next moves to the House. According to projections, Pennsylvania has the potential to store approximately 2.4 billion metric tons of CO_2 underground.

From *Pennsylvania Business Report*. April 2024.

California Sets Targets to Reach Carbon-Neutrality by 2045

As part of the *California Climate Commitment*, the state is setting 81 targets for nature-based solutions that support the ability of the land to absorb more CO_2 than it releases. Specific targets include 11.9 million acres of forest managed for carbon storage and biodiversity and water supply protection, and 2.7 million acres of shrublands and chaparral managed for carbon storage, resilience, and habitat connectivity.

From *Office of California Governor Gavin Newsom*. April 2024.

Alabama Legislature Passes CO_2 Storage Bill

The Alabama State Senate and House passed legislation that will allow manufacturers to store CO_2 emissions in pore space where oil and natural gas have been pumped out of the ground. In addition, the *legislation* creates the Underground Carbon Dioxide Storage Facility Administrative Fund and the Underground Carbon Dioxide Storage Facility Trust Fund.

From *Yellowhammer News*. May 2024.

EU Parliament Approves Deal on Carbon Removal Certification Scheme

The European Parliament approved a deal with national governments on a new carbon removal scheme, establishing a registry for certified units of CO_2 that have been removed from the atmosphere via industrial or nature-based processes.

From *Euractiv*. April 2024.

EU Strategy to Develop CCS Technologies

The European Commission adopted an *Industrial Carbon Management Communication* that outlines its ambitions for a strategy to boost the deployment of technologies in the EU that can capture, store, transport and use CO_2 emissions from industrial facilities. While the Communication does not change current rules, it identifies a series of actions to undertake at the EU and national level to establish a business environment that enables industrial carbon management in the EU in the decades ahead.

From *Lexology*. April 2024.

Canadian Province Announces CCS Legislation

The government of the Canadian province of Manitoba introduced legislation that would create a framework for industries to begin work on underground CCS projects. The proposed legislation would allow the Manitoba government to implement a licensing process for CCS projects that would include a comprehensive assessment for each project.

From *Manitoba Government News Release*. April 2024.

July 2024 (Vol. 24 No. 7)

Minnesota Passes Energy Permitting Policy Reform

The Minnesota State Legislature passed a bill that contains significant energy permitting policy reform, including addressing the issues related to CO_2 pipelines. Specifically, the Agriculture and Energy Omnibus Bill requires the Minnesota Public Utilities Commission to complete (1) an environmental impact statement under the Minnesota Environmental Policy Act for all CO_2 pipelines, and (2) a general study evaluating specific issues related to routing CO_2 pipelines.

From *Lexology*. May 2024.

Report Examines Laws Governing International Transport of CO_2 for Storage

The Sabin Center at Columbia Law School published a report that examines the laws governing international transport of CO_2 for storage. The report, "*Legal Issues in Oceanic Transport of Carbon Dioxide for Sequestration*," focusses specifically on the shipping of CO_2 captured in Europe and transported to the United States for storage. Much of the report would also be relevant to the shipping of CO_2 between other regions, though domestic laws at either end of the trip may also be relevant.

From *Carbon Capture Journal*. June 2024.

Illinois to Enact CO_2 Storage and Transportation Regulations

The Illinois State Legislature passed a bill that outlines a series of CCS provisions for the state. The *SAFE CCS Act* addresses pore space ownership and severability, unitization, protections for nonconsenting landowners, and post-injection monitoring requirements. It also institutes a moratorium on CO_2 pipelines, creates an emergency planning and training fund for emergency services, and creates a long-term carbon storage trust fund. Under the bill, CO_2 pipelines cannot be developed until the *proposed CO_2 pipeline rulemaking* recently issued by the Pipeline and Hazardous Materials Safety Administration is finalized, or until July 1, 2026, whichever is sooner.

From *Global CCS Institute*. May 2024.

Norway, Switzerland to Cooperate on CCS and CDR

The governments of Norway and Switzerland signed a *Declaration of Intent* to strengthen cooperation on CCS and CDR between the two countries. The cooperation is aimed at enhancing climate action and facilitating net-zero GHG development in both countries.

From *Carbon Capture Journal*. Mat 2024.

Japan Passes CCS Bill

The parliament of Japan passed a law establishing a permit system for business operators to facilitate the implementation of CCS technology. The law mandates that the government will identify specific areas suitable for CO_2 storage and grant permits to businesses chosen through a public selection process. Businesses granted these permits will receive "prospective drilling rights" to assess the geologic suitability for CO_2 storage, as well as "storage rights" to store the captured CO_2. Additionally, the law requires business operators to monitor for potential CO_2 releases.

From *Carbon Herald*. May 2024.

August 2024 (Vol. 24 No. 8)

Bipartisan Legislation Could Lead to Carbon Import Tax

Bipartisan U.S. lawmakers introduced legislation calling for a federal study of carbon intensity for common domestic imports. The *Providing Reliable, Objective, Verifiable Emissions Intensity and Transparency (PROVE IT) Act* could help advance a carbon import tax. The Senate version of the legislation, which was introduced June 2023 and passed the Environmental and Public Works Committee in January 2024, would authorize DOE to publish a comparative study between the carbon emissions of products produced in the United States versus their foreign import counterparts.

From *The Hill*. July 2024.

Pennsylvania Passes CCS Bill

A CCS bill was signed into law in Pennsylvania that aims to bolster the commonwealth's efforts to decarbonize power and industrial sectors while ensuring safe, permanent storage of CO_2. *Senate Bill 831* enhances landowner rights and empowers the Pennsylvania Department of Environmental Protection to require additional analysis for permitting decisions that may affect environmental justice communities. It also mandates seismic activity monitoring to ensure the safe and permanent geologic storage of CO_2 and addresses long-term liability concerns by setting a default 50-year period for monitoring and accountability.

From *Clean Air Task Force*. July 2024.

Austria Unveils National Strategy for Managing Carbon Emissions

Austria unveiled its national strategy for managing carbon emissions, focusing on three key technologies: CCS, carbon capture and utilization (CCU), and CDR. The *plan* unfolds in two phases: the first, currently underway, assesses Austria's current carbon management situation and outlines steps to regulate the reduction of emissions through these technologies; the second phase will focus on putting these plans into action.

From *Carbon Herald*. July 2024.

European Commission Approves Swedish Scheme to Support Reduction of Biogenic CO_2 Emissions via CCS

The European Commission *approved* a Swedish scheme to support the capture, transport, and storage of biogenic CO_2 and contribute to Sweden's efforts to reduce its emissions and achieve its climate objectives. Running until December 2028, the Swedish scheme will be rolled-out via 15-year contracts under a competitive bidding process. The first auction is expected to open in 2024. Aid will be awarded to companies emitting biogenic CO_2 in Sweden and implementing projects with a potential capacity to capture and store 50,0000 metric tons of biogenic CO_2 per year.

From *Global CCS Institute*. July 2024.

Danish Energy Agency Opens Public Consultation on CCS Fund

The Danish Energy Agency published public consultation material in connection with the launch of the CCS Fund, which is intended to cover costs for the capture, transport, and geologic storage of fossil, biogenic, or atmospheric CO_2. The *consultation* will run until August 20, 2024, and the Danish Energy Agency expects to publish the tender material in October 2024 and award contracts in April 2026 following a prequalification and negotiation round.

From *Carbon Capture Journal*. June 2024.

German Government Adopts Draft Law to Amend Carbon Dioxide Storage Act

The German Federal Cabinet adopted a draft law to amend the Carbon Dioxide Storage Act and key points of a carbon management strategy. The draft law is based on a draft bill from February 2024, which has been partially refined. In future, the law will be known as the Act on the Permanent Storage and Transportation of Carbon Dioxide. The aim of the amendment is to promote the decarbonization of German industry and Germany's competitiveness, create a secure legal framework for the onshore and offshore storage of CO_2, and promote the construction and operation of privately owned CO_2 pipelines for the transport of CO_2.

From *Lexology*. June 2024.

September 2024 (Vol. 24 No. 9)

SAFE CCS Act Signed Into Law in Illinois

The Safety and Aid for the Environment in Carbon Capture and Sequestration (SAFE CCS) Act was signed into law, establishing strict safety requirements and a temporary ban on CO_2 pipeline construction in Illinois. The law sets rigorous standards for CCS projects, mandating state permits that include comprehensive safety monitoring and require projects to achieve a net reduction in greenhouse gases (GHGs).

From *Mahomet Daily*. July 2024.

CCUS Bill Signed Into Law in Alaska

Three energy bills were signed into law in Alaska, including a bill that creates a regulatory framework for the state to utilize its geologic resources for CCUS. By creating the regulatory framework necessary for operation, HB 50 will enable the state to attract investment in CCUS and authorizes the state to charge operators for the use of public lands for the geologic storage of CO_2.

From *Office of Governor Mike Dunleavy*. July 2024.

Law Targets Impact of Carbon Credits on Forests

A bill signed into law in New Hampshire will address two concerns raised about forest carbon credit programs. House Bill 1697 requires the New Hampshire Department of Revenue Administration to undertake an immediate study on the impact of such carbon credits on timber tax revenues. The bill also calls on the New Hampshire Division of Forest and Lands to establish and maintain a public registry of all forest lands in the state that are enrolled in a carbon credit program.

From *The Berlin Daily Sun*. July 2024.

European Commission Publishes Revised Guidance Documents to CCS Directive

The European Commission published *revised guidance documents* supporting the implementation of a directive on the geologic storage of CO_2. The updates aim to streamline permitting procedures and support sustainable CO_2 storage solutions in the European Economic Area. Key updates focus on novel CO_2 storage technologies in mafic/basalt rocks and depleted hydrocarbon reservoirs, CCS value chain aspects, corrosion and safety issues, and the regulatory transition from hydrocarbon production to CO_2 storage. The documents also provide additional guidance for member states in determining geologic areas suitable for CO_2 storage or exploration.

From *European Commission*. July 2024.

Scottish Government to Fund CCS Project

The Scottish government announced funding to explore how a pipeline could transport CO_2 from Scotland's central belt to the northeast. The Acorn Carbon Transport and Storage Project — a joint venture with the Scottish Cluster — is working with industrial, power, hydrogen, bioenergy, and waste-to-energy businesses that wish to capture CO_2 emissions and transport them for geologic storage under the North Sea.

From *Aberdeen & Grampian Chamber of Commerce*. July 2024.

Indonesian Government to Issue Ministerial Regulation on CCS Projects

The Indonesian Ministry of Energy and Mineral Resources announced it will issue a ministerial regulation on CCS and CCUS projects. The regulation will include operating permits, CCS/CCUS in the oil and gas sector, carbon definitions, storage capacity, measurement reporting and verification, cross-border CO_2 transport requirement, carbon value, guarantee fund, and operational safety. Indonesia currently has 15 CCS/CCUS projects under study or preparation.

From *Enerdata*. August 2024.

EMISSIONS TRADING

October 2023 (Vol. 23 No. 10)

RGGI Auction Results Announced

The RGGI-participating states announced the results of the 61st RGGI auction of CO_2 allowances. A total of 21,948,358 CO_2 allowances were sold at a clearing price of $13.85 (bids ranged from $2.50 to $20.00 per allowance). None of the 11.25 million cost containment reserve (CCR) allowances made available were sold, nor were any of the 10.62 million emissions containment reserve (ECR) allowances. (The CCR is a fixed additional supply of allowances made available for sale if an auction's interim clearing price exceeds $14.88. The ECR is a designated quantity of allowances to be withheld if an auction's interim clearing price is below $6.87.) Additional details are available in the Market Monitor Report for Auction 61.

From *RGGI Press Release*. September 2023.

Singapore, Chile Sign MOU for Carbon Markets

Singapore and Chile signed a Memorandum of Understanding (MOU) to collaborate on carbon markets and carbon pricing. The MOU will include the identification of mutually beneficial projects and the exchange of best practices related to carbon services and trading and ecosystem development.

From *Singapore Business Review*. August 2023.

Nassau Releases Draft Carbon Management Regulations

The Nassau government released draft Carbon Markets and Greenhouse Gases Regulations describing the process for the sale of carbon credits by companies managing those credits. The document provides a draft application form for the registration of a management company and an application to purchase carbon credits. It also lays out the details for companies seeking to engage in emissions reduction initiatives and outlines the companies' responsibilities upon finding any new carbon storage assets within the borders of the Bahamas.

From *The Nassau Guardian*. August 2023.

California and Québec Release Auction Results

California and Québec released the results of the 36th joint cap-and-trade auction of carbon allowances from both jurisdictions. The final numbers include sales figures and settlement prices for 2023 (current) and 2026 (advance) vintages. The California Cap-and-Trade Program and Québec Cap-and-Trade System are linked, enabling the mutual acceptance of compliance instruments issued by each jurisdiction to be used for compliance with each program.

From *California Air Resources Board News Release*. August 2023.

November 2023 (Vol. 23 No. 11)

Global Carbon Credit Investment Report Released

A report by Trove Research found that investment in carbon credit projects between 2012 and 2022 totaled $36 billion, with half of it occurring in the last three years and more than $3 billion in future investment already committed. According to the report, the investments are expected to deliver more than 1,000 new carbon-reduction projects, ranging from forest protection to CCS.

From *Trove Research*. September 2023.

Indonesia Carbon Credit Trading Platform Inaugurated

Indonesia's president inaugurated the country's first carbon emissions credit trading system, with the first session seeing the exchange of 13 carbon credits (equivalent to nearly 460,000 metric tons of CO_2). The credits were initially priced at 69,600 Indonesian rupiah (approximately USD 4.48) per ton and were traded on the Indonesia Stock Exchange's dedicated carbon trading platform. Indonesia has pledged to achieve carbon neutrality by 2060.

From *Carbon Herald*. September 2023.

Zimbabwe, UAE Sign Carbon Credit MOU

The United Arab Emirates (UAE) Global Carbon Investments (GCI) signed a memorandum of understanding (MOU) with the Ministry of Environment, Climate, and Wildlife to unlock the value of Zimbabwe's carbon sinks and carbon mitigation measures. The MOU will be used to finance the development and sale of future carbon credits, in the form of Internationally Transferable Mitigation Outcomes, aligned with Article 6 of the Paris Agreement. Under the agreement, financing will be directed toward the prefinancing of carbon credit projects in Zimbabwe that will be developed by Blue Carbon, a GCI fully-owned subsidiary and project developer specializing in nature-based solutions.

From *The Herald*. October 2023.

December 2023 (Vol. 23 No 12)

EU Launches Initial Phase of Carbon Border Adjustment Mechanism

The European Union (EU) launched the first phase of its system to impose CO_2 emissions tariffs on imported steel, cement, and other goods. Under the Carbon Border Adjustment Mechanism (CBAM), EU importers will be required to report the GHG emissions embedded during the production of volumes of iron and steel, aluminum, cement, electricity, fertilizers, and hydrogen. The bloc will not begin collecting any CO_2 emissions chargers at the border until 2026; starting in 2026, importers will be required to purchase certificates to cover the emissions, similar to what EU industries must do, when they buy permits from the EU carbon market.

From *Reuters*. September 2023.

Carbon Trading Commences in Abu Dhabi

AirCarbon Exchange (ACX) announced the *ACX Abu Dhabi*—an exchange and clearing house in Abu Dhabi Global Market—is live, with key transactions already being carried out and settled on the platform. With secured investments and approved regulatory licenses in place, ACX established the necessary foundation for the participation of Voluntary Carbon Market (VCM) entities in trading carbon credits and other environmental instruments.

From *Carbon Herald*. October 2023.

January 2024 (Vol. 24 No. 1)

China Issues Guidance for Restart of Domestic Voluntary Carbon Market

China's Ministry of Ecology and Environment (MEE) issued guidance for the development and implementation of projects in the domestic voluntary carbon market. The domestic voluntary carbon market, known as China Certified Emission Reduction (CCER), has been paused since 2017 for new project registrations as the government called for an enhancement of the regulatory framework. In early 2023, MEE released new legislation and approved methodologies for CCER credit issuance, paving the way for the market to onboard new projects and new supplies.

From *S&P Global*. November 2023.

Government of India Proposes Procedure for Carbon Credits Trading

The Government of India's Bureau of Energy Efficiency issued a draft Detailed Procedure for Compliance Mechanism under the Carbon Credit Trading Program. Under the procedure, the Ministry of Environment, Forest, and Climate will announce GHG emission intensity targets for tons of CO_2e per unit of equivalent product for each defined trajectory cycle applicable to obligated entities. The obligated entities will be informed of an annual target for three years; upon conclusion of this period, the targets will undergo revision.

From *Mercom India*. November 2023.

Japan Approves Projects Under Domestic Offset Scheme

Japan approved 26 projects with the potential to generate approximately 3.1 million carbon credits over their lifetimes. The projects were approved under the *J-Credit scheme*, which is designed to certify the amount of GHG emissions reduced and removed by sinks within Japan.

From *Carbon Pulse*. November 2023. (Subscription may be required.)

RGGI Secondary Market Report Available

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released the *Report on the Secondary Market for RGGI CO_2 Allowances: Third Quarter 2023*. Prepared by independent market monitor Potomac Economics, the report is based on data reported to the U.S. Commodity Futures Trading Commission, the Intercontinental Exchange, and the Nodal Exchange, as well as other data.

From *RGGI*. November 2023.

February 2024 (Vol. 24 No. 2)

RGGI Auction Results Announced

The Regional Greenhouse Gas Initiative (RGGI)-participating states announced the results of the 62nd RGGI auction of CO_2 allowances. A total of 27,656,000 CO_2 allowances were sold at a clearing price of $14.88 (bids ranged from $2.50 to $20.00 per allowance). The auction generated $411.5 million for states to reinvest in strategic programs, including energy efficiency, renewable energy, direct bill assistance, and greenhouse gas (GHG) abatement programs. Additional details are available in the *Market Monitor Report for Auction 62*.

From *RGGI*. December 2023.

Maritime a Part of EU ETS

The European Union Emissions Trading System (EU ETS) came into effect for the maritime transportation sector on January 1, 2024. The system will cover 50% of CO_2 emissions from voyages starting or ending in an EU port and 100% of emissions from voyages between two EU ports and when ships are within EU ports.

From *JD Supra*. December 2023.

Government of India Introduces Amendments to Carbon Credit Trading Scheme

The Government of India introduced amendments to its Carbon Credit Trading Scheme. The key changes focus on an "offset mechanism," allowing non-obligated entities to register projects for tracking and certifying reductions or avoidance of GHG emissions. The amendments also include adjustments to the Principal Scheme, specifying that non-obligated entities can either generate or validate projects. Moreover, the compliance mechanism now involves giving a target for emissions reduction. The offset mechanism aims to facilitate the accounting of GHG emissions reduction, removal, or avoidance.

From *Solar Quarter*. December 2023.

Sylvera, Singapore Collaborate on Carbon Credits

Sylvera—a carbon data provider—is collaborating with the Singapore government to facilitate high-quality carbon credits for meeting Paris Agreement commitments. Based in London, Sylvera builds software that independently assesses carbon projects aimed at capturing, removing, or preventing emissions. The collaboration aims to swiftly allocate climate finance to areas making tangible climate impacts and use these credits in alignment with Singapore's Paris Agreement objectives.

From *CarbonCredits.com*. January 2024.

March 2024 (Vol. 24 No. 3)

DAC Carbon Removal Credit Agreement Announced

Global commodities company Trafigura announced an agreement with CCUS company 1PointFive for an advance purchase of CDR credits to be produced from 1PointFive's industrial-scale direct air capture (DAC) facility, STRATOS, which is currently under construction in Texas. STRATOS is designed to capture up to 500,000 metric tons of CO_2 annually when fully operational. The captured CO_2 underlying Trafigura's removal credits will be stored through subsurface saline storage.

From *Trafigura Press Release*. January 2024.

Five-Part Series on Forest Carbon Credits and the Voluntary Market

Mongabay, a U.S.-based nonprofit conservation and environmental science news platform, concluded its *five-part series* on the carbon trade and its role in addressing potential climate change. Takeaways of the reporting include (1) the need to consult Indigenous and local communities in decision-making around forest carbon projects and (2) that governance bodies are looking to increase standards in the voluntary carbon market.

From *Mongabay*. January 2024.

Kenyan Government Publishes Draft Carbon Market Regulations

The Kenyan government published draft carbon market regulations, providing a framework for the implementation of all carbon market projects in the country. In addition, the draft regulations aim to create incentives and implement initiatives to support GHG emissions reduction and removal targets in line with nationally determined contributions.

From *The Kenyan Wall Street*. January 2024.

China Relaunches National Voluntary Carbon Market

China's Ministry of Ecology and Environment stated that China's national voluntary carbon market—China Certified Emission Reduction (CCER)—has begun trading in Beijing. The registration of CCER projects has been paused since 2017 to refine the regulatory and methodological framework. In 2023, the Chinese government launched the refined regulations and announced four methodologies for CCER issuance, paving the way for the market's reboot. The four methodologies are forestation, mangrove cultivation, solar thermal power, and grid-connected offshore wind power projects.

From *S&P Global*. January 2024.

April 2024 (Vol. 24 No. 4)

Red Trail Energy Issues Carbon Removal Credits

North Dakota-based Red Trail Energy (RTE) and Pure.earth announced that RTE has produced CO_2 Removal Certificates in the voluntary carbon market. The CO_2 removal credits are generated through BECCS from ethanol production and comply with Puro's geologically stored carbon methodology. The *RTE project* was supported by DOE/NETL through its cooperative agreements with the University of North Dakota Energy and Environmental Research Center.

From *Gasworld*. March 2024.

Germany to Launch CBAM Awareness Campaign

German emissions trading authority Dehst is launching an awareness campaign on compliance with the European Union's (EU) carbon border adjustment mechanism (CBAM), as many companies did not register or submit the mandatory report at the end of the first reporting phase. The EU's CBAM aims to prevent companies from relocating to other jurisdictions to avoid carbon costs in sectors covered by the bloc's emissions trading system and is initially being applied to cement, iron and steel, aluminum, fertilizers, electricity, and hydrogen. Reporting obligations began with the launch of the transition period on October 1, 2023, while the levy on imports will be phased in from the start of 2026.

From *Argus Media*. February 2024.

Washington State Passes Legislation to Link Carbon Markets with California, Quebec

The Washington State Senate passed legislation aimed at bolstering efforts to integrate its cap-and-invest carbon market with those of California and Quebec. *Senate Bill 6058* introduces a series of technical adjustments to the carbon markets, facilitating better alignment with the respective systems.

From *Carbon Herald*. February 2024.

EU Reaches Deal on Carbon Removal Certification Scheme

The European Parliament and the Council of EU member states reached a deal on a proposal to set up a registry for certified CDRs obtained from eco-farming practices and industrial processes. The tentative agreement aims to scale up high-quality carbon removal in the EU to reach the EU's objective of reducing emissions to net zero by 2050.

From *Euractiv*. February 2024.

May 2024 (Vol. 24 No. 5)

RGGI States Release Auction Results

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released the results of their 63rd auction of CO_2 allowances. A total of 24,272,157 CO_2 allowances were sold at a clearing price of $16.00, with bids ranging from $2.56 to $25.00 per allowance. The auction generated $388.4 million for states to reinvest in strategic programs, including energy efficiency, renewable energy, direct bill assistance, beneficial electrification, and GHG abatement programs. Additional details are available in the *Market Monitor Report for Auction 63*.

From *RGGI*. March 2024.

RGGI States Release Fifth Control Period Compliance Report

The RGGI-participating states released the *Compliance Summary Report* for RGGI's fifth three-year control period. The report found that 221 of the 222 power plants subject to RGGI requirements (CO_2 budget sources), or 99.5%, met their compliance obligations. In terms of emissions, 99.9% of covered power sector emissions were in compliance.

From *RGGI* Press Release. April 2024.

Australia's Soil Carbon Credit Issuance Expected to Rise

According to Australia's Clean Energy Regulator, the country's issuance of carbon credits for soil storage projects is expected to continue to rise in 2024 following a jump last year. A total of 253,009 Australian carbon credit units were issued for soil storage in 2023, with less than 2,000 issued before 2023.

From *S&P Global*. March 2024.

Paper Provides Legal Clarity for Voluntary Carbon Credits in Singapore

A legal paper, titled "*The Legal Character of Voluntary Carbon Credits: A Way Forward*," examined the importance of clarifying the legal characterization of voluntary carbon credits (VCCs) and offers a possible characterization of VCCs as intangible property in Singapore. The paper, launched jointly by investment platform company GenZero and the Singapore law firm Allen & Gledhill LLP, highlights carbon market gaps to address market fragmentation and related challenges through legal certainty and international consensus.

From *GenZero*. March 2024.

June 2024 (Vol. 24 No. 6)

RGGI Compliance Materials Available

The states participating in the Regional Greenhouse Gas Initiative's (RGGI) sixth control period released *guidance materials* for CO_2 budget source compliance for the 2024 interim control period. The 2024 interim control period began on January 1, 2024, and extends through December 31, 2024. Each CO_2 budget source must provide allowances for compliance equal to 50% of its emissions by March 3, 2025.

From *RGGI*. May 2024.

Global Carbon Trading Revenues Grew in 2023

According to the International Carbon Action Partnership's annual emissions trading status report, global revenues from the sale of carbon permits in emissions trading systems (ETSs) grew from $64 billion in 2022 to $74 billion in 2023. Jurisdictions making up 58% of global gross domestic product are now using an ETS, according to the report, with 36 systems currently in place. In addition, another 22 ETSs are under development or consideration.

From *Reuters*. April 2024.

July 2024 (Vol. 24 No. 7)

Biden Administration Releases Joint Policy Statement and Principles on VCMs

DOE, the U.S. Department of the Treasury, the U.S. Department of Agriculture, and senior U.S. policy advisors *announced* the publication of a Joint Statement of Policy and new Principles for Responsible Participation in Voluntary Carbon Markets (VCMs). VCMs are markets in which carbon credits—each representing one metric ton of carbon reduced or removed from the atmosphere—are bought and sold by companies, nongovernmental organizations, governments, and others on a voluntary basis to offset their emissions. The *Statement and Principles* aims to advance responsible market practices that will help VCMs drive meaningful climate ambitions and generate economic opportunity at home and abroad.

From *energy.gov*. May 2024.

RGGI Reports Made Available

Potomac Economics, the independent market monitor for the RGGI CO_2 allowance market, released a pair of reports. The *Annual Report on the Market for RGGI CO_2 Allowances: 2023* evaluates activity in the market for RGGI CO_2 allowances in 2023, focusing on allowance prices, trading and acquisition of allowances in the auctions and the secondary market, participation in the market by individual firms, and market monitoring. The *Report on the Secondary Market for RGGI CO_2 Allowances: First Quarter 2024*, which covers the period from January through March 2024, contains information on the secondary market for RGGI CO_2 allowances, including futures prices, market activity, and allowance holdings.

From *RGGI*. May 2024.

RGGI CO_2 Allowance Auction Results Announced

The RGGI-participating states announced the results of their 64th auction of CO_2 allowances, which saw a total of 16,053,188 allowances sold at a clearing price of $21.03 (with bids ranging from $2.56 to $40.00 per allowance). The auction generated $337.6 million for states to reinvest in strategic programs, including energy efficiency, renewable energy, direct bill assistance, and GHG abatement programs. Additional details are available in the *Market Monitor Report for Auction 64*.

From *RGGI*. June 2024.

August 2024 (Vol. 24 No. 8)

Study: Emissions Trading Good for Health

The European Union Emissions Trading System (EU ETS) has considerable health benefits and saves billions in costs, according to a study by the Cluster of Excellence "Climate, Climatic Change and Society" at the University of Hamburg. The study also analyzed the indirect effects of the EU ETS on hazardous air pollutants such as sulfur oxide, particulate matter, and nitrogen oxides.

From *Hamburg News*. July 2024.

RGGI Report Tracks Proceeds Investment

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released a report tracking the investment of proceeds generated from RGGI's regional CO_2 allowance auctions. The *report* tracks investments of RGGI proceeds in 2022, providing state-specific success stories and program highlights. In 2022, $364 million in RGGI proceeds were invested in programs including energy efficiency, clean and renewable energy, beneficial electrification, GHG abatement, and direct bill assistance.

From *RGGI*. July 2024.

RGGI Release Materials for Quarterly CO_2 Allowance Auction

The RGGI states released materials for their 65th quarterly CO_2 allowance auction, to be held September 4, 2024. As indicated in *the Auction Notice for CO_2 Allowance Auction 65*, a total of 15,943,608 CO_2 allowances will be offered for sale at a minimum reserve price of $2.56. Auction 65 includes an emissions containment reserve (ECR) of 7,807,029 allowances, from which allowances can be withheld if the interim clearing price is less than the ECR trigger price of $7.35.

From *RGGI*. July 2024.

September 2024 (Vol. 24 No. 9)

Carbon Trading in Indonesia Reaches $2.26 Million

According to government officials, Indonesia's carbon trading market reached a transaction value of $2.26 million from its launch in September 2023 to June 2024, amounting to 608,000 tons of CO_2 equivalent. For comparison, the global market for CO_2 permits reached almost $950 billion in 2023, marking a 2% increase from the previous year, according to analysts. The European Union's emissions trading system alone was worth approximately $830 billion, representing 87% of the global total; North American markets combined were valued at approximately $77 billion; and the Chinese market was worth approximately $2.5 billion. The Indonesian government has committed to reducing carbon emissions by nearly 32% independently and over 43% with international support.

From *Jakarta Globe*. July 2024.

SCIENCE

October 2023 (Vol. 23 No. 10)

NETL Researchers Develop Improvements for CO_2 Transport Pipelines

Researchers from NETL's Structural Materials Team produced a more robust pipeline material for transporting hydrogen and captured CO_2 by adding the rare earth element (REE) cerium to create a tougher steel alloy and address two DOE priorities: development of the infrastructure needed for decarbonization and improvement of the critical minerals supply chain. In addition, NETL researchers developed a coating technology to protect against corrosion in natural gas, hydrogen, and CO_2 pipelines.

From *NETL*. August 2023.

Researchers Add Crushed Volcanic Rock to Soil to Boost CO_2 Storage

According to a study published in AGU's journal Earth's Future, incorporating crushed basalt—a rapidly weathering rock originating from cooled lava—into the soil on farms can help store CO_2. The researchers' model simulated the process of enhanced rock weathering across 1,000 agricultural sites worldwide, spanning from 2006 to 2080, and found that regions with the most promise for this climate strategy are in the warm, wet tropics. The findings also revealed that in just 75 years, these sites could reduce atmospheric CO_2 by 64 gigatons.

From *earth.com*. August 2023.

Study Analyzes CDR Potential in U.S.

A group of researchers, led by the Electric Power Research Institute (EPRI), published a paper analyzing and mapping the CDR potential across the United States. Their research is based on the Global Change Analysis Model for the United States and is used to analyze how regional resources will influence and be influenced by CDR deployment in service of the U.S. national net-zero targets. The types of CDR primarily examined are direct air capture with permanent storage, bioenergy with carbon capture and storage (BECCS), land-use change, and BECCS liquids (i.e., ethanol and Fischer–Tropsch biofuels with CCS).

From *Carbon Herald*. August 2023.

November 2023 (Vol. 23 No. 11)

New Ions Facilitate Low-Energy Carbon Storage

Leveraging technology powered by humidity, as discussed in their recent article published in Environmental Science & Technology, a Northwestern University research team discovered several new ions that facilitate low-energy carbon storage. The materials being developed for direct air carbon capture (DAC) are utilized in a "moisture-swing" technique, that captures CO_2 at low humidities and releases it at high humidities. This research enhances our understanding of DAC and offers a more energy-efficient carbon capture method compared to traditional techniques. (Hegarty, J. et al. (2023). Expanding the library of ions for moisture-swing carbon capture. Environmental Science & Technology. https://doi.org/10.1021/acs.est.3c02543)

From *SciTechDaily*. October 2023.

Researchers Use CCU Technology to Recycle Industrial CO_2

Korean researchers are studying carbon capture and utilization (CCU) processes that use waste materials or abundant natural resources as raw materials to ensure their economic feasibility. The Chung-Ang University study, published in the Chemical Engineering Journal, discussed the utilization of industrial CO_2 and dolomite for the production of two commercially viable products: calcium formate and magnesium oxide. (Yoon, H. et al. (2023). Kinetic conversion of magnesium and calcium ions of dolomite into useful value-added products using CO_2. Chemical Engineering Journal, 469, 143684. https://doi.org/10.1016/j.cej.2023.143684)

From *Phys.org*. September 2023.

December 2023 (Vol. 23 No 12)

Project Investigating Ocean's Carbon Storage Role

The Natural Environment Research Council (NERC) Biological Influence on Future Ocean Storage of Carbon (BIO-Carbon) Program earmarked funding for three projects investigating the role of marine life in carbon storage. The Particle Transformation and Respiration Influence on Ocean Carbon Storage (PARTITRICS) project employs shipboard observations and autonomous underwater vehicles (AUVs) to investigate the transformation of organic matter through interactions with particles and organisms. The Coccolithophore Controls on Ocean Alkalinity (CHALKY) project focuses on quantifying how diversity and ecology influence carbon absorption in the oceans. Finally, the Integrating Drivers of Atlantic Productivity (IDAPro) project employs a combination of ship-based, robotic, and satellite platforms to enhance understanding of phytoplankton productivity, the foundational single-cell organisms in the ocean responsible for substantial carbon storage.

From Hydro International. October 2023.

Scientists Identify Gene that Triggers Root Growth, Boosts Carbon Storage

Oak Ridge National Laboratory (ORNL) scientists identified a gene "hotspot" in the poplar tree that triggers increased root growth, supporting an increase in carbon storage. Published in the journal *New Phytologist*, the research finds that more roots allow the poplar tree to draw more carbon for long-term storage underground. (Tao Yao et al, Expression quantitative trait loci mapping identified PtrXB38 as a key hub gene in adventitious root development in Populus, New Phytologist (2023). *DOI: 10.1111/nph.19126*)

From *Phys.org*. October 2023.

Carbfix Turning Stored CO_2 Into Stone

In a geodesic dome at the Hellisheidi geothermal power plant in Iceland, CO_2 transported via pipeline from the nearby power plant is mixed with water drawn up from the ground and injected into the basalt rock below. In the nine years that Carbfix has been using this practice, approximately 95% of the CO_2 was turned into rock in the subsurface in less than two years, according to the company.

From *Reuters*. October 2023.

Scientists Study New Approach to Valuing Carbon Storage Potential of Natural Habitats

A team led by University of Cambridge scientists developed a new approach to valuing the carbon storage potential of natural habitats, enabling investors to directly compare carbon credit pricing across a wide range of projects. The method was published in the journal *Nature Climate* Change, where the researchers argue that saving tropical forests is a less-expensive way of balancing emissions than some current CCS technologies. (Realising the social value of impermanent carbon credits, Nature Climate Change (2023). *DOI: 10.1038/s41558-023-01815-0*, *www.nature.com/articles/s41558-023-01815-0*)

From *Phys.org*. October 2023.

Researchers Study Tree Leaves and Carbon Storage

Researchers worldwide collected data on tree species to improve their understanding of the different types of tree leaves and to draw conclusions about the CO_2 cycle. By quantifying the distribution of tree leaf types and their corresponding biomass, and identifying regions where climate change will exert greater pressure on current leaf types, these findings are expected to enable better predictions about the future functioning of terrestrial ecosystems and the carbon cycle. (Haozhi Ma et al, The global biogeography of tree leaf form and habit, Nature Plants (2023). *DOI: 10.1038/s41477-023-01543-5*)

From *Phys.org*. October 2023.

January 2024 (Vol. 24 No. 1)

Study Focuses on Carbon Storage Potential

Research led by the Crowther Lab at ETH Zürich and co-authored by more than 200 scientists throughout the world found that forests have the potential to store up to 226 billion metric tons of carbon if protected and restored. Published in the journal *Nature*, the study found that approximately 61% of this potential is attainable by protecting existing forests and allowing them to reach old-growth maturity. The remainder requires restoring degraded and deforested areas and connecting forest fragments in key areas.

From *Mongabay*. November 2023.

Study: Reservoir Construction May Reduce Carbon Storage in Ocean Sediments

Research published in the journal *Frontiers in Marine Science* calculated carbon storage in the western Pacific Ocean since 1855, noting the negative impact of reservoir construction on carbon stocks. The researchers measured total organic carbon in the South Yellow Sea and East China Sea and found a noticeable trend in declining total organic carbon content from north to south through the study area, matching the increase in sediment grain size. They also found a noticeable decline in carbon reservoir stocks since the early 1990s, following the construction of reservoirs in the Ou River basin in 1988 and 1989, whose courses terminate in the sampled seas.

From *Phys.Org*. November 2023.

February 2024 (Vol. 24 No. 2)

Novel Catalyst for CO_2 Conversion

A team of researchers explored the conversion of CO_2 using electrocatalysis. In the process, a voltage source supplies electrical energy, which is fed to the reaction system via electrodes and drives the chemical conversions at the electrodes. The researchers showed that their system could efficiently convert CO_2—it generated current densities of more than 300 milliamperes per square centimeter. The researchers—led by Ruhr University Bochum and the Fraunhofer Institute for Environmental, Safety, and Energy Technology UMSICHT in Oberhausen—outlined their findings in the journal *Cell Reports Physical Science*.

From *Science Daily*. December 2023.

Ocean's CO_2 Storing Capacity Studied

According to a study published in the journal *Nature* (subscription may be required), the ocean's capacity to store atmospheric CO_2 is approximately 20% greater than current estimates. The scientists looked at the role played by plankton in the natural transport of carbon from surface waters down to the seabed. By analyzing a bank of data collected from around the world by oceanographic vessels since the 1970s, scientists were able to digitally map fluxes of organic matter throughout the world's oceans. The resulting new estimate of carbon storage capacity is 15 gigatonnes per year, an increase of around 20% compared with previous studies (11 gigatonnes per year) published by the Intergovernmental Panel on Climate Change in its *2021 report*.

From *Science Daily*. December 2023.

March 2024 (Vol. 24 No. 3)

AI Modeling Could Help Power Plants Capture, Store CO_2

According to a *study* from the University of Surrey, U.K., AI modeling could be used to help power plants capture CO_2 using less energy. Researchers aimed to self-optimize the CO_2 capture process in a renewable energy system via enhanced weathering of calcite with fresh water in a packed bubble column reactor. Through that process, CO_2 is captured by bubbling the flue gas through freshwater containing limestone in the reactor, converting the CO_2 into bicarbonate and storing it in the ocean. But since it takes energy to pump the water and the CO_2, the capture system had its own wind turbine. And when the wind wasn't blowing, it took energy from the grid. Using AI, researchers taught a model system to predict what would happen so it could pump less water when there was less CO_2 to capture, or when less renewable energy was available. Researchers said the model could capture 16.7% more CO_2 over a one-month operation while using 36.3% less energy.

From *Power Engineering International*. January 2024.

Science for the Planet: Sinking Seaweed for Carbon Storage

The Columbia Climate School posted a video of a biological oceanographer explaining how seaweed might help reduce atmospheric CO_2 levels. He's studying the practicality and impacts of sinking massive amounts of this surface-growing plant down to the seafloor, which would trap and store the carbon it absorbs via photosynthesis for at least a century.

From *Columbia Climate School*. January 2024.

Researchers Study Impact of Climate Change on Forest Carbon Storage

According to analysis of U.S. Forest Service data, climate change is causing Western U.S. forests to be less effective carbon sinks. Published in *Proceedings of the National Academy of Sciences*, the study reveals a pronounced regional imbalance in forest productivity, a key barometer of forest health that gauges tree growth and biomass accumulation. Over the past two decades, the Western U.S. has exhibited a notable slowdown in productivity while the Eastern U.S. has seen slightly accelerated growth.

From *Science Daily*. January 2024.

Researchers Discover Microbes that Convert CO_2 into Rocks

Scientists are exploring efforts to bind CO_2 gas underground by pumping it into rock layers with specific geochemical properties that will dissolve the gas and turn it into a carbonate mineral in a process called in situ mineralization. However, this process takes a long time (between seven to 10 years) in nature. However, an innovation discovered by researchers working at the Sanford Underground Research Facility (SURF) found a set of naturally occurring microbes inside SURF that eat CO_2 gas and turn it into solid rock through a process called carbon mineralization.

From *Sanford Underground Research Facility*. January 2024.

April 2024 (Vol. 24 No. 4)

Study: Improved Rangeland Grazing Management Could Boost Carbon Storage

A study found that improved grazing practices implemented at the scale of traditional pastoralist migrations can remove a significant volume of GHGs from the atmosphere and store in soil carbon. The study, conducted by a team of scientists from various universities and organizations in the United States, Kenya, and Tanzania, was performed across more than five million acres of rangeland in Northern Kenya. According to the *study findings*, the statistically significant magnitude of increase in soil carbon associated with conducting high-density, short-duration grazing practices was slightly higher than that predicted by a relatively simple model that links soil carbon changes to grazing management. Calculations from this long-term study suggest that improved grazing practices, implemented at a large scale, have removed millions of metric tons of CO_2 from the atmosphere and support the issuance of carbon credits to the *Northern Kenya Rangelands Carbon Project*.

From *Newswise*. February 2024.

Anoxic Marine Basins Viable Carbon Storage Candidates: Study

Research led by UC Santa Barbara suggests that anoxic marine basins may be among the most viable places to conduct large-scale carbon storage in the deep ocean while minimizing negative impacts on marine life. Anoxic marine basins are deep and largely isolated from the main, oxygen-supplying currents. They cannot support animal life and are populated primarily by microbes and fungi with metabolisms different from those of creatures in oxygen-rich environments. Combined, these conditions are ideal for the preservation of plant matter. The study's results are *published in the journal AGU Advances*.

From *Phys.org*. February 2024.

Carbon Capture Method Powered by Geothermal Energy Could Help Store CO_2

According to a study conducted by researchers from Ohio State University, by combining direct air CO_2 capture technologies (DACC) and geothermal energy, large-scale CO_2 removal systems could potentially generate enough energy to remove CO_2 from the atmosphere and store it underground. Traditional DACC methods require a significant amount of energy, which can contribute to GHG emissions. The new approach, called direct air CO_2 capture with CO_2 utilization and storage, aims to integrate recycled CO_2 into the system to make it more efficient. The researchers' findings were *published in Environmental Research Letters*.

From *Tech Explorist*. February 2024.

May 2024 (Vol. 24 No. 5)

Researchers Conduct Global Study of Coastal Seas as Carbon Reservoirs

Coastal seas form a complex transition zone between the two largest CO_2 sinks in the global carbon cycle—land and ocean. A team of researchers led by the Cluster of Excellence Climate, Climatic Change, and Society at Universität Hamburg and the Helmholtz-Zentrum Hereon investigated the role of the coastal ocean in a model representation and found that the intensity of CO_2 uptake is higher in coastal seas than in the open ocean. The study was *published in the journal Nature Climate Change*.

From *ScienceDaily*. March 2024.

Scientists Discover Methods to Regulate Carbon Storage in Humus Layer of North China Forest

A team of scientists from the Institute of Applied Ecology of the Chinese Academy of Sciences studying litterfall and soil carbon ascertained that exchangeable manganese (Mn) is a critical factor regulating carbon accumulation in boreal forests. The researchers showed that exchangeable Mn is essential for maintaining humus in boreal forests to the extent that changes in global carbon cycles may be significantly affected over decades. Thus, they suggested that a more accurate representation of Mn-mediated mechanisms affecting carbon storage in biogeochemical models will increase confidence in model structure, parameter estimation, and predictions of soil organic matter production and litter decomposition. The study was *published in the journal Proceedings of the National Academy of Sciences*.

From *Phys.org*. March 2024.

Researchers Study How Disturbances Influence Carbon Storage in Forest Soils

A *study* by the Swiss Federal Research Institute WSL analyzed the role of natural disturbances on carbon storage in forest soils. The scientists examined 151 studies worldwide to assess the release of CO_2 and, therefore, of stored carbon following a disturbance. They concluded that forest fires have the greatest impact, followed by windthrow, timber harvesting, and insect pests. More important than the type of disturbance, however, were the types and amounts of organic carbon stored in the soil before an event.

From *WSL News*. March 2024.

Carbon Storage Capacity of Trees Studied

A study *published in the journal Proceedings of the National Academy of Sciences* attempted to calculate how potential climate change could impact the carbon storage capacity of trees. Researchers found that when average daily temperatures exceed 68°F, and in conditions of drought, trees may release more CO_2 into the atmosphere than previously thought with current climate models. This occurs through a process called photorespiration, which is a "leak" in photosynthesis that happens only during the daytime. CO_2 release increases as temperatures rise and water availability declines, but falls as atmospheric concentrations of CO_2 increase.

From *Nautilus*. March 2024.

June 2024 (Vol. 24 No. 6)

EPA: Forests Storing Less CO_2 Than Before

According to EPA's *annual report on greenhouse gases (GHGs)* by sector, U.S. forests stored 787 million metric tons of CO_2 equivalent in 2022, down from 844.2 million metric tons the year before and from 974 million in 1990. The numbers, EPA says, reflect a downward trend during the period and are part of the reason for the overall decline in carbon storage attributable to land use, including agriculture. (Total carbon storage in the land use and forestry category fell by 11% from 1990 to 2022.)

From *E&E News*. April 2024.

Scientists Discover Carbon-Storing Material

A team led by scientists in Edinburgh created hollow, cage-like molecules with high storage capacities for GHGs such as CO_2. The researchers used computer simulations to accurately predict how molecules would assemble themselves into the new porous material, a method that scientists believe could be further enhanced in the future through the use of AI. The research was published in the journal *Nature Synthesis*.

From *The North West Star*. April 2024.

Researchers Study Soil Inorganic Carbon

While most studies investigating the role of soil in the global carbon cycle focus on organic carbon, a study *published in Science* instead concentrated on soil inorganic carbon, analyzing more than 200,000 soil measurements from around the world. The researchers found that the top two meters of soil globally holds approximately 2.3 trillion metric tons of inorganic carbon, which is around five times more carbon than found in all the world's terrestrial vegetation. The researchers estimate that approximately 23 billion metric tons (1%) of this carbon may be released over the next 30 years.

From *The Conversation*. April 2024.

July 2024 (Vol. 24 No. 7)

DOE Study to Assess Shipping Carbon Emissions from Japan for Storage in Alaska

DOE is initiating a formal study of the possibility of capturing carbon emissions in Japan and storing them underground in Alaska, building on recently announced *cooperative agreements* between Japan and the United States. DOE's study will assess the technical and economic feasibility of shipping carbon emissions to Alaska for storage, and also explore potential synergies with Alaska's energy exports, such as hydrogen, to create a comprehensive energy value chain.

From *Carbon Herald*. May 2024.

Study to Focus on Low-Carbon Ammonia Facility With CCS

Hanwha and INEOS are collaborating on a study for a low-carbon ammonia facility with CCS. The two companies will explore the feasibility of a facility to meet the global demand for ammonia with low-carbon emissions. The final investment decision is planned for 2026, with planned commercial operation in 2030. The location of the plant has not yet been determined.

From *Carbon Capture Journal*. June 2024.

August 2024 (Vol. 24 No. 8)

Researchers Develop Fast Carbon Storage Technology

Researchers at the University of Texas at Austin developed a method for creating CO_2 hydrates — substances that trap CO_2 like ice — at an unprecedented speed, eliminating the need for harmful chemicals. The researchers achieved a sixfold increase in hydrate formation speed compared to existing methods. The research was published in *ACS Sustainable Chemistry & Engineering*.

From *Carbon Herald*. July 2024.

Researchers Study Ocean's Role in Storing CO_2

Massachusetts Institute of Technology researchers conducted a study of the ocean's ability to store CO_2 in the face of weakening ocean circulation. The results, published in *Nature Communications*, found that the expected benefits of the ocean's carbon storage ability may not only be reduced but reversed, indicating an increase in atmospheric CO_2 concentrations with slowed ocean turnover.

From *Hoodline*. July 2024.

Process Stores CO_2 in Concrete Without Strength Loss

By using a carbonated — rather than a still — water-based solution during the concrete manufacturing process, a Northwestern University-led team of engineers discovered a way to store CO_2 in the ubiquitous construction material without compromising its strength or durability. In laboratory experiments, the process achieved a CO_2 storage efficiency of up to 45%, meaning that nearly half of the CO_2 injected during concrete manufacturing was captured and stored. Their work was published in *Communications Materials*.

From *Northwestern University*. June 2024.

Simulators to Predict Fate of CO_2 Underground

Chemistry researchers are expanding the *GEOS carbon storage simulator*, enabling it to predict what happens when CO_2 is injected and stored in subsurface formations. GEOS is an open-source tool originally developed by Lawrence Livermore National Laboratory, Stanford University, and TotalEnergies. A group of researchers from the Technical University of Denmark are expanding it to include, among other things, their expert knowledge on geochemical reactions. The researchers' work is part of the *INNO-CCUS* partnership.

From *Carbon Capture Journal*. July 2024.

Research Unveils Carbon Storage Power of Planted Mangroves

Research published by ecologists from the U.S. Forest Service and their partners revealed that planted mangroves can store up to 70% of the carbon stock found in intact mangrove stands after just 20 years. The research, derived from logistic models built from 40 years of data and nearly 700 planted mangrove stands worldwide, could impact global mangrove restoration efforts, as over the past five decades, 35% of the global mangrove area has been lost due to historical factors, human-driven land use changes, extreme weather events, and erosion.

From *The Express Tribune*. July 2024.

Enhanced Method for Seismic Monitoring of CO_2 Storage

Los Alamos National Laboratory research claims that a new rock physics model provides more comprehensive and actionable data about how CO_2 changes rock properties throughout geologic storage sites. The new rock physics model is expected to help improve the underground CO_2 storage system and reduce the amount of CO_2 that is able to escape into the atmosphere. The paper was published in *Nature, Communications Earth & Environment*.

From *Carbon Capture Journal*. July 2024.

September 2024 (Vol. 24 No. 9)

Study Demonstrates Verification and Quantification of Small-scale Carbon Mineralization

Researchers from Pacific Northwest National Laboratory (PNNL) developed a process that transforms CO_2 into solid rock, mimicking Earth's natural processes, but at a faster pace — from thousands of years to mere months. But since storing CO_2 in solid minerals (i.e., carbon mineralization) at a scale large enough to make an impact takes more than just the discovery alone, researchers are also attempting to measure, verify, and communicate that the CO_2 stored underground is mineralized and won't escape. Recent research *published in the journal Analytical Chemistry* counts carbon mineral molecules at a scale of less than 100 parts per million, allowing researchers to see how much carbon is actually being stored.

From *PNNL News*. July 2024.

Research Aims to Quantify Carbon Storage in Grasslands

A research project in North Dakota is studying carbon storage in pastures with results that could help ranchers benefit from carbon storage credits. The project is being conducted on a ranch in central North Dakota to try to quantify just how much carbon can be stored in the root systems of grasses on a cattle ranch. The project, in the second year of a two-year study, has found that in pastures that have been grazed by cattle, the grasses store more carbon than if they had been left ungrazed.

From *Carbon Herald*. July 2024.

Catalyst Converts Captured CO_2 into Valuable Products

Researchers at the University of Toronto's Faculty of Applied Science & Engineering designed a catalyst that can efficiently convert captured carbon into valuable products, even in the presence of contaminants that degrade the performance of current versions. The discovery, described in a paper *published in Nature Energy*, is believed to be a step toward more economically viable techniques for CCS that could be added to existing industrial processes.

From *University of Toronto*. July 2024.

Researchers Study Biochar's CO_2 Storage Potential in Bhutan

A recent study revealed Bhutan has the potential to store 68% of its GHG emissions by converting crop residues into biochar — a carbon-rich, lightweight, black material that looks like charcoal and is used in soil to help crops grow. It has potential for mitigating climate change because the carbon in biochar can remain in the soil for a long time, rather than being released into the atmosphere as CO_2. The research was published in *GCB Bioenergy*.

From *Mongabay*. July 2024.

Study Finds Southern Ocean Absorbing More CO_2 Than Previously Thought

Research led by the University of East Anglia and Plymouth Marine Laboratory found that the Southern Ocean absorbs more CO_2 than previously thought. Using direct measurements of CO_2 exchange, or fluxes, between the air and sea, the scientists found that the ocean around Antarctica absorbs 25% more CO_2 than previous indirect estimates based on shipboard data have suggested. The results — *published in Science Advances* — show the summer Southern Ocean is likely to be a strong CO_2 sink, challenging the much weaker estimates based on float data and model simulations.

From *ScienceDaily*. July 2024.

Study Finds Forests Consistently Absorb CO_2

Despite facing regional threats like deforestation and wildfires, a study found that the world's forests have consistently absorbed CO_2 for the past three decades, even as disruptions chip away at their capacity. The study, based on long-term ground measurements combined with remote sensing data, found that forests take up an average of 3.5 ± 0.4 billion metric tons of carbon per year. The study was *published in the journal Nature*.

From *ScienceDaily*. July 2024.

ANNOUNCEMENTS

October 2023 (Vol. 23 No. 10)

NETL, EPA Seeking CCS Stakeholder Input on Computational Tools to Support Class VI Permitting

NETL and the U.S. Environmental Protection Agency (EPA) are seeking input from geologic carbon storage stakeholders on computational tools relevant to environmentally protective permitting of Underground Injection Control (UIC) Class VI wells. In 2022, NETL researchers collaborated with EPA, other contributing national laboratories, and DOE's Regional Initiative to Accelerate CCUS Deployment to release the report "Rules and Tools Crosswalk: A Compendium of Computational Tools to Support Geologic Carbon Storage Environmentally Protective UIC Class VI Permitting," which is also available on the EPA UIC Program's website for Class VI (Geologic Sequestration) Permit Application and Permitting Tools. The report summarizes computational tools and methods that may be used to address specific requirements of the UIC Class VI (Geologic Sequestration) permit application process and is intended to serve as a resource for industry, regulatory, academic, and public stakeholders. Stakeholder input on new relevant tools and new functionality of documented tools is requested to inform revision of this report (estimated release: spring 2024). Inquiries can be directed to *NRAP@netl.doe.gov* with subject: Rules and Tools Crosswalk.

Petra Nova CCS Facility Restarts Operations

Shut down since May 2020, Petra Nova, a carbon capture and storage (CCS) retrofit of a commercial power plant, has restarted operations, JX Nippon Oil and Gas Exploration Corp. announced. The project is designed to remove more than 90% of the CO_2 from a flue gas slipstream from an NRG Energy coal-fired unit at the W.A. Parish generating station in Fort Bend County, Texas. The project previously demonstrated CCS over a three-year period starting in December 2016. DOE, which supported the demonstration, stated in a 2020 report that during the three-year demonstration period, Petra Nova captured 3,904,978 short tons of CO_2, representing 92.4% of the CO_2 from the slipstream of flue gas processed.

From *POWER Magazine*. September 2023.

NETL Releases Updated Version of CO_2 Transport Cost Model

NETL released an updated version of its open-source tool that helps industry decision-makers, planners, and researchers calculate the cost of transporting CO_2 by pipeline from the point of capture to the point of underground storage or when converted into useful products. The FECM/NETL CO_2 Transport Cost Model (CO_2_T_COM) is an Excel-based tool that estimates revenues and capital, operating, and financing costs for transporting liquid phase CO_2 by pipeline.

From *NETL*. August 2023.

DOE Announces Start-Up Support for DAC Technology

DOE/FECM announced the selection of 13 semifinalists to receive funding for innovations in carbon dioxide removal (CDR) technology. The 13 DAC Pre-Commercial Energy Program for Innovation (EPIC) Prize "Think It" semifinalists will elevate DAC technology through entrepreneur and start-up support. The DAC EPIC Prize is one of several prize competitions hosted by DOE and funded by the BIL to support breakthrough DAC technologies that demonstrate strong potential to accelerate economic support and expand domestic carbon removal.

From *energy.gov*. August 2023.

DOE Funding to Advance DAC Development, Demonstrate CO_2 Storage

DOE announced funding to advance the development of two commercial-scale DAC facilities in Texas and Louisiana. The two projects, representing the initial selections from the BIL-funded Regional DAC Hubs Program, will help further demonstrate the ability to capture and store atmospheric CO_2. Project Cypress (Calcasieu Parish, Louisiana) seeks to capture more than 1 million metric tons of CO_2 from the atmosphere annually and store it underground. The South Texas DAC Hub (Kleberg County, Texas) seeks to develop and demonstrate a DAC facility designed to remove up to 1 million metric tons of CO_2 annually and store it in an associated saline geologic CO_2 storage site.

From *energy.gov*. August 2023.

Report Highlights Health Benefits of CCS

According to a study conducted by the Great Plains Institute and Carbon Solutions LLC, installing CCS technologies has the potential to result in over a billion dollars of annual health benefits in the United States. The report, "Carbon Capture Co-benefits: Carbon Capture's Role in Removing Pollutants and Reducing Health Impacts," quantifies the dollar value of the health benefits from reducing harmful co-pollutants by installing these technologies at representative facilities for seven industrial and power sectors across 10 U.S. regions.

From *Carbon Capture Journal*. August 2023.

RGGI Releases Report on Secondary Market

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released the "Report on the Secondary Market for RGGI CO_2 Allowances: Second Quarter 2023." Prepared by independent market monitor Potomac Economics, the report found no evidence of anticompetitive conduct in the RGGI CO_2 allowance secondary market.

From *RGGI*. August 2023.

Australia Opens Areas for CCS

The Australian government opened more acreage for offshore CCS, announcing 10 new areas across seven basins in federal waters for CCS exploration. The areas were chosen for their geology and CO_2 storage potential while minimizing impacts to other marine users and the environment.

From *Argus Media*. August 2023.

CCS Feasibility Studies Offered To Shipowners, Operators

Technology group Wärtsilä is providing shipowners and operators with feasibility studies to bring maritime CCS technologies to market. The feasibility studies are being conducted across vessels to be built and existing vessels, with the process taking four to six months of study and design work.

From *Marine Insight*. August 20203.

Gulf Coast Storage Network Announced

Barrell Energy Inc. announced it is developing the Gulf Coast Storage Network consisting of four carbon storage sites along the Gulf Coast in Louisiana and Texas. The energy company has performed an extensive evaluation of multiple carbon storage sites targeting the Miocene, Frio, Wilcox, and Cretaceous reservoirs in Louisiana and Texas.

From *Business Wire*. August 2023.

Summit Carbon Solutions Submits Revised Pipeline Application

Summit Carbon Solutions (SCS) submitted a Petition for Reconsideration for their pipeline permit application to the North Dakota Public Service Commission. SCS addressed community feedback and secured nearly 90% of the space needed for its carbon storage sites in North Dakota.

From *SCS Press Release*. August 2023.

November 2023 (Vol. 23 No. 11)

DOE/NETL's CarbonSAFE Initiative Progressing Toward Commercialization

The DOE/NETL-led Carbon Storage Assurance Facility Enterprise (CarbonSAFE) Initiative has funded 24 projects—and is currently negotiating 20 additional projects—throughout the United States to address key gaps on the path toward commercial carbon capture and storage (CCS) deployment. The CarbonSAFE Initiative began in 2016, building on the knowledge and experience gained from the Regional Carbon Sequestration Partnerships' (RCSPs) efforts. The vision of CarbonSAFE is to provide examples and data on the development of CCS storage complexes from the feasibility study until the point of injection through the following phases of project progress: Integrated CCS Pre-Feasibility; Storage Complex Feasibility; Site Characterization and Permitting; and, ultimately, Construction.

From *NETL*. September 2023.

NETL's CO_2-SCREEN Attracts Users

To date, CO_2-SCREEN—a tool developed by NETL researchers to estimate the feasibility of storing CO_2 in underground geologic environments—has been downloaded more than 1,900 times by users, including academic institutions and international- and U.S.-based organizations. CO_2-SCREEN offers a graphical user interface that enables users to enter geologic data and efficiency factor ranges quickly and easily, providing CO_2 storage and efficiency outputs in the form of probability estimates. The tool uses DOE methods and equations as a consistent mechanism for calculating prospective CO_2 storage resources.

From *NETL*. September 2023.

DOE Announces Funding to Accelerate CDR

DOE/FECM announced funding to advance carbon dioxide removal (CDR) technologies. The CDR Purchase Pilot Prize will enable companies to compete for the opportunity to sell CO_2 removal credits directly to DOE, helping to build standards for successful CDR programs and create a market to encourage technology innovation and the growth of the industry. The prize will provide cash awards in the form of offtake agreements from the federal government in four CDR pathways: direct air capture with storage, biomass with carbon removal and storage, enhanced weathering and mineralization, and planned or managed carbon sinks.

From *energy.gov*. September 2023.

NETL Geodata Update Includes CCS Database

Since November 2021, demand for NETL's geo-data science expertise to help map and visualize energy data and affiliated environmental, community, and justice data has grown. An example of NETL's analyses and mapping efforts include DOE/FECM's Carbon Capture and Storage Environmental Justice and Social Justice (CCS-EJ-SJ) Database, supporting the need for information and data on environmental, social, economic, and energy justice metrics to support planning and engagement for CCS projects.

From *NETL*. September 2023.

DOE Announces Launch of Regional Clean Hydrogen Hubs

DOE announced the launch of seven Regional Clean Hydrogen Hubs (H_2Hubs), several of which will have a CO_2 transport and storage component. The Appalachian Hydrogen Hub, for example, will leverage the region's (West Virginia, Ohio, Pennsylvania) ample access to low-cost natural gas to produce low-cost clean hydrogen and permanently store the associated carbon emissions.

From *energy.gov*. October 2023.

ADNOC Awards CCUS Project

Adnoc Gas, a subsidiary of Abu Dhabi National Oil Company, awarded the Habshan CCUS project to the UK's Petrofac. Located at the Habshan gas processing plant, about 90 miles southwest of Abu Dhabi, the project is expected to triple Adnoc's carbon capture capacity to 2.3 million metric tons per year.

From *Upstream Online*. October 2023.

Geomaterials Characterization Lab Tour

A new virtual tour video reviews NETL's geomaterials characterization work to support carbon storage projects.

From *NETL YouTube Channel*. September 2023.

CCSA Studies Accelerated Deployment of CCS

The Carbon Capture and Storage Association's (CCSA) Delivery Plan examines the pipeline of potential CCS projects across the United Kingdom to identify the economic opportunities available as well as the hurdles to successful deployment. According to CCSA, there are enough schemes in the pipeline to capture approximately 94 million metric tons of CO_2 per year, which is a 29% increase from 73 million metric tons last year.

From *The Engineer*. September 2023.

GoM Carbon Storage Study Released

CGG—a global technology and high-performance computing company—announced the delivery of the eastern phase of its GeoVerse Carbon Storage Gulf of Mexico Study and the commencement of its westward extension. Combined, the studies provide a map-based assessment of carbon storage opportunities—coupled with a desktop-ready well database and web-based visualization dashboards—for informed and rapid decision-making.

From *World Oil*. October 2023.

Screening and Ranking Tool for CO_2 Storage Sites Launched

Oilfield services company SLB (formerly known as Schlumberger) launched its carbon storage screening and ranking solution that provides a detailed assessment of CO_2 storage sites. The tool increases confidence in site-selection decisions based on scientific analysis of the long-term integrity and economic potential of an asset. It screens and ranks carbon storage sites using both technical and nontechnical data to provide a detailed assessment of their capacity and economic viability while identifying potential risks.

From *Carbon Herald*. October 2023.

December 2023 (Vol. 23 No 12)

FECM Fact Sheets Available

Fact sheets are available for download on DOE's website covering topics such as *hydrogen with carbon management*; the *Inflation Reduction Act (IRA) and carbon management*; *carbon capture, use, transport, and storage*; and *carbon dioxide removal (CDR) technologies*. In addition, DOE/FECM also prepared a *sampling of resources* on safety and risk assessment to assist stakeholder understanding of carbon capture, transport, and storage.

From *energy.gov*. November 2023

2023 MRCI Partners and Stakeholders Meeting Recap

The 2023 Midwest Regional Carbon Initiative's (MRCI) Partners and Stakeholders Meeting discussed the growth in carbon capture, utilization, and storage (CCUS) across the *20-state MRCI region*. Held in Morgantown, West Virginia, the meeting comprised *presentations* (including from DOE/NETL) on topics such as capturing and transporting CO_2, demonstrating CCUS, geologic storage resources, and CarbonSAFE. Two pre-meeting workshops on Community Benefits Plans and Storage Resources Management Systems were held, as was a post-meeting workshop on hydrogen energy and related CO_2 management. MRCI is part of the *DOE/NETL Regional Initiative to Accelerate CCUS Deployment*.

From *MRCI*. October 2023.

FERC Order Permits Conversion to CO_2 Transportation

The Federal Energy Regulatory Commission (FERC) issued an *order* that will permit Trailblazer Pipeline Company LLC to convert its natural gas pipeline system to CO_2 transportation. The company intends to use the pipeline to transport CO_2 from ethanol plants and other emissions sources in Nebraska and Colorado to Wyoming for geologic storage.

From *Akin Gump Strauss Hauer & Feld LLP*. October 2023.

Partnership to Deliver CCS Solutions

Getech—a locator of subsurface resources—and *Cozairo*—a carbon capture and storage (CCS) solutions and blue hydrogen project development company—signed a strategic collaboration agreement to collaboratively identify CCS opportunities. Together, the companies will deliver end-to-end CCS solutions to non-oil and gas CO_2 emitters seeking to reduce their carbon footprint. The focus will be on storing carbon in the vicinity of the emission point source, reducing infrastructure and capital requirements.

From *Energy-Pedia*. October 2023.

Background Seismicity Monitoring at Northern Lights CO_2 Storage Project

CGG joined Phase III of the HNET Horda Platform Region project to monitor background seismicity at the *Northern Lights CO_2 storage project* in the Norwegian North Sea. Phase III will run until April 2024 and is focused on determining natural seismicity in the planned CO_2 offshore injection site. The operator aims to assess the nature of tectonic seismic activity prior to CO_2 injection underground and more accurately analyze any induced seismicity during the injection period.

From *Offshore Magazine*. October 2023.

Report Focuses on CCUS Impact

A report from the United Nations Climate Change *Katowice Committee on Impacts* explores the impacts and potential of emerging industries that can help reduce GHG emissions and reach net-zero by 2050. The *report* focuses on three industries: hydrogen, CCUS, and artificial intelligence.

From *United Nations Framework Convention on Climate Change*. October 2023.

ABB, Imperial College Extend Carbon Capture Collaboration

A carbon capture pilot plant will continue to be used to train the net-zero workforce after ABB and Imperial College London signed a 10-year contract to extend their partnership. More than 4,500 students have had hands-on experience of ABB's technology solutions at the plant since it opened in 2012 at Imperial College. To enable the commercial CCS market to scale, ABB is deploying technology solutions to lower the capital and operational investment costs and de-risk integration into existing and new operations. In March 2023, ABB joined forces with London-based Pace CCS to make the capture, transportation, and storage of industrial CO_2 emissions more accessible.

From *World Pipelines*. October 2023.

MOU Focuses on Development of CCS Value Chain

Mitsui O.S.K. Lines Ltd. (MOL) and Cosmo Oil Co. Ltd. announced the signing of a Memorandum of Understanding (MOU) on the study of ocean transport, with the goal of establishing a CCS value chain. Under the MOU, MOL and Cosmo Oil will collaborate on the establishment of a "CCS value chain consisting of separation, capture, transport, injection, and storage" for CO_2 released from Cosmo Oil's refineries.

From *MOL Press Release*. October 2023.

CO_2 Pipeline Project Canceled

Navigator CO_2 Ventures canceled its Heartland Greenway pipeline project aimed at capturing 15 million metric tons of CO_2 annually from Midwest ethanol plants and storing it underground, the company announced.

From *Reuters*. October 2023.

Joint Venture Formed to Develop DAC Plant

Occidental and BlackRock announced a joint venture to invest in the development of the STRATOS direct air capture (DAC) plant. Construction of the facility is underway and is expected to be commercially operational in mid-2025. The amount of carbon captured (the plant has the potential to capture up to 500,000 metric tons of CO_2 per year) will generate carbon removal credits.

From *Occidental Press Release*. November 2023.

January 2024 (Vol. 24 No. 1)

DOE's Carbon Management Day Webinar

DOE-FECM celebrated its third annual Carbon Management Day on December 1, 2023. The *webinar* provided the latest news and announcements on DOE carbon management initiatives, featured a fireside chat with DOE carbon management leaders, and informed stakeholders on how they can get involved.

From *energy.com*. December 2023.

Proposed Rule to Allow CCS Projects in National Forests

The U.S. Forest Service is working toward allowing CCS projects on national forest land according to a *proposed rule published by the agency*. The rule would amend existing Forest Service regulations by allowing "exclusive and perpetual use" of national forest land and pore space beneath it for approved CCS projects.

From *Reuters*. November 2023.

Fifth National Climate Assessment Report Released

The U.S. Global Change Research Program released the *Fifth National Climate Assessment* report, which demonstrates how climate change is affecting America's working lands, how communities are reducing their risks, and how solutions to climate change can be found in productive landscapes. Mandated by the Global Change Research Act of 1990 and produced approximately every four years, the report provides authoritative scientific information about climate change risks, impacts, and responses in the United States.

From *U.S. Department of Agriculture*. November 2023.

2023 Global Status of CCS Report

The latest edition of the Global CCS Institute's CCS report found that as of July 31, 2023, there are 41 commercial-scale CCS facilities in operation, 26 facilities in construction, and 325 in various stages of development. The *Global Status of CCS Report 2023* also found that between 2022 and 2023, 11 new countries registered CCS facilities in various stages of development.

From *Carbon Capture Journal*. November 2023.

IEA CCUS Handbook on CCUS Policies and Business Models

The latest International Energy Agency (IEA) CCUS Handbook, *CCUS Policies and Business Models: Building a Commercial Market*, provides governments with a policy toolkit to address challenges to CCUS deployment. It also provides an overview of existing policies that have helped launch CCUS projects to date, identifies the main challenges to future large-scale deployment, and highlights international best practices. The handbook is supported by IEA's *CCUS Projects Database* and complements the IEA CCUS Handbooks on *Legal and Regulatory Frameworks for CCUS* and *CO_2 Storage Resources and Their Development*.

From *IEA*. November 2023.

UK Forum Commissions Projects to Test, Demonstrate Offshore Wind and CCS

The Crown Estate's Offshore Wind and CCS Colocation Forum commissioned two research projects designed to inform the best approach to test and demonstrate the colocation of offshore wind and CCS activities in the future. The research projects—Project Colocate and Project Anemone—build on the forum's *Spatial Characterisation Report*, which identified areas of potential overlap for offshore wind and CCS on the seabed, and the *North Sea Transition Authority's Seismic Imaging Report*, which explored various options for monitoring carbon storage and offshore wind sites to help resolve possible colocation issues.

From *The Crown Estate*. November 2023.

EU Announces Funding for Decarbonization Projects

The European Commission announced funding for projects developing technologies that help reduce GHG emissions as well as projects expanding the production of clean power components. The call is from the Innovation Fund, which is funded by the European Union's (EU) Emissions Trading System (ETS).

From *Rigzone*. November 2023.

Carbon Storage Hub Declared Project of Common Interest

The European Commission announced the selection of the *Norne Carbon Storage Hub* as a Project of Common Interest to promote the storage of European CO_2 emissions in Denmark. Launched by Fidelis New Energy in 2021, Project Norne was designed to be a large-scale, vertically integrated onshore CO_2 transportation and storage network in Denmark, supporting decarbonization efforts across Europe.

From *PR Newswire*. November 2023.

Report Outlines North Sea's Carbon Storage Potential

According to a report by Xodus and Subsea7, approximately 100 reservoirs will need to be prepared in the North Sea to satisfy the UK government's climate ambitions by 2050. Over the next decade, the report predicts that up to 100% of Europe's CCUS projects will be focused on the North Sea.

From *Offshore Magazine*. November 2023.

Sri Lanka Plans CO_2 Storage

To achieve carbon neutral status by 2050, Sri Lanka's cabinet of ministers approved a *roadmap and strategic plan*, which has identified measures to reduce GHG emissions and increase carbon storage.

From *Economy Next*. November 2023.

Application for CCS Onshore CO_2 Transportation Pipeline Accepted

The UK Planning Inspectorate accepted for examination Harbour Energy's application to build the *Viking CCS onshore CO_2 transportation pipeline*. The onshore pipeline will transport captured CO_2 from the Immingham industrial area to the former Theddlethorpe Gas Terminal site on the Lincolnshire coast. From Theddlethorpe, the CO_2 will be transported to the depleted Viking gas fields for storage beneath the seabed.

From *Carbon Capture Journal*. November 2023.

Companies Agree to Employ Concrete CO_2 Storage Technology

Deloitte and CarbonCure have agreed to utilize concrete CO_2 storage technology. Under the agreement, Deloitte will purchase *high-quality carbon credits* to directly support the deployment of *CarbonCure's carbon removal technologies* worldwide.

From *Carbon Herald*. November 2023.

February 2024 (Vol. 24 No. 2)

DOE Announces Funding for CDR Technology

DOE-FECM announced the semifinalists for the development phase of the Direct Air Capture (DAC) Pre-Commercial Prize. The seven semifinalists will receive cash awards and technical assistance for technology solutions that reduce CO_2 emissions by removing them directly from the atmosphere.

From *energy.gov*. December 2023.

DOE to Fund Projects that Transform Carbon Emissions into Valuable Products

DOE-FECM *issued a Notice of Intent (NOI)* to provide funding for the large-scale conversion of carbon emissions into environmentally responsible and economically valuable products. This effort supports the Biden administration's climate goal of achieving net-zero emissions by 2050, as well as the goals of DOE's Clean Fuels and Products Energy Earthshot, which aims to meet projected 2050 net-zero emissions demands for 100% of aviation fuel; 50% of maritime, rail, and off-road fuel; and 50% of carbon-based chemicals by using sustainable carbon resources.

From *energy.gov*. December 2023.

CBO Report on CCS in the US

A report by the Congressional Budget Office (CBO) examined the status, federal support, and future potential of carbon capture and storage (CCS) in the United States. According to *the CBO report*, there are 15 CCS facilities currently operating in the United States, with an additional 121 under construction or in development. The report also states that annual appropriations for CCS research and related programs totaled $5.3 billion (in nominal dollars) over the 2011–2023 period.

From *CBO*. December 2023.

Environmental Review of California CCS Project Released

The Kern County Planning and Natural Resources Department released a *draft environmental impact report* for a CCS project in California that plans to store CO_2 underground at the Elk Hills Oil Field. The release of the draft started the clock on a public review that included four joint workshops with the U.S. Environmental Protection Agency (EPA). (See Project and Business Developments for more information on this project.)

From *Bakersfied.com*. December 2023.

March 2024 (Vol. 24 No. 3)

DOE Announces Funding for Pilot-Scale Testing of Advanced CDR Technologies

DOE-FECM announced funding to help develop a commercially viable carbon dioxide removal (CDR) industry in the United States. The funding will support pilot projects and testing facilities to demonstrate and scale CDR technologies that reduce carbon dioxide (CO_2) emissions by removing it directly from the atmosphere and then storing it in geologic, biobased, and ocean reservoirs, or converting it into value-added products.

From *energy.gov*. February 2024.

DOE Invests in University-Led Projects to Advance Decarbonization

DOE-FECM announced the selection of 19 projects to receive funding to support novel, early-stage research at 17 U.S. colleges and universities. Projects were selected under DOE-FECM's *University Training and Research Program*, which includes the University Carbon Research and the Historically Black Colleges and Universities and Minority-Serving Institutions sub-programs. Five of the projects will establish a visiting scholar program consisting of multi-institution collaborations for student exchanges from minority-serving institutions, including the New Mexico Institute of Mining and Technology's Southwest CCUS Training and Research Partnership.

From *NETL News*. January 2024.

Fact Sheet on CBPs in Carbon Management FOAs

DOE-FECM plans and funds the implementation of large-scale field projects for CDR and CCUS. Projects are required to develop *Community Benefits Plans (CBPs)* that describe the project's knowledge gaps related to community context and workforce needs, approach to early and continuous engagement with community and labor stakeholders, and commitments to ensure high-quality jobs and a diverse workforce. DOE-FECM published a fact sheet answering frequently asked questions regarding CBPs in funding opportunity announcements (FOAs).

From *energy.gov*. December 2023.

NETL's CO_2-Locate Database with Legacy Wells to Support CO_2 Storage Site Selection

The National Energy Technology Laboratory's (NETL) *CO_2-Locate Database* developed, with Bipartisan Infrastructure Law (BIL) funding, to support more efficient and effective carbon capture and storage (CCS) site selection, risk analysis, and other key stakeholder needs. The database includes the start of an integrated national well dataset representing open-source wellbore data from disparate state and federal entities. NETL released a new video on the *CO_2-Locate Database*, providing stakeholders with a better idea of the database's impact and how to use it. Published on NETL's *Energy Data eXchange (EDX)*, the database is a centralized platform that enables users to obtain data quickly and accurately.

From *NETL*. December 2023.

NETL AI Tool Unlocks Vast Energy Data Opportunity

NETL researchers have harnessed the power of artificial intelligence (AI) to develop a tool that can ingest enormous amounts of unstructured geologic data (e.g., publications, maps, websites, and presentations) and then accurately label the visual data—work that could lead to a better understanding of the subsurface for safer energy production and CO_2 storage.

Ethanol Plant Joins Summit Carbon Pipeline Project

Ethanol producer POET is partnering with Summit Carbon Solutions to capture and store CO_2 from 17 of POET's U.S. Midwest ethanol plants. Summit will capture and store 4.7 million metric tons of CO_2 from 12 POET plants in Iowa and five plants in South Dakota.

From *Reuters*. January 2024.

Report on CCUS Outlook for 2024

Wood Mackenzie, an energy research and consultancy group, released a report on key themes that could shape the CCUS landscape in 2024. "*CCUS: 5 things to look for in 2024*" also includes an overview of notable projects and an analysis of regulatory framework development and CCUS policy.

From *Wood Mackenzie*. January 2024.

Report Assesses CDR in the US

A report from more than a dozen institutions offers an assessment of CDR in the United States. "*Roads to Removal: Options for Carbon Dioxide*" charts a path for the United States to achieve a net-zero GHG economy by 2050. The report provides an integrated analysis of the CDR techniques and resources that are currently available, along with the costs that will be incurred on the path to net zero.

From *Phys.org*. January 2024.

CCS Company Looks to Expand in UK, Europe

Neustark—a carbon capture, storage, and removal solutions provider based in Switzerland—is looking to expand in the UK and Europe, with 20 new storage sites planned in 2024. The company's mission is to address the need for scalable and permanent CDR solutions for carbon emissions that cannot be reduced in the global drive toward deep decarbonization.

From *Carbon Capture Journal*. January 2027.

Research Project to Help Guide CO_2 Storage Decisions

Geoscience BC's Central Interior Geological CCS Assessment research project is assessing the geologic CCS potential of the Nechako Basin, assisting the transition to a net-zero emissions economy and potentially diversifying economies across central and northern British Columbia. The project will compile all available geoscience data and reports on the basin, focusing on deep saline aquifers, to identify and quantify carbon storage potential. The published and freely available results will provide data and information that can be used to evaluate CCS opportunities.

From *Geoscience BC*. January 2024.

Firm Launches CCS Insurance

Insurance firm Howden launched insurance for potential CO_2 release from commercial-scale CCS facilities, aiming to "unlock" investment in the technology. The insurance provides cover for environmental damage and loss of revenue arising from the sudden or gradual release of CO_2 from CCS projects into the air, land, and water.

From *Gasworld*. January 2024.

Study Predicts Utilization of Captured CO_2 to 2044

A report published by IDTechEx predicts that the utilization of waste CO_2 will reach 800 million metric tons, creating more than 3 billion metric tons of useful products, by 2044. "*Carbon Dioxide Utilization 2024-2044: Technologies, Market Forecasts, and Players*" also analyzes the importance of combining CO_2 utilization with CCUS technologies to reach net-zero goals.

From *PR Newswire*. January 2024.

MOU Aims to Accelerate CCUS in North America

Aker Carbon Capture and MAN Energy Solutions signed a memorandum of understanding (MOU) to jointly pursue opportunities related to CCUS and CO_2 compression in the North American market. The two companies are currently collaborating on delivering a carbon capture plant at *Heidelberg Materials' Brevik CCS project* in Norway.

From *energy-pedia*. January 2024.

April 2024 (Vol. 24 No. 4)

DOE Announces Intent to Launch Voluntary CO_2 Removal Purchasing Challenge

DOE-FECM issued a notice of intent (NOI) to launch a Voluntary Carbon Dioxide Removal Purchasing Challenge, which will call on external organizations to join DOE in purchasing high-quality CDR credits. This public-private partnership structure aims to catalyze CDR credit purchases and improve the transparency of the CDR credit supply. No new funding will be made available through this Challenge. DOE-FECM is seeking public input on how to structure the Challenge, as well as on interest in joining when it formally launches later this year. Interested parties may submit comments electronically to *VoluntaryCDRchallenge@hq.doe.gov* and include "Voluntary CDR Purchasing Challenge" in the subject line no later than May 15, 2024. Responses must be provided as attachments to an email. Only electronic responses will be accepted.

From *energy.gov*. March 2024

NETL Researchers Awarded Patent for Laser Technology That Detects CO_2 Emission Releases from Underground Storage Sites

National Energy Technology Laboratory (NETL) researchers were awarded a patent for improvements to laser technology that can be used to more efficiently detect potential release of CO_2 from underground carbon storage sites. The technology also holds potential for use as an online sensor in a range of other hostile environments that require environmental monitoring. The patent was the fifth in a series of technology patents that cover aspects of a laser-induced breakdown spectroscopy probe for underground storage site monitoring.

From *NETL*. February 2024.

DOE to Continue Investing in CO_2 FEED Studies

DOE-FECM intends to *reissue an FOA* that will provide Bipartisan Infrastructure Law (BIL) funding for front-end engineering design (FEED) studies that support and accelerate the planning for CO_2 transport from anthropogenic sources to CO_2 conversion or secure geologic storage locations. All modes of CO_2 transport (pipeline, truck, rail, barge, and ship), including any combination of transport modes, may be considered. Projects will accelerate the development of a large-scale carbon storage industry needed to achieve the Biden Administration's goals calling for net-zero carbon emissions in the power sector by 2035 and the broader economy by 2050. If released, a third closing date could be anticipated in the third quarter of fiscal year 2024.

From *NETL*. February 2024.

NETL Launches EDX Spatial to Bring Energy Research Data and Interactive Maps to Decision Makers

NETL developed *EDX Spatial*, the official geospatial visualization, exploration, and discovery tool of the Energy Data Exchange (EDX). Now available to the public, EDX Spatial offers access to thousands of individual spatial data layers, as well as collated *Data Collections* that align with DOE-FECM/NETL-funded research. The current inventory of EDX Spatial Data Collections includes the *Carbon Storage Open Database* and the *National Carbon Sequestration Database (NATCARB) Viewer 2.0*.

From *NETL*. February 2024.

NETL Launches Class VI Data Support Tool Geodatabase

NETL has a *new video* describing its *Class VI Data Support Tool Geodatabase* that provides information needed to accelerate the completion of federal well construction permit applications to store CO_2 in the subsurface. The free and publicly available tool leverages data from the Carbon Storage Open Database, EDX, the U.S. Geological Survey, and other sources.

From *YouTube*. February 2024.

NETL's CCS Pipeline Route Planning Database Highlighted in Research Journal

NETL's Carbon Capture and Storage (CCS) Pipeline Route Planning Database was highlighted in the science journal Data in Brief. The *paper* outlined details on individual data layers and methods used to identify data needs and planned upgrades for the next version of the database. The CCS Pipeline Route Planning Database is a one-stop-shop for U.S. geospatial data resources collected to help strategically plan safe and sustainable routes for the transportation of CO_2 from where it is captured to where it can be stored underground or converted into other products.

From *NETL*. February 2024.

Carbon Capture Scotland Secures Milestone Storage Capacity

Carbon Capture Scotland, with German-based partner Landwärme, has secured 300,000 metric tons of CO_2 storage at the Stenlille project site in Denmark, anticipated to open in 2026. Carbon Capture Scotland operates an end-to-end carbon-removal offering, including capture, liquefaction, transport, and storage of biogenic CO_2. Landwärme, a biomethane supplier, integrates carbon capture solutions with biomethane production.

From *Carbon Capture Scotland News Release*. February 2024.

Partnerships to Drive Innovation in BECCS

Drax has joined Boeing as a founding member of the University of Sheffield's Energy Innovation Centre (EIC). The partnership is expected to drive research into next-generation carbon capture technology, including innovations in bioenergy with carbon capture and storage (BECCS). EIC offers industry partners access to two of its research facilities, including the Translational Energy Research Centre, which contains pilot-scale production facilities suitable for investigating different methods of carbon capture, utilization, and storage (CCUS).

From *Bioenergy Insight*. February 2024.

Quality Scores Released for Forestry Carbon Credit Types

The Carbon Credit Quality Initiative (CCQI) released scores for two types of forestry carbon credits via detailed factsheets—*improved forest management* and *commercial afforestation*. According to CCQI, these project types comprise approximately 10% of recent credit issuances in the voluntary carbon market.

From *Carbon Credit Quality Initiative*. February 2024.

Online Tool Estimates Carbon Storage in Oregon Coastal Habitats

Oregon's Coastal Management Program partnered with experts to develop a greenhouse gas (GHG) inventory that estimates carbon storage rates in coastal habitats, which are efficient at capturing and storing CO_2 from the air and surrounding waters.

From *Pew Charitable Trusts*. February 2024.

NSTA Opens Consultation on Publicly Accessible Carbon Storage Data

The North Sea Transition Authority (NSTA), which regulates the United Kingdom's (UK) oil and gas, offshore hydrogen, and carbon storage sectors, opened a public consultation to determine what information about carbon storage data could be publicly disclosed. NTSA is seeking public views regarding proposals for a set of regulations relating to the public disclosure of carbon storage information and samples. The consultation will be open until April 12, 2024.

From *Carbon Herald*. February 2024.

Southeast Asia Carbon Storage Study Released

Technology company CGG released a Southeast Asia Carbon Storage Study to support and accelerate the screening process for all players in the region's CCUS market. The study ranks and prioritizes large-scale opportunities across 58 basins in Indonesia, Malaysia, Thailand, and Vietnam to help streamline the process of identifying the best basins and plays for potential carbon storage.

From *CGG Press Release*. February 2024.

RGGI Secondary Market Report Available

The independent market monitor for the Regional Greenhouse Gas Initiative (RGGI) market released the *Report on the Secondary Market for RGGI CO_2 Allowances: Fourth Quarter 2023*. Prepared by Potomac Economics, the report contains information on the secondary market for RGGI CO_2 allowances, including futures prices, market activity, and allowance holdings.

From *RGGI*. February 2024.

Webinar on CCS Developments in the US

The *Carbon Capture Journal* recorded a webinar reviewing CCS projects in the United States. Speakers included Tracy Evans, CEO of *CapturePoint*, and John Thompson, Technology and Markets Director at the *Clean Air Task Force*.

From *Carbon Capture Journal*. February 2024.

Capture Carbon, Capture Value: An Overview of CCS Business Models

The Oxford Institute for Energy Studies released a *paper* identifying the main commercial and non-commercial risks associated with CCS. The paper also analyzes incentive mechanisms, regulatory and legal frameworks, types of industry and ownership structures, and public-private partnerships that are likely to emerge in different parts of the world to mitigate these risks and enable viable business models to scale up the technology.

From *The Oxford Institute for Energy Studies*. February 2024.

May 2024 (Vol. 24 No. 5)

DOE Announces Funding to Transform Industrial Sector, Reduce Emissions

DOE announced funding for 33 projects across more than 20 states to decarbonize energy-intensive industries, reduce industrial greenhouse gas (GHG) emissions, support good-paying union jobs, revitalize industrial communities, and strengthen the nation's manufacturing competitiveness. Funded by the Bipartisan Infrastructure Law and Inflation Reduction Act, the projects will focus on the highest-emitting industries where decarbonization technologies will have the greatest impact. Together, the projects are expected to reduce the equivalent of more than 14 million metric tons of CO_2 emissions each year.

From *energy.gov*. March 2024.

RECS 2024 Accepting Applications

The Research Experience in Carbon Sequestration (RECS) 2024 Program is accepting applications from graduate students and early career professionals who are interested in carbon capture, utilization, and storage (CCUS). RECS 2024 will include interactive content on a range of CCUS topics, incorporating site tours at a power plant, coal mine, carbon capture facility, direct air capture (DAC) facility, and injection wellhead; geology field exercises, live lectures, discussion sessions, and group projects; and access to CCUS experts from DOE and its national laboratories, the energy industry, CCUS project developers, and academia. Supported by FECM and NETL, RECS 2024 will be held July 21–30, 2024, in Colorado and Wyoming. Applications are due by May 15, 2024.

From *energy.gov*. April 2024.

DOE Announces Demonstrate Deploy Decarbonize 2024

DOE announced that Demonstrate Deploy Decarbonize 2024 (Deploy24) will take place in Washington, DC, on December 4 and 5, 2024. Hosted by DOE, Deploy24 is the second annual gathering of decision-makers from across the private and public sectors—including senior industry executives, capital allocators, community leaders, and others across the clean energy supply chain—all focused on accelerating the deployment of critical energy and decarbonization technologies and supply chains in the United States.

From *energy.gov*. March 2024.

Low-Carbon CCU Methanol Receives Certification

The International Sustainability and Carbon Certification (ISCC) has certified Celanese Corporation's low-carbon carbon capture and utilization (CCU) methanol under the ISCC Carbon Footprint Certification system. The newly certified low-carbon CCU methanol demonstrates a greater than 70% reduction in carbon footprint relative to a global average benchmark for fossil-based methanol production, as included in European Union legislation.

From *Celanese News Release*. March 2024.

College Class Begins 10-Year Carbon Storage Study

Arizona State University's Polytechnic campus began a 10-year study on carbon storage in arid environments, offering students hands-on research experience to help them understand the role of biodiversity in carbon storage.

From *The State Press*. March 2024.

University to Drill CCUS Research Well on Campus

Louisiana State University's (LSU) College of Engineering will drill a well on its campus to research CCUS. The well will be added to LSU's Petroleum Engineering Research, Training, and Testing Lab—a hands-on research facility comprising two industrial-scale research wells, additional storage wells, and surface facilities. The facility will be funded through a combination of federal and state funds, with oil and gas industry partners supplying most of the equipment.

From *Biz New Orleans*. March 2024.

SLB, Norway's Aker Carbon Capture to Combine Carbon Capture Businesses

U.S. oilfield services provider SLB (formerly Schlumberger) and Norway's Aker Carbon Capture are combining their carbon capture businesses to accelerate the deployment and scale of CCUS solutions, according to company officials.

From *Reuters*. March 2024.

June 2024 (Vol. 24 No. 6)

NETL Analytical Tool Available on EDX

NETL publicly released an award-winning analytical tool that uses advanced big data computing, artificial intelligence (AI), machine learning, and advanced analytical models to evaluate energy infrastructure integrity—a capability that can lead to effective cost savings and improved operational measures for environmental safety. The NETL-developed *Advanced Infrastructure Integrity Model (AIIM)* web mapping application is available on DOE's Energy Data eXchange® (EDX). AIIM began in 2018 as an approach to assess offshore energy infrastructure integrity but has also been used to perform onshore infrastructure assessments related to carbon capture, transport, and storage research.

From *NETL*. May 2024.

DOE Carbon Management Portal

DOE-FECM released a user-friendly platform that can be used to find and access reports, fact sheets, data, and other information on a variety of topics related to carbon management. The *Carbon Management Portal* aims to help communities and other stakeholders access information grounded in science to better understand carbon management technologies.

From *energy.gov*. May 2024.

DOE Announces DAC EPIC Prize Finalists

DOE-FECM announced five finalists to receive a total of $1.5 million for developing commercialization programs that support technologies that remove CO_2 emissions directly from the atmosphere. The Direct Air Capture Energy Program for Innovation Clusters (EPIC) Prize is one of several prize competitions hosted by DOE and funded by the Bipartisan Infrastructure Law to support breakthrough DAC technologies that demonstrate strong potential to accelerate economic support and expand domestic carbon removal. DAC is a process that separates CO_2 from the air for underground storage or for conversion into useful carbon-containing products.

From *energy.gov*. April 2024.

Publication of U.S. Government-Funded CCUS Handbook for Policymakers

In support of the *Clean EDGE (Enhancing Development and Growth through Energy) Asia* initiative, the U.S. Department of State's Bureau of Energy Resources (ENR) and the U.S. Department of Commerce's Commercial Law Development Program (CLDP) jointly announced the launch of the *Carbon Capture, Utilization, and Storage: Handbook for Policymakers*. The handbook, sponsored by ENR and developed by CLDP, is a guide to empower legislators, ministries, regulators, and state-owned companies to adopt and enforce legal instruments that will rapidly and effectively deploy carbon capture, utilization, and storage (CCUS) capabilities.

From *U.S. Department of State*. April 2024.

Report on CCS Opportunities in PA

The Clean Air Task Force released a report detailing the magnitude of storage capacity for CO_2 in Pennsylvania based on publicly available and private data. *The report* identified 219 facilities in the state that could benefit from CCS technology subsidized by the section 45Q tax credit to transition to a decarbonized future. The report also found that in most cases, CO_2 pipelines will likely be necessary to transport CO_2 from where it is captured to where it will be stored due to geologic considerations of the emissions sites and the geographical distribution of sources.

From *Clean Air Task Force*. April 2024.

EPA Finalizes Guidelines to Reduce Emissions from Power Plants

The U.S. Environmental Protection Agency (EPA) announced a suite of final rules to reduce emissions from fossil fuel-fired power plants. The rules were finalized under separate authorities, including the Clean Air Act, Clean Water Act, and Resource Conservation and Recovery Act.

From *EPA News Release*. April 2024.

Alliance to Explore CCS Solutions

CGG and Baker Hughes signed a memorandum of understanding (MOU) to explore jointly offered CCS solutions. The collaboration and proposed commercial alliance intend to support the increase of CCS projects by providing high-quality and fully integrated end-to-end solutions to screen, select, characterize, and monitor potential carbon storage sites worldwide.

From *Yahoo Finance*. May 2024.

Investment to Facilitate Development of CCS Projects in Canada

Mizuho Bank Ltd. announced an investment in Bison Low Carbon Ventures Inc. to facilitate development of Bison's CCS projects in Alberta, Canada. Bison is an Alberta-based carbon storage project developer with two storage hub projects that are being evaluated for regulatory approval and commercial development.

From Bison *Low Carbon Ventures News Release*. April 2024.

Report Examines Potential of CCUS Technology

A research report from Clean Prosperity's Net-Zero Pathways for Canada project examined the potential of CCUS technology to address emissions from Canada's major industrial sectors. The report, *Evaluation of carbon capture and storage potential in Canada*, mapped the locations and emissions of high-emitting industrial facilities that could integrate CCUS technology. The facilities were grouped according to their distance to potential geologic storage basins and to functioning or planned infrastructure for CO_2 transport and injection.

From *Carbon Capture Journal*. April 2024.

Report on the Role of Carbon Credits in Scaling Up Clean Energy Technologies

A report explores how carbon credits could help scale up direct air capture and storage (DAC+S), among other clean energy technologies. *The Role of Carbon Credits in Scaling Up Innovative Clean Energy Technologies* was prepared jointly by the International Energy Agency and GenZero.

From *IEA*. April 2024.

Invitation to Submit Abstracts for 2024 GSA Annual Meeting

The Geological Society of America (GSA) is calling for abstract submissions for its annual meeting, GSA CONNECTS 2024, to be held in Anaheim, California, September 22–25, 2024. The topical session "T56: Geologic Carbon Storage" will provide a forum for researchers to share their research in all aspects of geologic carbon storage, including but not limited to site selection, geologic and geophysical site characterization, modeling and monitoring of CO_2 injection/migration, risk assessment, and case studies of large-scale geologic carbon storage projects. The submission deadline is June 18, 2024.

From *Geological Society of America*. May 2024

July 2024 (Vol. 24 No. 7)

Save the Date: DOE's Demonstrate Deploy Decarbonize 2024

DOE announced that Demonstrate Deploy Decarbonize 2024 (Deploy24) will take place in Washington, DC, December 4–5, 2024. Hosted by DOE, Deploy24 is the second annual gathering of decision-makers from across the private and public sectors—including senior industry executives, capital allocators, community leaders, and others across the clean energy supply chain—all focused on accelerating the deployment of critical energy and decarbonization technologies and supply chains in the United States.

NETL Research Targets Degradation of Sorbents Used in DAC

NETL researchers are working on ways to reduce and prevent the degradation of sorbents used in DAC technologies, in which CO_2 is separated from ambient air and delivered in a compressed form for storage or reuse. The results could lead to more efficient and cost-effective use of DAC to attain a carbon pollution-free power sector by 2035 and a greenhouse gas (GHG)-neutral "net-zero" economy by 2050.

From *NETL*. May 2024.

NOAA, DOE Sign Agreement to Advance mCDR

DOE and the National Oceanic and Atmospheric Administration (NOAA) signed a memorandum of agreement (MOA) on future collaborations regarding marine carbon dioxide removal (mCDR) R&D. The MOA will formalize collaboration between NOAA and DOE to share expertise on research and technology development as well as avoid duplicative work. Under the MOA, NOAA and DOE recognize four responsibilities: (1) coordination and collaboration; (2) acceleration of R&D infrastructure, including facilities, data management, and feasibility studies; (3) development of protocols for accountable and science-based marine CDR for ecosystem safety, social benefit, and economic viability; and (4) the potential for future additional collaboration between both agencies.

From *energy.gov*. June 2024.

Recording Available for FECM Webinar on CDR Purchase Pilot Prize Semifinalists

DOE-FECM hosted a webinar about the 24 semifinalists selected for *DOE's CDR Purchase Pilot Prize* that will create a just and sustainable framework for scalable carbon management and help develop a CO_2 purchasing market to encourage technology innovation. Funded by the Bipartisan Infrastructure Law, the CDR Purchase Pilot Prize allows companies to compete for the opportunity to deliver CDR credits directly to DOE.

From *YouTube*. May 2024.

MRCI Partners and Stakeholders Meeting

The DOE-funded Midwest Regional Carbon Initiative (MRCI) will be hosting their 2024 Stakeholders and Partnership Meeting September 23–24, 2024, in Columbus, Ohio. MRCI will share the work they have been doing to accelerate CCS acceptance and deployment in its 20-state region of the United States.

From *MRCI*. May 2024.

Comprehensive CCS Insurance Solution Launched

Aon—a British-American professional services and management consulting firm—launched a comprehensive CCS insurance solution for international transport and storage companies. According to the firm, the product will provide cover for key risks associated with CCS and is aimed at de-risking global CCS projects.

From *Reinsurance News*. May 2024.

Report Assesses Technical Viability of Current CCS Technology

Bureau Veritas released a report that assesses the technical viability of current CCS technology within the marine market. The report, titled "*Onboard Carbon Capture: An Overview of Technologies to Capture CO_2*," also details the challenges to the wider adoption and integration of CCS technologies.

From *Carbon Capture Journal*. May 2024.

Report Finds CCS Sector in Scotland Could Boost UK Economy

Research led by the Centre for Energy Policy at the University of Strathclyde found that the establishment of a CO_2 transport and storage sector in Scotland could support more than 3,000 full-time equivalent jobs for the United Kingdom's (UK) economy. The estimated figures, according to *A New Scottish CO_2 Transport and Storage Sector: Supporting Decarbonisation, Jobs and Value across the UK Economy*, are 300% higher than estimates for a scenario where no such action is taken. (The research assumes a Scottish CO_2 transport and storage sector that is fully operational by 2030.)

From *Carbon Capture Journal*. May 2024.

RGGI States Release CO_2 Emissions Dashboard

The states participating in the Regional Greenhouse Gas Initiative (RGGI) released an interactive emissions mapping tool that can be used to explore CO_2 emissions and other data from power-generating facilities subject to RGGI. According to RGGI, the *RGGI CO_2 Emissions Dashboard* was developed in an effort to increase transparency regarding current and historical CO_2 emissions changes within the RGGI states at the local level.

From *RGGI*. May 2024.

CCS Europe Launches Action Plan for CCS

CCS Europe launched an *Action Plan for Carbon Capture*, identifying three central priorities for the European Union's (EU) goal of achieving net-zero carbon emissions by 2050. The priorities are securing political support for CCS deployment in Member States, strengthening the business case for CCS investment, and developing a regulatory framework to support CCS deployment.

From *CCS Europe*. May 2024.

APAC Region Emerging in CCS Sector

The Asia-Pacific (APAC) region is emerging as a key player in the CCS sector, as Asian countries are intensifying their decarbonization efforts. Rystad Energy's research highlights Australia, Malaysia, and Indonesia as emerging hubs in the APAC region, driven by the CO_2 storage potential in their depleted oil and gas reservoirs and supportive regulations that incentivize CO_2 storage initiatives.

From *Rystad Energy*. June 2024.

CCS Services Group Launched

Energean, an international hydrocarbon exploration and production company, launched EnEarth, a carbon storage and environmental services group. *EnEarth* will seek to create green hubs by identifying and exploring suitable geologic structures, including depleted oil and gas fields, that can be suitably repurposed into sustainable and efficient carbon storage fields.

From *Energean*. June 2024.

August 2024 (Vol. 24 No. 8)

OCED Awards CCS Project

DOE's Office of Clean Energy Demonstrations (OCED) awarded the *Baytown Carbon Capture and Storage Project*, led by Calpine Texas CCUS Holdings, with $12.5 million (of the total federal cost share of up to $270 million) to begin activities in Phase I. During Phase I, Calpine will complete an integrated front-end engineering design (FEED) study to determine the specifications for CO_2 capture, transport, and storage components.

From *OCED*. July 2024.

NETL Review Article Among Most Read

NETL's work in developing carbon mineralization technologies, which presents an alternative pathway toward a decarbonized power sector and economy, is gaining widespread recognition from the greater research community. According to Wiley, publisher of ChemBioEng Reviews, NETL's review article "*Mineralization of Carbon Dioxide: Literature Review*" is among the most read articles (top 40 most read, recently and all-time) and the most cited articles (top 30 most cited, recently and all-time) from that journal.

From *NETL*. July 2024.

U.S. Site Review Tool Released

The U.S. Interagency Working Group on Coal and Power Plant Communities and Economic Revitalization (*Energy Communities IWG*), of which DOE is a member agency, released a new Site Review Tool as a resource for manufacturers and investors interested in developing or expanding clean energy manufacturing projects in energy communities and nationwide, including those interested in developing commercial-scale storage facilities, PSCC projects, direct air capture (DAC) hubs, hydrogen production hubs with CCS, carbon utilization, and CO_2 transport. The interactive map provides access to publicly available information on facilities, nearby infrastructure, and community attributes.

From *Energy Communities IWG*. July 2024.

TGS Grants Early Access to CCS Data

Energy data company TGS announced early access to a comprehensive carbon storage assessment dataset along the Texas and Louisiana Gulf Coast. This evaluation will help prospective bidders maximize their bid accuracy, optimize project costs, and drive sustainable growth in the CCS sector.

From *TGS Press Release*. July 2024.

Report Forecasts CCUS Capture Capacity

According to a report, carbon capture, utilization, and storage (CCUS) capture capacity is projected to reach 2.5 gigatonnes per year by 2045. The IDTechEx report, "*Carbon Capture, Utilization, and Storage (CCUS) Markets 2025-2045: Technologies, Market Forecasts, and Players*," includes a CCUS market outlook; 20-year granular forecasts; company profiles; and benchmarking of PSCC, DAC, CO_2 transport and storage, CO_2 utilization cases, and carbon removals.

From *IDTechEx*. July 2024.

Survey to Explore Potential CCS at EemsEnergyTerminal

In partnership with the Netherlands' Ministry of Economic Affairs and Climate Policy, Gasunie — a Dutch natural gas infrastructure and transportation company — and Vopak — a Dutch independent infrastructure provider — are exploring options to keep operating the EemsEnergyTerminal for longer than initially planned at the port of Eemshaven (Groningen Netherlands). The survey will explore ways to bring about a future, rapid transition to a sustainable energy system — one where hydrogen and CCS play key roles.

From *EemsEnergyTerminal News*. June 2024.

Report on CCUS 10-Year Market Forecast

According to a report from Wood Mackenzie, by 2034, global carbon capture capacity is projected to reach 440 million metric tons per year and storage capacity is projected to reach 664 million metric tons per year, providing an almost $200 billion investment opportunity. The *CCUS: 10-year market forecast* also estimates that nearly half of the investment globally is associated with CO_2 capture, with the remaining $53 billion from transport and $43 billion from storage. Approximately 70% of the investment will be in North America and Europe across the value chain.

From *Carbon Capture Journal*. June 2024.

CCS Methodology Released

Verra — a nonprofit that develops and manages standards for sustainable development, climate action, and responsible business practices — released a globally applicable framework for technology-based CCS activities that generate CDRs and emissions reductions. *Verified Carbon Standard (VCS) Methodology VM0049 Carbon Capture and Storage* outlines the overarching requirements for CCS projects; projects will select from a set of modules for different CO_2 capture, transport, and storage activities to quantify the CDRs and emissions reductions they generate. These modules can be combined to suit a project's specific design or its technological needs. This modular format is adaptive to project expansions, the development of shared infrastructure, and future innovations.

From *Verra News Release*. June 2024.

September 2024 (Vol. 24 No. 9)

NETL Online Tool Supports Development of Permits for Geologic Carbon Storage

NETL introduced a free online tool to accelerate the discovery of publicly available data when developing permit applications for the underground storage of CO_2. The *Carbon Storage Site Mapping Inquiry Tool (MapIT)* provides operators, project leads and researchers with user-friendly, web-based assistance to find, query and download relevant data to use in the development of Class VI permit applications. The MapIT database has been aggregated from publicly available data gathered by various state and federal agencies, such as the U.S. Geological Survey, the U.S. Environmental Protection Agency (EPA), DOE and state geological surveys.

From *energy.gov*. August 2024.

DOE Awards Funding to CCS Hydrogen Hub

DOE's Office of Clean Energy Demonstrations (OCED) awarded the Appalachian Hydrogen Hub — also known as the *Appalachian Regional Clean Hydrogen Hub* ($ARCH_2$), led by Battelle — with federal funding to begin Phase 1 of the project plan. $ARCH_2$ is proposing locations across West Virginia, Ohio, and Pennsylvania and plans to leverage the region's ample access to low-cost natural gas to produce low-cost clean hydrogen and permanently store the associated carbon emissions.

From *OCED*. August 2024.

How the U.S. Federal Government Invests in Carbon Management

Over the past two decades, the federal government has invested billions of dollars into more than a 1,000 carbon management projects across the country. These projects advance the research, development, and commercial-scale deployment of carbon management technologies and infrastructure and expand U.S. carbon management capabilities to reduce carbon emissions from industrial and power sectors.

From *energy.gov*. July 2024.

FECM Launches Carbon Management Projects (CONNECT) Toolkit

The Carbon Management Projects (CONNECT) Toolkit is an online mapping tool and database that provides details about key federally funded carbon management projects, such as the funding status and amount, location, sources of CO_2 emissions, and many other project details. It also offers relevant information on other federal initiatives, regulatory permits, natural resource potential, existing infrastructure, point-source emissions, socio-demographic indicators, and protected lands.

From *energy.gov*. July 2024.

NETL Chairing Carbon Transport and Storage Sessions at the 2024 AIChE Annual Meeting

NETL is chairing three sessions on carbon transport and storage at the 2024 American Institute of Chemical Engineers (AIChE) Annual Meeting (October 27–31, 2024, in San Diego, California). The sessions, titled "Engineering Geologic Carbon Dioxide Storage Systems I, II and III," will focus on CCS research and development (R&D) for permanent, efficient, and cost-effective storage of CO_2.

IRS Issues Guidance for Claiming Carbon Oxide Utilization Credit

The Internal Revenue Service (IRS) issued initial guidance on the credit for the storage of carbon oxide, which was amended by the Inflation Reduction Act of 2022 (IRA). The *notice* describes information that must be included in a written life cycle analysis report and provides the procedures that taxpayers must follow to submit the report, along with required supporting information, to the IRS and DOE for review.

From *IRS*. July 2024.

NSF-Funded Center Established to Lead Geologic CO_2 Storage Innovation

A team of researchers from the University of Southern California (USC) Viterbi School of Engineering and the Penn State College of Earth and Mineral Sciences received funding from the National Science Foundation (NSF) to establish a center for CO_2 Storage Modeling, Analytics, and Risk Reduction Technologies (CO_2-SMART). *CO_2-SMART*, which will be dedicated to innovation in the geologic storage of CO_2 as a technology to enable industrial decarbonization at scale, will hold its formal kickoff meeting in fall 2024.

From *USC Viterbi*. July 2024.

Global CCS Institute Releases Two Reports on CCS/CCUS

The Global CCS Institute released two reports on both CCS and carbon capture, utilization and storage (CCUS). "*The Status of CCUS in France: Present and Future Opportunities*" posits that France's plan to decarbonize its economy makes it a key player in the European CCUS space. "*State of the Art: CCS Technologies 2024*" showcases the latest carbon capture and storage technologies that are available on the market. Featured in the 2024 edition are over 120 state-of-the-art CCS offerings.

From *Global CCS Institute*. July 2024.

Report Outlines Trends, Opportunities in CCUS Supply Chain

The Carbon Capture and Storage Association published a report that sets out key trends and opportunities in the CCUS supply chain across six areas: transparency, skills, jobs, United Kingdom (UK) content, technology, and wider economic benefits. The findings in the report were developed by engaging with nine CCS project developers over a six-month period to analyze the commitments and aspirations across 11 individual CCS projects that are deploying over the next few years.

From *Carbon Capture Journal*. August 2024.

Report Reviews Major CCS Projects

A report from the Clean Air Task Force evaluated the performance of 13 CCS projects to better understand the technology's future impact on climate action. The findings from "*Carbon capture and storage: What can we learn from the project track record*" show that several large-scale projects have consistently met high levels of technical performance, providing a foundation for increased climate benefits at future projects.

From *Clean Air Task Force*. July 2024.

PUBLICATIONS

Beginning this fiscal year, a "Publications" section was added to the CTSN, where the Office of Fossil Energy and Carbon Management (FECM) occasionally published links to a small collection of peer-reviewed journal articles and reports by authors who are not affiliated with the Department nor a recipient of U.S. Department of Energy (DOE) funding. These resources, not often found in DOE's Office of Scientific and Technical Information (OSTI) database, are chosen by FECM HQ staff based on their credibility, relevance and potential applicability to stakeholders. Selection criteria are not dependent upon an author's viewpoint and instead represent timely developments and study findings that are informative and influential when considering the deployment of carbon management technologies. While in the past we have linked to government-funded studies, this new effort focuses on research that is not available through OSTI.

A review by FECM and NETL technical experts was conducted before links were published; however, the content in the studies does not represent official Government positions and should not be interpreted as having been endorsed by any official within the Department of Energy. Moreover, neither the U.S. Government nor DOE, nor any of their employees, makes any warranty, expressed 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. Likewise, references in the studies to any specific commercial product, process, or services by trade name, trademark, manufacturer, or otherwise, do not constitute or imply an endorsement, recommendation, or favoring by the U.S. Government or DOE or its contractors or subcontractors.

Due to resource constraints with internal reviewers, each topic-specific collection should not be considered an exhaustive or comprehensive representation of the literature or subject area. Unlike publications found in OSTI, some articles may remain behind journal subscription paywalls indefinitely, with access only feasible through payment directly to the publisher, with whom DOE does not have any relationship.

March 2024 (Vol. 24 No. 3)

Topic: Safety and Security of Geologic Storage

Recent advances in carbon dioxide geological storage, experimental procedures, influencing parameters, and future outlook.

Muhammad Ali, Nilesh Kumar Jha, Nilanjan Pal, Alireza Keshavarz, Hussein Hoteit, Mohammad Sarmadivaleh, Earth-Science Reviews, Volume 225, February 2022, 103895.

Subsurface carbon dioxide and hydrogen storage for a sustainable energy future.

Samuel Krevor, Heleen de Coninck, Sarah Gasda, Navraj Singh Ghaleigh, Vincent de Gooyert, Hadi Hajibeygi, Ruben Juanes, Jerome Neufeld, Jennifer J. Roberts, Floris Swennenhui, Nature Reviews Earth & Environment, Volume 4, Pages 102-0118, January 19, 2023.

Frontiers | An Overview of the Status and Challenges of CO_2 Storage in Minerals and Geological Formations.

Peter Kelemen, Sally M. Benson, Hélène Pilorgé, Peter Psarras, Jennifer Wilcox, Frontiers in Climate, Volume 1, November 15, 2019.

Reducing uncertainty in geologic CO_2 sequestration risk assessment by assimilating monitoring data.

Bailian Chen, Dylan R. Harp, Zhiming Lu, Rajesh J. Pawar, International Journal of Greenhouse Gas Control, Volume 94, March 2020, 102926.

CO_2 geological storage: Critical insights on plume dynamics and storage efficiency during long-term injection and post-injection periods.

Y. Zapata, M.R. Kristensen, N. Huerta, C. Brown, C.S. Kabi, Z. Reza, Journal of Natural Gas Science and Engineering, Volume 83, November 2020, 103542.

Criteria and workflow for selecting depleted hydrocarbon reservoirs for carbon storage.

Catherine Callas, Sarah D. Saltzer, J. Steve Davis, Sam S. Hashemi, Anthony R. Kovscek, Esuru R. Okoroafor, Gege Wen, Mark D. Zoback, Sally M. Benson, Applied Energy, Volume 324, October 15, 2022, 119668.

ABOUT DOE'S CARBON TRANSPORT AND STORAGE PROGRAM

The **Carbon Transport and Storage Program** at the National Energy Technology Laboratory (NETL) is focused on developing and advancing technologies to enable safe, cost-effective, permanent geologic storage of CO_2, both onshore and offshore, in different geologic settings. The technologies being developed will benefit both industrial and power sector facilities that will need to mitigate future CO_2 emissions. The program also serves to increase the understanding of the effectiveness of advanced technologies in different geologic reservoirs appropriate for CO_2 storage—including saline formations, oil reservoirs, natural gas reservoirs, unmineable coal seams, basalt formations, and organic-rich shale formations—and to improve the understanding of how CO_2 behaves in the subsurface. These objectives are necessary to increasing public confidence in safe, effective, and permanent geologic CO_2 storage.

The *Carbon Transport and Storage Program Overview* webpage provides detailed information of the program's structure, as well as links to the webpages that summarize the program's key elements.

Carbon Transport and Storage Program Resources

Newsletters, program fact sheets, best practices manuals, roadmaps, educational resources, presentations, and more information related to the Carbon Transport and Storage Program is available on *DOE's Energy Data eXchange (EDX) website*.

Rig drilling a site characterization well at the Craig Power Station in Colorado, USA.
Photo Source: Schlumberger Carbon Services

ABOUT NETL'S CARBON TRANSPORT AND STORAGE NEWSLETTER

Compiled by the National Energy Technology Laboratory, this newsletter is a monthly summary of public and private sector carbon transport and storage news from around the world. The article titles are links to the full text for those who would like to read more (note that all links were active at the time of publication).

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