CSN CARBON STORAGE NEWSLETTER

AUGUST 2016

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

CARBON STORAGE PROGRAM DOCUMENTS and REFERENCE MATERIALS

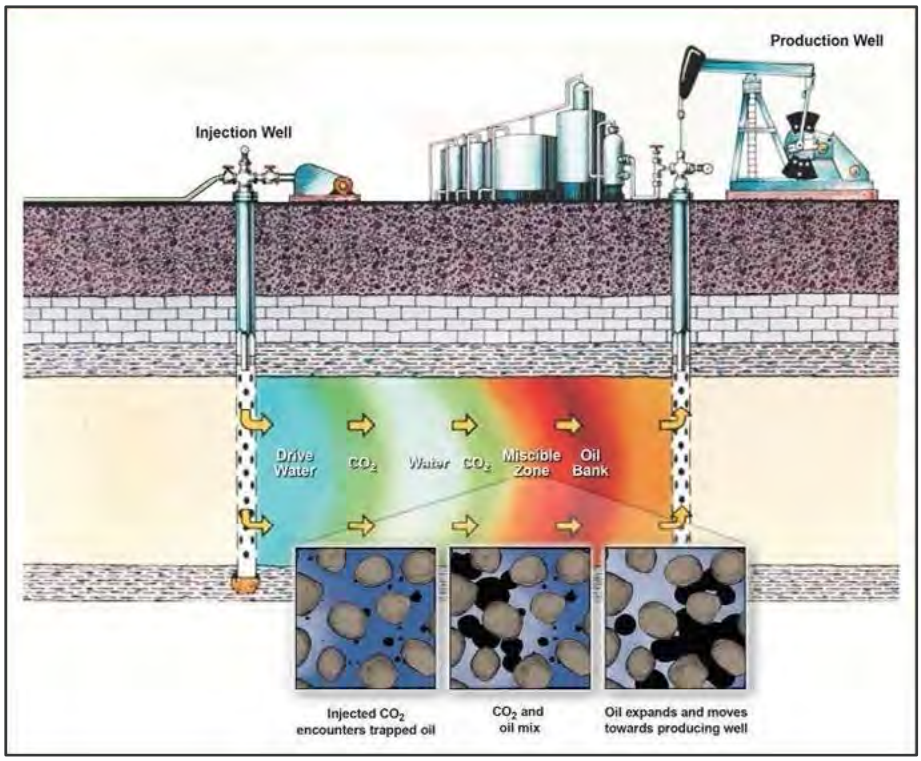
DOE/NETL HIGHLIGHTS

DOE Investing $11.5 Million to Advance Geologic Carbon Storage and Geothermal Exploration."

The U.S. Department of Energy (DOE) selected eight new research and development (R&D) projects to receive Federal funding under its *Subsurface Technology and Engineering Research, Development, and Demonstration (SubTER)* Crosscut initiative. The projects, which will be funded by the *Office of Fossil Energy's (FE)* Carbon Storage Program and the *Office of Energy Efficiency and Renewable Energy's (EERE)* Geothermal Technologies Office (GTO), will address two objectives. Projects selected under the first objective – to deploy and validate prototype carbon storage monitoring, verification, and accounting (MVA) technologies in an operational field environment – will deploy technologies or techniques associated with near-surface and/or subsurface monitoring at a large- or commercial-scale site for validation. Projects selected under the second objective – to identify and validate new subsurface signals to characterize and image the subsurface – will develop new approaches to characterize and image subsurface systems. From *energy.gov* on July 27, 2016.

"Texas CO_2 Capture Demonstration Project Hits Three Million Metric Ton Milestone."

A carbon capture and storage (CCS) project sponsored by DOE and managed by the National Energy Technology Laboratory (NETL) has successfully captured and transported 3 million metric tons of carbon dioxide (CO_2) via pipeline. The project demonstrates the implementation of Air Products and Chemicals, Inc.'s *vacuum swing adsorption* technology into a hydrogen production facility in Port Arthur, Texas, USA. The gas separation technology captures 90 percent of the CO_2 from the product streams of two commercial-scale steam methane reformers. In addition, the project verifies the effective use of CO_2 enhanced oil recovery (EOR) for permanently storing CO_2, as the CO_2 captured from the Port Arthur facility is being used for EOR at the West Hastings Unit (oilfield) in southeast Texas, USA. The West Hastings Unit is estimated to have the potential to produce in the range of 60 to 90 million additional barrels of oil using CO_2 injection. The Air Products project is supported through DOE's *Industrial Carbon Capture and Storage (ICCS)* Program. From *energy.gov* on June 30, 2016.



Enhanced Oil Recovery Process

ANNOUNCEMENTS

NETL Technologies Named Finalists for Awards.

The Carbon Capture Simulation Initiative (CCSI) Toolset was one of four NETL-developed technologies named finalists for this year's R&D 100 Awards, presented annually by R&D Magazine in recognition of the top technologies and services across multiple categories. The CCSI Toolset is a suite of computational tools and models tailored to help maximize learning and reduce potential risk during scale-up of carbon capture technologies.

NETL Releases CCS Education Videos.

NETL released two educational videos on the safe and permanent storage of CO_2. The *first video* describes the National Risk Assessment Partnership (NRAP), an NETL-led initiative within DOE's FE that applies science-based prediction for engineered-natural systems to the long-term storage of CO_2. The *second video* discusses NETL's advances and innovation in cost-effective and safe CCS strategies.

DOE Announces Funding to Advance Safe and Permanent Storage of CO_2.

DOE announced funding for cost-shared R&D projects focused on the safe and permanent storage of CO_2 during CCS operations. The Carbon Storage Assurance and Facility Enterprise (CarbonSAFE) initiative is intended to develop integrated CCS storage complexes, which will be constructed and permitted for operation in the 2025 timeframe following a series of developmental phases.

DOE Awards Funding to Small Businesses for Fossil Energy Research and Technology Transfer.

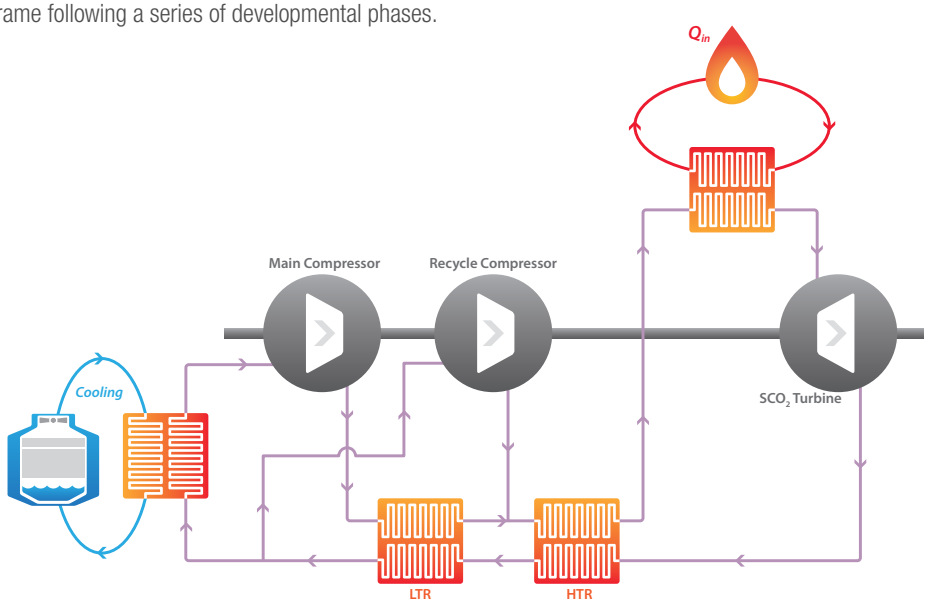
DOE selected 10 research projects to be funded under the *Small Business Innovative Research (SBIR) and Small Business Technology Transfer (STTR) Programs* through DOE's Office of Science. Of the 10 selected projects, 8 were made under Topic Area 1: Clean Coal and Carbon Management, and include key R&D programs, such as carbon storage technologies in the area of wellbore release pathway detection techniques.

DOE to Invest in Advanced Turbine and Supercritical CO_2-Based Power Cycles.

DOE's NETL selected six Phase II projects to further develop innovative technologies for advanced gas turbine components and supercritical carbon dioxide (sCO_2) power cycles.

PTRC and CO2CRC Agree to Collaborate on Carbon Management.

The Petroleum Technology Research Center (PTRC) and the CO_2 Commonwealth Research Center (CO2CRC) signed a Memorandum of Understanding (MOU) on Aquistore, an integrated CO_2 storage project associated with an industrial-scale coal-fired power plant. The MOU represents efforts to prepare and execute joint research; facilitate the exchange of scientists and technical personnel; and encourage dedicated CO_2 storage on regional, national, and international scales.



Closed Loop SCO_2 Recompression Brayton Cycle Flow Diagram

PROJECT and BUSINESS DEVELOPMENTS

"Carbon Capture and Storage Pilot Planned for Rotterdam."

Approximately 1 million metric tons of CO_2 will be captured at a coal-fired power station and injected into a gas field in the North Sea as part of a planned pilot project to be held in Rotterdam, Netherlands. An investment decision is expected by early next year. Once infrastructure is in place, the pilot project, called "ROAD," will operate for a three-year trial period. From *Digital Energy* on July 22, 2016.

"Scientists in Scotland Receive Funding for Offshore Carbon Dioxide Storage Investigation."

Scientists from the University of Strathclyde in Scotland have received funding from the United Kingdom's Natural Environment Research Council (NERC) for a four-year study of CO_2 storage solutions. The project, titled "Migration of CO_2 through North Sea Geological Carbon Storage Sites: Impact of Faults, Geological Heterogeneities and Dissolution," will explore the ability of complex rock strata beneath the North Sea to safely store CO_2 emissions. Specifically, the initiative will study how injected CO_2 could potentially migrate through overlying layers of underground rocks, while also examining the interaction of embedded faults and rock tiers with CO_2 flow. From *Gas World* on July 6, 2016.

LEGISLATION and POLICY

"EU Commission Proposes Emissions Cuts for Member States."

The European Commission has proposed country-specific emissions targets in a proposal known as the *Effort Sharing Regulation*. The proposal, which clarifies roles in helping the European Union (EU) reach a 40 percent reduction in greenhouse gas (GHG) emissions by 2030 compared to 1990 levels, targets sectors not included in the European Union Emissions Trading System (EU ETS). In addition, the proposal includes requirements for member states to report on their progress toward meeting goals, as well as sets annual interim targets from 2021 to 2030. The Effort Sharing Regulation builds upon the *Effort Sharing Decision*, which is the emissions roadmap for 2013 to 2020. From *International Centre for Trade and Sustainable Development* on July 28, 2016.

"[Senators] Introduce Bill to Support Carbon Capture Utilization [and] Storage."

Two U.S. Senators introduced a bill to incentivize development and use of carbon capture, utilization, and storage (CCUS) technologies and processes. The bill would promote carbon capture technologies by extending the 45Q tax credit, which encourages investment in carbon capture, utilization, and storage. In addition, the bill would also utilize the credit system to encourage innovation and the use of CO_2 in EOR. For more information, refer to the *press release*, or read the bill, titled "*Carbon Capture and Utilization Act of 2016*." From *U.S. Senator Heidi Heitkamp Press Release* on July 13, 2016.

EMISSIONS TRADING

"[RGGI States Initiate Auction Process for Auction 33]."

The states participating in the *Regional Greenhouse Gas Initiative (RGGI)* released the Auction Notice and application materials for their third-party quarterly CO_2 allowance auction. The CO_2 Allowance Auction 33 Auction Notice provides potential auction participants with the information needed to submit a Qualification Application and indicate their intent to bid. Auction 33, scheduled for September 7, 2016, will offer 14,911,315 CO_2 allowances for sale at a reserve price of $2.10. In addition, a 10 million CO_2 allowance cost containment reserve (CCR) is available for this auction, which will be accessed if the interim clearing price exceeds the CCR trigger price of $8.00. From *Regional Greenhouse Gas Initiative* on July 11, 2016.

CLIMATE and SCIENCE NEWS

"CO_2 Fingerprint Discovery Enables Safe Storage of Greenhouse Gas."

Researchers from the University of Edinburgh found that CO_2 captured from power stations and industrial sites has a distinct chemical fingerprint that allows it to be distinguished from other CO_2 present near storage sites. The fingerprint, which is dependent on the fuel producing the gas and the technology being used for its capture, may aid in the storage and monitoring of underground CO_2. By comparing the chemical fingerprints in the captured CO_2 with those in geologic storage reservoirs and drinking water formations, the research shows that the fingerprints can be easily identified and distinguished from natural sources of CO_2. The study, titled *"Inherent Tracers for Carbon Capture and Storage in Sedimentary Formations: Composition and Applications,"* was published in the journal *Environmental Science and Technology*. From *Scottish Carbon Capture and Storage News Release* on July 25, 2016.

"Polar Ice Reveals Secrets of Carbon-Climate Feedbacks."

A team of international researchers has quantified the relationship of the Earth's land biosphere to changes in temperature, as well as how it affects the cycles of carbon between land, ocean, and the atmosphere. Published in the journal *Nature Geoscience*, the paper shows that the Earth's land biosphere takes up less carbon in a warmer climate. Scientists used air bubbles in polar ice from pre-industrial times, focusing on CO_2 changes preserved in ice before, during, and after the Little Ice Age. The study, titled *"Low atmospheric CO_2 levels during the Little Ice Age due to cooling-induced terrestrial uptake,"* showed that for every degree Celsius of global temperature rise, the equivalent of 20 parts per million (ppm) less CO_2 is stored by the land biosphere. From *Phys.org* on July 26, 2016.

"Scientists Convert Carbon Dioxide, Create Electricity."

Cornell University researchers have created an oxygen-assisted aluminum/CO_2 power cell capable of storing CO_2 while producing electrical energy. The proposed power cell would use aluminum as the anode and mixed streams of CO_2 and oxygen as the active ingredients of the cathode. The electrochemical reactions between the anode and the cathode would store the CO_2 while also producing electricity and an oxalate byproduct. The researchers' findings are detailed in a paper, titled *"The O_2-assisted Al/CO_2 electrochemical cell: A system for CO_2 capture/conversion and electric power generation,"* published in the journal *Science Advances*. From *ScienceDaily* on August 4, 2016.

JOURNAL ARTICLES

"The effects of fiscal policy on CO_2 emissions: Evidence from the U.S.A."

The following is from the Abstract of this article: "This paper examines the effects of fiscal policy on CO_2 emissions using Vector Autoregressions on U.S. quarterly data from 1973 to 2013. In particular, [the authors] analyze the short- and mid-term interactions between fiscal policy and emissions by using sign restrictions to identify the policy shocks. [The authors] construct the impulse responses to linear combinations of fiscal shocks, corresponding to the scenarios of deficit-financed spending and deficit-financed tax-cuts. To consider possible variations of the effect of fiscal policy, [the authors] distinguish between production- and consumption-generated CO_2 emissions. The results point out that the implementation of expansionary fiscal spending provides an alleviating effect on emissions, whereas deficit-financed tax-cuts are associated with an increase on consumption-generated CO_2 emissions. The exact pattern of the effects depends on the source of emissions, the scenario of fiscal policy that is implemented and the functional class of government expenditure being increased." **George E. Halkos and Epameinondas A. Paizanos**, *Energy Policy*. (Subscription may be required.)

"Heletz experimental site overview, characterization and data analysis for CO_2 injection and geological storage."

The following is the Abstract of this article: "This paper provides an overview of the site characterization work at the Heletz site, in preparation to scientifically motivated CO_2 injection experiments. The outcomes are geological and hydrogeological models with associated medium properties and baseline conditions. The work has consisted on first re-analyzing the existing data base from ~40 wells from the previous oil exploration studies, based on which a 3-dimensional structural model was constructed along with first estimates of the properties. The CO_2 injection site is located on the saline edges of the Heletz depleted oil field. Two new deep (>1600 m) wells were drilled within the injection site and from these wells a detailed characterization program was carried out, including coring, core analyses, fluid sampling, geophysical logging, seismic survey, in situ hydraulic testing and measurement of the baseline pressure and temperature. The results are presented and discussed in terms of characteristics of the reservoir and [caprock], the mineralogy, water composition and other baseline conditions, porosity, permeability, capillary pressure and relative permeability. Special emphasis is given to petrophysical properties of the reservoir and the seal, such as comparing the estimates determined by different methods, looking at their geostatistical distributions as well as changes in them when exposed to CO_2." **Auli Niemi, Jacob Bensabat, Vladimir Shtivelman, Katriona Edlmann, Philippe Gouze, Linda Luquot, Ferdinand Hingerl, Sally M. Benson, Philippe A. Pezard, Kristina Rasmusson, Tian Liang, Fritjof Fagerlund, Michael Gendler, Igor Goldberg, Alexandru Tatomir, Torsten Lange, Martin Sauter, and Barry Freifeld**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

"Geochemical impact of O_2 impurity in CO_2 stream on carbonate carbon-storage reservoirs."

The following is the Abstract of this article: "Carbon capture and storage (CCS) is regarded as an effective, large-scale mitigation technology for reducing CO_2 atmospheric emissions from the use of fossil fuels. One of the major barriers for widespread deployment of the technology is the high cost of CO_2 capture from the flue gas of fossil-fuel power plants and other industrial emitters. In general, the purer the desired captured CO_2 stream, the more expensive the capture process. Coinjecting some of these impurities with CO_2 can reduce the operational cost of CCS. Potential detrimental effects, if any, of impurities on storage formations need to be identified and evaluated. Previous studies on the effects of impurities have focused on sandstone reservoir rocks and mudstone caprock, but little work has been done to evaluate potential impacts on carbonate reservoirs, which are major storage candidates. [The authors] conducted a series of autoclave experiments on Redwater Leduc limestone (Alberta, Canada) and SACROC dolostone (Texas, United States) to investigate the effect of O_2 impurity on CO_2–brine–rock interactions. A total of eight reaction experiments were conducted with or without O_2 for ~3 weeks each at 200 bar and 70°C or 100°C. Chemical analyses of the reaction fluids show that carbonate dissolution is the major mineral reaction caused by injection of CO_2. The addition of 3.5 [percent] O_2 had no significant impact on the limestone, whereas it led to precipitation of iron hydroxides in dolostone experiments that contained ankerite and a small amount of siderite. Porosity and permeability increased when CO_2 was added, but the addition of O_2 did not lead to notable changes. The results suggest that the addition of O_2 impurity into the CO_2 stream will not cause significant damage to carbonate formations, which potentially allows significant cost reduction by retaining a small O_2 content in the injection gas stream." **Jiemin Lu, Patrick J. Mickler, Jean-Philippe Nicot, Changbing Yang, and Roxana Darvari**, *International Journal of Greenhouse Gas Control*. (Subscription may be required.)

"CO_2 huff and puff for heavy oil recovery after primary production."

The following is the Abstract of this article: "In this study, micromodel tests were performed to investigate the microscopic flow behavior during primary production and the subsequent CO_2 huff and puff. A series of 12 tests was conducted in sandpacks to evaluate the effects of the injection and production parameters on the displacement efficiency of the CO_2 huff and puff. The micromodel tests and sandpack tests showed that the flow characteristics of CO_2 huff-and-puff process was significantly affected by the pressure of converting the solution gas drive to the subsequent CO_2 huff and puff. A foamy oil flow could be more easily formed in the production period of the CO_2 huff and puff with a higher conversion pressure. Foamy oil can reduce the mobility of gas and provide tremendous energy to the system, thereby improving the performance of the CO_2 huff and puff. The sandpack flood results show that the oil recovery of the solution gas drive decreased as the conversion pressure increased, whereas the oil recovery of the CO_2 huff and puff increased as the conversion pressure increased. The highest total oil recovery was obtained at the pseudo-bubblepoint pressure. The oil recovery of the CO_2 huff and puff increased as the CO_2 injection pressure and pressure decline rate increased. The oil recovery of CO_2 huff and puff increased with the soaking time, and it exhibits a significant change when the soaking time ranges from 10 h to 24 h; above this value, the increase become slight." **Teng Lu, Zhaomin Li, Weiyu Fan, and Songyan Li**, *Greenhouse Gas Sci Technol*. (Subscription may be required.)

JOURNAL ARTICLES *(cont.)*

"Integration of reservoir simulation, history matching, and 4D seismic for CO_2-EOR and storage at Cranfield, Mississippi, USA."

The following is the Abstract of this article: "In this paper, [the authors] compare 4D seismic interpretations of CO_2 plume evolution with fluid-flow numerical simulation results for Cranfield, Mississippi. Historic pressure trends, oil and gas production rates, and current CO_2-EOR production data from the field were history matched, and a tuned model was used for predictive simulations. For CO_2-EOR operations, numerical simulation results of the CO_2 plume distribution and CO_2 first arrival (breakthrough) times in production wells were compared to the available field data. Three interpretations of 4D seismic data show discrepancies on the edges of the seismic survey, and along the sealing fault, where numerical simulations show high CO_2 saturations. In areas between these two limits, the match between simulation and 4D seismic interpretation improves. In addition, for most of the production wells, comparison of the breakthrough time of CO_2 showed a reasonable match. The tuned model was then used to predict reservoir response and storage capacity in different field development scenarios under CO_2 injection. [The authors] compared hypothetical scenarios where the operator transitions from CO_2-EOR to CO_2 injection without oil production (CO_2-EORT) when oil production is not economical anymore, to a scenario of continuing with CO_2-EOR. [The authors'] results show that CO_2-EOR can store more CO_2 and operations will last longer, whereas if switched to CO_2-EORT, the field must be abandoned earlier because of spillover of the CO_2 plume. However, the amount of CO_2 stored per year is larger for CO_2-EORT as compared to CO_2-EOR." **Masoud Alfi and Seyyed A. Hosseini**, *Fuel*. (Subscription may be required.)

"Design of CO_2 Injection Pilot in Offshore Middle East Carbonate Reservoir."

The following is the Abstract of this article: "Carbon dioxide injection is considered to be a viable option for EOR and has already been implemented commercially for more than 40 years. However, the applications are limited to onshore and offshore application for EOR activities have not yet been implemented. This paper presents the subsurface evaluation using laboratory experiments (PVT and corefloods) and compositional modeling, the design and surveillance program of a CO_2 pilot project planned in a carbonate reservoir located offshore Abu Dhabi. PVT and coreflood experiments demonstrate the local displacement efficiency of CO_2 in tertiary mode due to gas-oil miscibility, swelling of oil and reduction in oil viscosity. The screening study performed using a tuned equation of state (EOS) predicts significant additional recovery in a previously waterflooded area. A pilot is planned in one of the reservoirs of the field, which has 40 years of peripheral seawater injection history. The pilot design is influenced by existing peripheral pressure gradient, and is located down-dip in the field that covers approximately 80 acres. The pilot location is selected based on geology, reservoir quality, maturity to waterflood and surface facility constraints. A comprehensive reservoir surveillance plan, including one to two observers well, is developed to monitor pilot performance. The planned pilot will reduce uncertainties and risk associated with CO_2 injection and address bottleneck uncertainties in an offshore environment before large-scale application. The first offshore CO_2 injection pilot is designed for implementation in a tertiary mode in a giant carbonate field, which is still under secondary recovery production, to minimize interaction with current production and impact on surface facility. The paper also presents the possible mitigation for various challenges identified like asphaltene, scaling, corrosion, impact on existing carbon steel well completion, etc. associated with CO_2 injection. The methodology and technical analysis used to evaluate and design the CO_2 pilot are applicable to other potential fields in the region." **Jitendra Kumar, Elyes Draoui, and Satoru Takahashi**, *Society of Petroleum Engineers*. (Subscription may be required.)

"Spatio-Temporal Variation and Impact Factors for Vegetation Carbon Sequestration and Oxygen Production Based on Rocky Desertification Control in the Karst Region of Southwest China."

The following is the Abstract of this article: "The Grain to Green Program (GTGP) and eco-environmental emigration have been employed to alleviate poverty and control rocky desertification in the Southwest China Karst region. Carbon [storage] and oxygen production (CSOP) is used to indicate major ecological changes, because they involve complex processes of material circulation and energy flow. Using remote sensing images and weather records, the spatio-temporal variation of CSOP was analyzed in a typical karst region of northwest Guangxi, China, during 2000–2010 to determine the effects of the Chinese government's ecological rehabilitation initiatives implemented in 1999. An increase with substantial annual change and a significant increase (20.94 [percent], $p < 0.05$) in variation were found from 2000 to 2010. CSOP had a highly clustered distribution in 2010 and was correlated with precipitation and temperature (9.18 [percent] and 8.96 [percent], respectively, $p < 0.05$). CSOP was significantly suppressed by human activities ($p < 0.01$, $r = -0.102$) but was consistent with the intensity of GTGP (43.80 [percent] positive). The power spectrum of CSOP was consistent with that of the gross domestic product. These results indicate that ecological services were improved by rocky desertification control in a typical karst region. The results may provide information to evaluate the efficiency of ecological reconstruction projects." **Mingyang Zhang, Kelin Wang, Huiyu Liu, Jing Wang, Chunhua Zhang, Yuemin Yue, and Xiangkun Qi**, *Remote Sensing*. (Subscription may be required.)

"Limited trading of emissions permits as a climate cooperation mechanism? US–China and EU–China examples."

The following is the Abstract of this article: "Recent multilateral climate negotiations have underlined the importance of international cooperation and the need for support from developed to developing countries to address climate change. This raises the question of whether carbon market linkages could be used as a cooperation mechanism. Policy discussions surrounding such linkages have indicated that, should they operate, a limit would be set on the amount of carbon permits that could be imported by developed regions from developing countries. This paper analyzes the impact of limited carbon trading between an ETS in the EU or the US and a carbon market covering Chinese electricity and energy intensive sectors using a global economy-wide model. [The authors] find that the limit results in different carbon prices between China and Europe or the US. Although the impact on low-carbon technologies in China is moderate, global emission reductions are deeper than in the absence of international trading due to reduced carbon [release]. If China captures the rents associated with limited permit trading, [the authors] show that it is possible to find a limit threshold that makes both regions better off relative to carbon markets operating in isolation." **Claire Gavard, Niven Winchester, and Sergey Paltsev**, *Energy Economics*. (Subscription may be required.)

REPORTS and PUBLICATIONS

"Carbon Dioxide Incubator Market - Global Trends, Market Share, Industry Size, Growth, Opportunities, and Market Forecast - 2015 – 2022."

The following is a description of this document: "Research Corridor recently added new report titled 'Carbon Dioxide Incubator Market - Global Trends, Market Share, Industry Size, Growth, Opportunities, and Market Forecast - 2015 – 2022' to its repertoire. This latest industry research study scrutinizes the Carbon Dioxide Incubator market by different segments, companies, regions and countries over the forecast period 2015 to 2022. The report titled 'Carbon Dioxide Incubator Market - Global Trends, Market Share, Industry Size, Growth, Opportunities, and Market Forecast - 2015 – 2022' offers a primary overview of the Carbon Dioxide Incubator industry covering different product definitions, classifications, and participants in the industry chain structure. The quantitative and qualitative analysis is provided for the global Carbon Dioxide Incubator market considering competitive landscape, development trends, and key critical success factors (CSFs) prevailing in the Carbon Dioxide Incubator industry."

"Developing the Public Engagement Strategy for the Guangdong CCUS Demonstration Program."

The following is from the Introduction of this document: "The China Resources Power (Haifeng) and China National Offshore Oil Corporation (CNOOC) Integrated Carbon Capture and Sequestration Demonstration Project (CRP Power Project) and the UK-China (Guangdong) CCUS Centre are committed to understanding and implementing CCS public engagement best practice throughout the lifecycle of the CRP Power Project as well as sharing the experience with the wider CCS community. This report presents an analysis of work undertaken by the CRP Power Project and the UK-China (Guangdong) CCUS Centre which will help guide the project's future work program. It may also be useful to other CCS project proponents in China who are considering the development of a public engagement strategy. This undertaking is the first of its kind in China and is an ongoing process. To date, the majority of CCS public engagement project case studies have [analyzed] activity that has taken place in Europe, North America and Australia. An important next step is to reflect on how current best practice may apply in other regional contexts. The UK-China (Guangdong) CCUS Centre is actively investigating this topic and this report seeks to capture the processes and analysis that have occurred so far."

"Approaches to Address Potential CO_2 Emissions [Release] to New Sources under the Clean Power Plan."

The following is from the Introduction and Summary of this document: "To guide state implementation of the Clean Power Plan, [the U.S. Environmental Protection Agency (EPA)] has proposed a model rule for states that regulates only existing affected generating units on a mass basis. The model rule also is expected to form the basis for a [Federal] plan. The model rule, when finalized, would be presumptively approvable for states. [The authors'] comments are presented as 10 recommendations that are organized in three groups: [(1) Allowance Allocation; (2) Requirements for State Compliance Plans; and (3) EPA Implementation of the Clean Power Plan. The authors'] summarize the recommendations in this introduction. [The authors'] comments focus on the emissions outcome that can be achieved under the mass-based proposed model rule and the cost of achieving those emissions reductions. A state's choosing an emissions cap that covers only existing sources raises generation costs relative to costs of new sources that are excluded from the cap. This may cause generation to shift from existing to new sources with an associated increase in emissions outside the emissions cap. This emissions [release] can be reduced by lowering the costs for existing sources so they are more competitive with new sources. Greater utilization of existing sources will reduce the use of new sources and help reduce [release]."

"Effective enforcement of underground storage of carbon dioxide."

The following is from the Executive Summary of this Global CCS Institute Document: "The perception of an effective enforcement regime that ensures the secure and safe storage of CO_2 in underground geologic formations will be crucial in increasing public and industry confidence in CCS as a viable low-carbon technology. An effective enforcement regime for underground storage of CO_2 has the following key features: [1] comprehensive obligations that address the key risks of underground storage of CO_2; [2] comprehensive monitoring and verification (M&V) requirements, including baseline monitoring, M&V obligations during the injection phase and M&V obligations post-injection; [3] enforcement mechanisms that are risk-based, layered and flexible, grounded in science and fact-based decision-making, and include the ability to deal with 'serious situations' (such as unintended releases and CO_2 not behaving as predicted); and [4] a clear allocation of roles and responsibilities for enforcement."

ABOUT DOE'S CARBON STORAGE PROGRAM

The **Carbon Storage Program** advances the development and validation of technologies that enable safe, cost-effective, permanent geologic storage of CO_2. The Carbon Storage Program also supports the development of best practices for CCS that will benefit projects implementing CCS at a commercial scale, such as those being performed under NETL's Clean Coal Power Initiative and Industrial Carbon Capture and Storage Programs. The technologies being developed and the small- and large-scale injection projects conducted through this program will be used to benefit the existing and future fleet of fossil fuel power-generating facilities by developing tools to increase our understanding of the behavior of CO_2 in the subsurface and identifying the geologic reservoirs appropriate for CO_2 storage.

The *Carbon 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 Storage Program Resources

The *National Energy Technology Laboratory's CCS Database* includes active, proposed, and terminated CCS projects worldwide. The information is taken from publically available sources to provide convenient access to information regarding efforts by various industries, public groups, and governments towards development and eventual deployment of CCS technology. NETL's CCS Database is available as a Microsoft Excel spreadsheet and also as a customizable layer in Google Earth.

Newsletters, program fact sheets, best practices manuals, roadmaps, educational resources, presentations, and more are available via the *Carbon Storage Program Publications webpage*.

Get answers to your carbon capture and storage questions at NETL's *Frequently Asked Questions webpage*.

ABOUT NETL'S CARBON STORAGE NEWSLETTER

Compiled by the National Energy Technology Laboratory, this newsletter is a monthly summary of public and private sector carbon storage news from around the world. The article titles are links to the full text for those who would like to read more.

National Energy Technology Laboratory

The *National Energy Technology Laboratory (NETL)*, part of DOE's national laboratory system, is owned and operated by the U.S. Department of Energy (DOE). NETL supports DOE's mission to advance the national, economic, and energy security of the United States.

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880

13131 Dairy Ashford Road, Suite 225
Sugar Land, TX 77478

420 L Street, Suite 305
Anchorage, AK 99501

1450 Queen Avenue SW
Albany, OR 97321-2198

Contacts

Traci Rodosta
304-285-1345
traci.rodosta@netl.doe.gov

Get Social with Us

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

Facebook
Twitter
Instagram
YouTube
LinkedIn
RSS Feed
Flickr

Disclaimer