U.S. DEPARTMENT OF ENERGY | OFFICE OF FOSSIL ENERGY AND CARBON MANAGEMENT

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

CTSN CARBON TRANSPORT and STORAGE NEWSLETTER

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This newsletter was compiled by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon transport and storage. It covers domestic, international, and public and private sector news in the following areas:

DOE/FECM/NETL HIGHLIGHTS

DOE Issues Two RFIs on Implementing and Developing Carbon Transport and Storage Programs.

The U.S. Department of Energy's (DOE) Office of Fossil Energy and Carbon Management (FECM) issued two Requests for Information (RFIs) on the implementation of Future Growth Grants under the Carbon Dioxide (CO_2) Transportation Infrastructure Finance and Innovation (CIFIA) Program and the development of field laboratories at carbon storage facilities through the Carbon Storage Technology Operations and Research (CarbonSTORE) Initiative. For the ***CIFIA Future Growth Grants RFI***, FECM and DOE's Loan Programs Office are working together to provide direct loans and loan guarantees (***CIFIA Loans***) and Future Growth Grants that will support the development of regional and national CO_2 transport infrastructure to accelerate the deployment and development of carbon capture and storage (CCS) projects. (Comments are due on January 17, 2023). The ***CarbonSTORE RFI*** seeks input on the best approaches and options for developing field laboratories, whether at ***Carbon Storage Assurance Facility Enterprise (CarbonSAFE)*** Initiative project sites or other sites, to catalyze the rapid development and field-testing of technologies that would support a safe and affordable CCS industry. (Comments are due on January 9, 2023.)

From *Office of Fossil Energy and Carbon Management*. December 2022.

CONTINUE

ANNOUNCEMENTS

NETL Case Study Explores Solvent-Based DAC for Removal of Atmospheric CO_2.

A ***case study*** conducted by DOE's National Energy Technology Laboratory (NETL) examined the performance and cost of solvent-based direct air capture (DAC). DAC is an emerging CO_2 removal (CDR) technology that concentrates CO_2 found in the ambient air rather than a power plant or industrial facility flue gas, thereby addressing both current and legacy emissions. Atmospheric concentrations of CO_2 (~415 parts per million) are much lower than those found in effluent streams from power plants or industrial facilities, presenting greater technical and cost challenges for technologies to concentrate the CO_2 to the degree necessary for storage or utilization.

DOE to Issue CO_2 MRV Lab Call.

DOE's Office of Technology Transitions, in partnership with FECM, intends to issue a lab call on CDR measurement, reporting, and verification (MRV) best practices and capabilities. The lab call is funded by the Bipartisan Infrastructure Law (BIL) and aims to support the development of MRV tools and protocols that are necessary to enable CDR commercialization at scale.

DOE/FECM Hosted Carbon Management Day Webinar.

DOE/FECM celebrated its second annual Carbon Management Day, recognizing the essential role carbon management has in meeting the nation's goal of net-zero emissions by 2050. (Carbon Management Day is celebrated on December 1, because 12.01 is the atomic mass of carbon.) As part of the celebration, FECM ***hosted a webinar*** to gather stakeholders throughout industry, academia, and communities to provide updates on key initiatives, take a closer look at FECM-funded carbon management projects, and inform stakeholders on how to get involved.

NETL Director Discusses Lab's Role in Low-Carbon Future.

In an interview with Deloitte Insights for Sustainability Leaders, NETL Director Brian Anderson discussed NETL's role in the advancement of climate technologies and the challenges of helping deliver a sustainable and equitable low-carbon energy future. Topics covered include the deployment of CCS in conjunction with other low-carbon technology to increase the amount of clean and renewable energy used on the grid.

Carbon Management Collegiate Competition.

DOE/FECM is funding the Carbon Management Collegiate Competition, which tasks students to propose a regional carbon transport network. The competition seeks a diverse range of participants, with consideration given to disadvantaged communities and underrepresented minorities in science, technology, engineering, and mathematics (STEM) fields to advance carbon management technologies and achieve net-zero greenhouse gas (GHG) emission goals in a just and sustainable way.

NETL Researchers' Impact Recognized.

A recent ***analysis*** by Stanford University (USA) listed 25 current and former NETL researchers as being in the top 2% of scientists worldwide. The analysis comprised lists according to career-long impact and single-year impact.

NETL Celebrates the First Anniversary of BIL.

NETL celebrated the first anniversary of the BIL and its contributions to building a more resilient future in the United States. Highlights of NETL's BIL support include providing an advanced, strategic, CCS-specific data infrastructure system to drive the efficient and rapid deployment of CCS efforts.

DOE/NETL SMART Technical Advisory Group Member Publishes Book.

A member of the DOE/NETL Science-informed Machine Learning for Accelerating Real-Time Decisions in Subsurface Applications (SMART) Technical Advisory Group is the lead author of a new book titled "*Artificial Intelligence and Data Analytics for Energy Exploration and Production*." The book aims to help unleash the power of artificial intelligence and data analytics for faster and more cost-effective exploration and production, involving subsurface characterization, carbon storage, and reservoir monitoring.

Japan's Mitsui Hunts for Carbon Storage Sites in Asia-Pacific.

Mitsui & Co. plans to secure sites in the Asia-Pacific region and other areas to store CO_2 produced at Japanese factories and power plants, with plans to obtain rights for storing 15 million metric tons yearly by 2035. After securing storage rights, Mitsui intends to debut a CCS service for Japanese companies and others as early as 2030.

Series of Documents Supporting CCS Deployment Published.

The consortium implementing the CCS Roadmap for Central and Eastern Europe (CCS4CEE) project released a series of documents that support CCS deployment across the CEE region. The CCS4CEE project aims to renew the discussion on the long-term deployment of CCS in the CEE region, leading to new policies and joint projects. It covers Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, and Ukraine. Included in the documents is a ***summary of national CCS roadmaps***.

Denbury Announces CO_2 Transport and Storage Agreement.

Denbury Carbon Solutions LLC executed a CO_2 Services Agreement with Clean Hydrogen Works, under which it will transport and store CO_2 captured from Clean Hydrogen's planned hydrogen-ammonia complex in Parish, Louisiana (USA). The complex is expected to be built less than two miles from Denbury's existing CO_2 pipeline network.

ANNOUNCEMENTS *(cont.)*

Chevron, MOL to Study CO_2 Shipping.

Chevron and Mitsui O.S.K. Ltd. (MOL) signed a Joint Study Agreement (JSA) on the feasibility of transporting liquified CO_2 from Singapore to storage locations offshore Australia. Under the JSA, the companies will explore the technical and commercial feasibility of initially transporting up to 2.5 million metric tons of liquified CO_2 per year by 2030.

UK Company Unveils New CO_2 Management Platform.

The United Kingdom (UK)-based Aquaterra Energy unveiled a new CO_2 management platform for long-term monitoring and sustained integrity of underwater CCS sites. The integrated solution is said to provide monitoring of both subsurface fiberoptic seismic arrays and dissolved CO_2 gas detection via solar- or wave-powered remote data transmission nodes between the seabed and the surface.

PROJECT AND BUSINESS DEVELOPMENTS

PA DCNR Announces CCUS Research Facility.

Pennsylvania Department of Conservation & Natural Resources

Pennsylvania's (USA) Department of Conservation and Natural Resources (DCNR) outlined plans for a $6 million carbon capture, utilization, and storage (CCUS) research and storage facility to house their collection of core samples and drill cuttings. DCNR's Geological Survey has developed a repository of rock core and drill cuttings generated through exploration into oil and gas-bearing and other formations across the state. The library currently has limited space at the Pennsylvania Geological Survey headquarters.

From *Pennsylvania Government Press Room*. November 2022.

CO_2 Storage Capacity Confirmed for Northern Lights Project.

The Northern Lights Project concluded drilling operations for a CO_2 injection well and a contingent injection well within its CO_2 storage license in the North Sea, with preliminary results confirming the storage capacity of at least 5 million metric tons of CO_2 per year. The Northern Lights project—a joint venture created by Equinor, Shell, and TotalEnergies—plans to ship the CO_2 to an onshore terminal on the Norwegian west coast and, from there, transport the liquefied CO_2 by pipeline to a subsea storage location in the North Sea.

From *Offshore Energy*. November 2022.

MOU to Explore East China CCUS Development.

Shell, Sinopec, China Baowu Steel Group, and BASF signed a non-binding Memorandum of Understanding (MOU) to explore the feasibility of developing an open-source CCUS project in the East China region. The parties intend to conduct a joint study to assess the technical solutions and develop a commercial model for the project, as well as to explore the potential establishment of low-carbon product supply chains and propose enabling policies.

From *Oil and Gas Journal*. November 2022.

NET Power Launches Large-Scale Plant with CCS.

A consortium led by NET Power will develop and build a utility-scale natural gas-fired power plant near Odessa, Texas (USA), with near-zero atmospheric emissions that fully integrates power production with the transportation and storage of CO_2. The plant will be built near Occidental's Permian Basin operations and is expected to be online in 2026. The project will transport captured CO_2 to a storage location through Occidental's existing Permian CO_2 handling infrastructure and operations.

From *Carbon Capture Journal*. November 2022.

Companies Sign Lease Agreement to Develop CO_2 Storage Hub.

Occidental Petroleum subsidiary 1PointFive signed a lease agreement with King Ranch, an agricultural company, to support large-scale DAC projects for dedicated CO_2 storage in Texas (USA). The agreement provides access to land with the potential to remove up to 30 million metric tons of CO_2 per year through DAC and pore space estimated to store up to 3 billion metric tons of CO_2 in geologic reservoirs.

From *Oil and Gas Journal*. November 2022.

Pertamina, ExxonMobil to Develop CCS Technology in Indonesia.

Indonesia's state-owned PT Pertamina and ExxonMobil signed a Heads of Agreement (HOA) to develop CCS technology. The HOA is in line with a previous joint study that found up to 1 billion metric tons of CO_2 storage capacity in Pertamina's oil and gas fields. By strengthening their collaboration, Pertamina and ExxonMobil will finalize and prepare a commercial model design for the development of a regional CCS hub in the working area of PT Pertamina Hulu Energi, which is tasked with managing Pertamina's upstream oil and gas assets in the Kalimantan region.

From *S&P Global*. November 2022.

CCS Hub to Be Built in Saudi Arabia.

Saudi Aramco, SLB, and Linde signed a Joint Development Agreement to establish a CCS hub in Jubail on the east coast of Saudi Arabia. The hub will have the potential to store up to 9 million metric tons of CO_2 per year by 2027, according to company officials, with the goal of contributing to the kingdom's plans to capture 44 million metric tons by 2035.

From *Reuters*. November 2022.

Companies Agree to Promote CCUS Development.

GS Caltex signed an MOU with eight other companies to cooperate on and promote the development of CCUS. GS Caltex, an energy-producing company, will oversee defining the business extent of CCUS for each participating company.

From *Korea JoongAng Daily*. November 2022.

LEGISLATION AND POLICY

EU Invests ETS Revenue in Clean Tech Projects.

The European Commission launched its third call for large-scale projects under the European Union (EU) Innovation Fund with revenue from the EU Emissions Trading System (ETS). The call will fund projects covering general decarbonization, seeking those in renewable energy, energy-intensive industries, energy storage, or CCUS. The EU Innovation Fund is focused on the demonstration and commercialization of innovative low-carbon technologies.

From *Carbon Capture Journal*. November 2022.

EU Legislation to Expand National Carbon Sinks.

The European Parliament and European Council agreed on legislation that expands the EU's forests, marshes, and other natural carbon sinks, with the goal of raising its target for reducing net carbon emissions. The ***Land Use, Land-Use Change, and Forestry*** legislation sets regulations and binding targets for removing 310 million metric tons of CO_2-equivalent by 2030 through the use of soil, trees, plants, biomass, and timber. The law currently calls for EU countries to ensure they compensate emissions from land use and forestry with at least an equivalent amount of carbon removal. The new law will, from 2026, require the removal of CO_2 to exceed emissions.

From *Carbon Herald*. November 2022.

EMISSIONS TRADING

EU Reaches Deal on National CO_2 Reduction Targets.

The EU agreed to a law that sets national targets to reduce overall carbon emissions by the end of the decade. The legislation, called the Effort Sharing Regulation (ESR), sets national targets for emission reductions from road transport, domestic maritime transport, heating of buildings, agriculture, small industrial installations, and waste management—all included in the EU ETS. ESR is part of the overall EU plan to reduce net emissions by 55% from 1990 levels by 2030 and to achieve climate neutrality by 2050.

From *Reuters*. November 2022.

RGGI Auction Results Announced.

The states participating in the Regional Greenhouse Gas Initiative (RGGI) announced the results of the 58th RGGI auction of CO_2 allowances. A total of 22,233,203 CO_2 allowances were sold at a clearing price of $12.99 (bids ranged from $2.44 to $22.00 per allowance). None of the 11.61 million cost containment reserve (CCR) allowances made available were sold, nor were any of the 10.96 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 $13.91. The ECR is a designated quantity of allowances to be withheld if an auction's interim clearing price is below $6.42.) Additional details are available in the ***Market Monitor Report for Auction 58***.

From *RGGI Press Release*. December 2022.

SCIENCE

Australia, Google to Research Seagrass Mapping.

Google and the Australian government's Commonwealth Scientific and Industrial Research Organisation (CSIRO) and Department of Foreign Affairs and Trade are partnering to conduct coastal research for a blue carbon project in the Indo-Pacific that will inform climate-smart decision-making. Delivered through Australia's Science and Technology for Climate Partnership, the initiative aims to learn more about how seagrass ecosystems absorb and store CO_2. As part of the project, imagery of seagrass and marine fauna will be collected using machine learning so that researchers can map and model data and insights. Previously, researchers relied on manual image analysis based on data from remote geospatial and aerial sensing platforms to assess the carbon stored by coastal and marine areas.

From *The Mandarin*. November 2022.

Datasets Used to Estimate Wetland Soil Carbon Stock.

National-scale maps of carbon stored in wetland soil across interior and coastal settings were created from harmonized public datasets. The datasets represent a revised national-scale estimate of wetland soil carbon stock assessments by improving soil organic carbon densities. Scientists created 3-D maps of soil carbon stored across the conterminous United States in inland and tidal wetlands of the U.S. Geological Survey's National Land Cover Database and National Oceanic and Atmospheric Administration's Coastal Change Analysis Program. The resulting maps identify (1) wetland soil carbon storage at high resolution, (2) issues of spatial bias among approaches used for different public datasets, and (3) strategic approaches to improve the assessment of the vulnerability of wetland carbon storage. The approach provides more accurate estimates of carbon storage for national- and regional-scale computer models and can be applied to other wetland soil datasets by region, or updated as new data becomes available.

From *U.S. Geological Survey*. November 2022.

SCIENCE *(cont.)*

Greenland Investigating Geologic CO_2 Storage.

The government of Greenland is investigating whether the Greenlandic land, specifically the ground in Disko and Nuussuaq, can be used to store CO_2. Together with the Icelandic company Carbfic, the Greenlandic Ministry for Raw Materials has begun tests where they use old drill cores from oil exploration on the Nuussuaq peninsula. This process is called carbon capture mineralization storage and examines the extent to which drill cores from Nuussuaq can bind CO_2.

From *High North News*. November 2022.

PUBLICATIONS

Evaluating the Impacts of the Bipartisan Budget Act of 2018 45Q Tax Credit on CCS Network Costs.

The following is from the Executive Summary of this DOE/NETL document: "This study evaluates the impact of the Bipartisan Budget Act of 2018 (BBA)-amended 45Q tax credit on integrated carbon capture and storage (CCS) networks for source types and geologic storage reservoirs common to the north-central U.S. The integrated CCS networks evaluated were chosen to closely replicate those in the forthcoming National Energy Technology Laboratory (NETL) central U.S. CCS cost options study's Northwest CCS Network Regional Impact Area (Northwest Impact Area). The Northwest Impact Area covers portions of Montana, North Dakota, South Dakota, Nebraska, and Wyoming, and includes the Williston Basin, Wind River Basin, Powder River Basin, and Denver Basin. Each network includes a single CO_2 source, a dedicated pipeline transport component, and a single saline storage reservoir. CCS-related costs are estimated from the perspective of a source that is capturing CO_2 and paying fees for its transport and storage. The three CO_2 sources assessed include a cement plant in South Dakota that produces 0.99 million metric tons per annum (Mtpa) of Portland cement, and captures 0.97 Mtpa of CO_2, and two 650 megawatt (MW) supercritical pulverized coal (SCPC) plants that capture 4.33 Mtpa of CO_2 each; one is located in North Dakota and the other in Wyoming…"

NETL 45Q Addendum to the CO2U LCA Guidance Toolkit.

The following is from the Introduction of this DOE/NETL document: "26 CFR § 1.45Q-4 (hereby referred to as 45Q) requires a life cycle analysis (LCA) to be performed to document the amount of qualified carbon oxide for the utilization tax credit. Under the Internal Revenue Service's (IRS) regulations, LCAs must be prepared and documented in conformance with certain ISO standards. The Treasury Department and the IRS noted in its final rule that the Department of Energy (DOE) National Energy Technology Laboratory (NETL) CO_2 Utilization Guidance Toolkit is consistent with the ISO standards and directed taxpayers in the final rule to use such guidance when submitting LCAs under 45Q. This toolkit, which includes the Carbon Dioxide Utilization Life Cycle Analysis Guidance for the U.S. DOE Office of Fossil Energy and Carbon Management (hereby referred to as the NETL CO2U LCA Guidance Document), was originally written to guide projects in performing LCAs as part of their laboratory-funded project... The purpose of this addendum [is] to guide applicants on how to use the NETL CO2U LCA Guidance Document when preparing LCAs under 45Q. This document outlines requirements for conforming with the NETL CO2U LCA Guidance Document only. Requirements for qualifying for a tax credit under 45Q are contained in IRS's regulations at 26 CFR Part 1. All sections contained in this addendum are meant to serve as either direct replacement for the corresponding section in the toolkit or provide recommendations on how to use the section for the purposes of 45Q…"

Policy incentives for Greenhouse Gas Removal Techniques: the risks of premature inclusion in carbon markets and the need for a multi-pronged policy framework.

The following is from the abstract of this article: "Almost all modelled emissions scenarios consistent with the Paris Agreement's target of limiting global temperature increase to well below two degrees include the use of greenhouse gas removal (GGR) techniques. Despite the prevalence of GGR in Paris-consistent scenarios, and indeed the UK's own net-zero target, there is a paucity of regulatory support for emerging GGR techniques. However, the role of carbon pricing is one area that has experienced more attention than others, including discussion about the future inclusion of GGR in carbon markets. Here [the authors] identify three risks associated with using carbon markets as the sole, or main, policy lever to encourage the deployment of GGR techniques. [The authors'] categorization of risks stems from discussions with policymakers in the UK and a review of the broader literature on carbon markets and GGR. [The authors] present a three-pronged risk assessment framework to highlight the dangers in doing so. First, treating emissions removals and emissions reductions as entirely fungible allows for undesirable substitution. Second, carbon markets may provide insufficient demand pull to drive currently more-costly GGR techniques to deployment at commercial scales. Third, opening up a carbon market for potentially lower-cost GGR (such as nature-based solutions) too early could exert downward pressure on the overall market-based price of carbon, in the absence of adjustments to emissions caps or other safeguards…"

Joshua Burke and Ajay Gambhir, *Energy and Climate Change*. (Subscription may be required.)

PUBLICATIONS *(cont.)*

Hydromechanical impact of basement rock on injection-induced seismicity in Illinois Basin.

The following is from the abstract of this article: "The common explanation of observed injection-induced microseismicity is based on the measured stress state at the injection interval and the assumption that it remains the same in the vicinity. [The authors] argue here that representing the stress state in different geologic formations over the injection site with the single Mohr's circle is insufficient due to local stratigraphic features and contrast in compressibilities of the involved formations. The role of hydromechanical coupling in the microseismic response is also crucial for the proper assessment of the problem. Thoroughly monitored Illinois Basin Decatur Project revealed the majority of CO_2 injection-associated microseismic events being originated in the crystalline basement. Even though basement faults can serve as the conduits for fluid flow—the predicted pressure increase seems to be insufficient to trigger seismicity. To address this issue, accurate laboratory measurements of rock properties from the involved formations are conducted. The pre-injection stress state and its evolution are evaluated with the hydromechanically coupled numerical model. It appears that the presence of an offset in a stiff competent layer affects the stress state in its vicinity. Therefore, both the pre-injection stress state and its evolution during the fluid injection should be addressed during the induced seismicity assessment."

Nikita Bondarenko, Yury Podladchikov, and Roman Makhnenko, *Nature*. (Subscription may be required.)

CO_2 zonal injection rate allocation and plume extent evaluation through wellbore temperature analysis.

The following is from the abstract of this article: "Temperature analysis during a pause in injection operations, known as warmback analysis, has been used in the petroleum industry for evaluating the injection conformance and estimating the location of the flooded front in applications, such as waterflooding oil reservoirs. In this work, methods are introduced to extend the application of temperature warmback analysis to estimate the zonal CO_2 injection rate and zonal CO_2 plume extent during geologic CO_2 storage in a saline aquifer. First, novel analytical solutions are developed to model transient temperature in the aquifer during the injection and subsequent shut-in periods considering two-phase flow (gaseous CO_2 and aqueous brine) conditions in the aquifer. The solution involves a discretization of the aquifer into regions; the energy and mass conservation equations for the regions are solved simultaneously considering appropriate boundary conditions at the interfaces. Two solutions techniques are presented: multi-region and three-region solutions. Inverse models are developed accordingly to evaluate the injection profile and estimate the extent of the plume front in the reservoir during the injection period. The multi-region solution results in an inversion approach that requires regression analysis. However, the three-region formulation results in a simple graphical technique for inverse modeling. The analytical solutions are validated against a thermally coupled reservoir simulation tool using different synthetic cases for CO_2 injection in deep saline aquifers. The results of the developed solutions provide a good match with numerical results during forward and inverse modeling."

Refaat G. Hashish and Mehdi Zeidouni, *Advances in Water Resources*. (Subscription may be required.)

Integration of energy storage systems based on transcritical CO_2: Concept of CO_2 based electrothermal energy and geological storage.

The following is from the abstract of this article: "Energy storage systems are crucial for the massive deployment of renewable energy at a large scale. This paper presents a conceptual large-scale thermoelectrical energy storage system based on a transcritical CO_2 cycle. The concept is developed through the analysis of three high-efficiency systems: renewable energy storage using a thermoelectric energy storage system based on a reversible heat pump; a CO_2 storage system; and novel integration of energy storage using a reversible heat pump and geological injection of CO_2. The latter system efficiently integrates energy and CO_2 storage, taking advantage of the synergies between the operational requirements of both systems. The system uses CO_2 captured in stationary sources as a working fluid to store energy from renewables. The energy is stored and recovered in geological formation and heat/cold tanks, with energy storage based on sensible or latent heat of ice and water. A fraction of the CO_2 is expected to be permanently sequestered in the geological formation. The analysis of the time evolution of the system, under different operation profiles, shows the interest of the concept as a feasible integration for energy storage and CO_2 capture based on renewable energy, with an electric-to-electric efficiency varying between 40 and 50 %."

A. Carro, R. Chacartegui, C. Ortiz, J. Carneiro, and J.A. Becerra, *Energy*. (Subscription may be required.)

Carbon Emission Trading Scheme in the shipping sector: Drivers, challenges, and impacts.

The following is from the abstract of this article: "The aim of this study is to review, identify and synthesize the drivers, challenges and impacts of implementing a Carbon ETS in the shipping sector. PRISMA is adopted to review relevant articles selected from Scopus and Web of Science databases. The review uncovers three categories of drivers, seven categories of challenges, and two categories of impacts. The drivers are (1) limitations of existing technical and operational solutions; (2) promise of market-based solutions; and (3) attitudes of stakeholders. Challenges are about (1) geographical coverage; (2) sectoral coverage; (3) free emissions quota percentage and the carbon trading price; (4) conflict between common but differentiated responsibilities and equal treatment; (5) management difficulties; (6) jurisdiction under international law; and (7) opposition from the shipping sector. Impacts are (1) environmental and economic impacts and (2) optimal abatement strategy. This study offers some implications and recommendations for relevant stakeholders on implementing carbon ETS."

Min Wu, Kevin X. Li, Yi Xiao, and Kum Fai Yuen, *Marine Policy*. (Subscription may be required.)

PUBLICATIONS *(cont.)*

Print media representations of carbon capture utilization and storage (CCUS) technology in China.

The following is from the abstract of this article: "Carbon Capture Utilization and Storage (CCUS) technology is an essential component to decarbonize society and reach carbon neutrality. Its success depends on not only technological advances but also people's reaction to it. This study applied traditional content analysis to uncover the CCUS reporting landscape and employed the Socio-Political Evaluation of Energy Deployment (SPEED) framework to explore how different aspects of the CCUS value chain were discussed in Chinese newspapers. A total of 492 news items from November 21st 2002 to May 8th 2021 were identified and analyzed. Results showed that news coverage of CCUS technology in China started in 2005. The media explained the nature and sources of carbon dioxide (CO_2), framed CCUS by various terms, for example, 'greengen' and 'a clean energy technology', as well as demonstrated various tones in CCUS. The analysis found 71.3% (N = 351) of newsletters took an affirmative stance towards CCUS. It was also revealed that environmental frames appeared in almost every article, while much less attention was paid to other issues. Moreover, this research demonstrated that CCUS-related policies were driving media coverage closely year by year. However, current news presentations were inadequate due to technical misperceptions and a lack of comprehensive coverage. Therefore, this research proposed a science-for-the-community communication strategy that involved several key factors such as policy guidance, newspaper functions at different levels, journalist training, direct engagement of the public as well as student education."

Kai Jiang, Peta Ashworth, Shiyi Zhang, and Guoping Hu, *Renewable and Sustainable Energy Reviews*. (Subscription may be required.)

CO_2 Pipeline risk assessment and comparison for the midcontinent United States.

The following is from the abstract of this article: "A comprehensive quantitative risk assessment for the construction and operation of CO_2 transportation networks considered for the Midcontinent United States was conducted. The results showed risks associated with CO_2 pipelines were significantly less than those of other pipeline types. The assessment used four conceptual pipelines of different lengths to discuss risks operators may see. The assessment evaluated the risk associated with construction and operation using data from the US Occupational Safety Health Administration to determine the risk of injury or death for pipeline workers and data from the US Pipeline and Hazardous Materials Safety Administration for CO_2, natural gas distribution, natural gas transmission/gathering, and non-CO_2 hazardous liquid pipelines to develop quantitative likelihood and severity values leading to risk values. The data for the assessment covered incidents from 2010 to 2017 for CO_2 pipelines. The average risk for construction and 30 years of operation for four CO_2 pipeline configurations ranging between 79 and 1,546 miles in length was found. The construction and operational risk averaged between $1,400,521 (approximately $0.02/tonne of CO_2) for the shorter pipeline (79 miles) and $27,481,939 (approximately $0.10/tonne of CO_2) for a longer pipeline (1,546 miles). The largest risks of fatality for CO_2 pipelines comes from vehicle transport. The largest operational risk to the pipeline was due to leakage. Public pipeline opposition is also a significant risk; it was not quantified but is addressed."

Andrew Duguid, Jared Hawkins, and Laura Keister, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

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***.

Get Social with Us

There are several ways to join the conversation and connect with NETL's Carbon Transport and Storage Program:

Disclaimer

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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