NETL the ENERGY lab
Office of Fossil Energy

Carbon Sequestration Newsletter

A Call for Papers
see page 3

November 2011

What's Inside?

Introduction

This Newsletter is created by the National Energy Technology Laboratory and represents a summary of carbon sequestration news covering the past month. Readers are referred to the actual article(s) for complete information. It is produced by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon sequestration. It covers domestic, international, public sector, and private sector news.

Highlights

***Fossil Energy Techline*, "CO_2 Injection Begins in Illinois."**

The Midwest Geological Sequestration Consortium (MGSC) has begun injecting carbon dioxide (CO_2) for their large-scale CO_2 injection test in Decatur, Illinois. The CO_2 is being captured from the Archer Daniels Midland (ADM) Ethanol Production Facility in Decatur, Illinois. A processing plant built for this project removes water from the CO_2 stream and then compresses the dry CO_2 to a supercritical phase. The compressed CO_2 then travels through a 1 mile-long pipeline to the wellhead where it is injected into the Mt. Simon Sandstone at a depth of about 7,000 feet. November 21, 2011, http://www.netl.doe.gov/publications/press/2011/111121_co2_injection.html.

***Fossil Energy Techline*, "Midwest Has Potential to Store Hundreds of Years of CO_2 Emissions."**

Injection field tests conducted by the Midwest Regional Carbon Sequestration Partnership (MRCSP) indicate that their region has the geologic potential to store hundreds of years of regional carbon dioxide (CO_2) emissions primarily in deep saline formations. The MRCSP Phase II field tests included seven small-scale field validation tests: three geologic injection tests, one in each of the major geologic provinces of the region (the Michigan Basin, the Appalachian Basin, and the Cincinnati Arch) and four terrestrial field tests representative of the region's diversity (croplands, reclaimed minelands, reclaimed marshlands, and forested wetlands). The small-scale geologic field tests injected CO_2 into saline formations to validate data gathered in Phase I research. The field tests also found that oil and gas reservoirs have a high potential for enhanced oil and gas recovery (EOR/EGR). MRCSP is one of seven Regional Carbon Sequestration Partnerships (RCSPs) established by the U.S. Department of Energy's (DOE) Office of Fossil Energy (FE) to determine the safest approaches and technology applications for the permanent storage of CO_2 emissions, which are believed to be key elements in moving toward the commercial deployment of geologic storage technologies. November 16, 2011, http://www.fossil.energy.gov/news/techlines/2011/11057-Midwest_CO2_Storage_Validated.html.

***Thunderbird Energy News Release*, "Thunderbird Energy Operations Update."**

The Southwest Regional Partnership on Carbon Sequestration (SWP) Deployment Phase activities are sited at Gordon Creek and the partnership is proceeding with a variety of design and permitting activities. An extensive 3-D seismic shoot will be included in the field activities in order to further understand the structure that is believed to host the previously discovered CO_2 at Gordon Creek, as well as to optimize the initial CO_2 source well that will be drilled in 2012. In addition, the existing injection well at Gordon Creek will be re-worked to conduct a CO_2-water injectivity test. To learn more about SWP, visit: http://southwestcarbonpartnership.org/. For more information on DOE's RCSP Program, go to:

National Energy
Technology Laboratory

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

1450 Queen Avenue SW
Albany, OR 97321-2198

2175 University Ave. South, Suite 201
Fairbanks, AK 99709

John T. Litynski
412-386-4922
john.litynski@netl.doe.gov

Dawn M. Deel
304-285-4133
dawn.deel@netl.doe.gov

Visit the NETL website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681

Sequestration in the News

http://www.fossil.energy.gov/programs/sequestration/partnerships/index.html. October 28, 2011, http://www.thunderbirdenergy.com/s/NewsReleases.asp?ReportID=487678&_Type=News-Releases&_Title=Thunderbird-Energy-Operations-Update.

***Mining Weekly*, "Centre for Carbon Capture and Storage Aiming to Start Test Injection in 2016."**

According to officials, the South African Centre for Carbon Capture and Storage (SACCCS) will initiate a CCS test injection in 2016. The regulatory requirements for a test injection are being investigated under the current regulatory regime, and a scoping study is being conducted in areas indentified in a 2010 atlas as suitable for CO_2 capture; this study is expected to be completed by the end of the year, followed by a business plan. In addition, geologic modeling of storage sites, CCS financial opportunities in South Africa, and public outreach are being investigated, and a definition of capture readiness is being determined. A joint industry study investigating industry development and collateral benefits, such as job creation and preservation, is also underway. November 4, 2011, http://www.miningweekly.com/article/sa-building-up-to-ccs-test-injection-2016-2011-11-04.

***SSE Press Release*, "Joint Development Agreement on Carbon Capture and Storage."**

Shell and power company SSE have entered into a joint development agreement that will enable the proposed CCS project at SSE's gas-fired power station in Peterhead, Aberdeenshire, to accelerate a number of pre-Front-End Engineering Design (FEED) studies. The intent of the agreement is to place the project in a position to undertake a full FEED study in the second half of 2012. The project's goal is to design and develop a full-chain, post-combustion CCS facility capable of capturing CO_2 from a 385-megawatt (MW) combined cycle gas turbine unit at SSE's Peterhead Power Station and transporting CO_2 with the use of existing infrastructure to the Shell-operated Goldeneye gas field in the North Sea. The Peterhead project is one of seven United Kingdom (UK) CCS applications to the European Investment Bank for consideration in the European Union's (EU) New Entrant Reserve (NER) scheme to support CCS and renewable energy projects across the EU. November 9, 2011, http://www.sse.com/PressReleases2011/JointDevelopmentAgreementCarbonCapture/.

***Magellan Petroleum Press Release*, "MPC Provides Update on Popular Infill Drilling."**

Magellan Petroleum Corporation (MPC) has begun a new series of infill wells at Poplar Field in Roosevelt County, Montana, with the goal of boosting their production levels while providing useful data for implementation of a CO_2-EOR pilot. The first infill well, EPU 119, was completed

Sequestration in the News (Continued)

in mid-October and, according to testing, produces approximately 45 barrels of oil per day. After several more weeks of pump-testing, a second interval will be tested; as more developments become definitive, Magellan will communicate results. October 25, 2011, http://www.magellanpetroleum.com/news/newsView.asp?NewsId=40968112.

Announcements

Call for Papers.

Abstracts are now being accepted for the 11th International Conference on Greenhouse Gas Control Technologies (GHGT-11), to be held November 18-22, 2012, at the Kyoto International Conference Center in Kyoto, Japan. Technical themes include: CO_2 capture technology development, geologic CO_2 storage, CCS for industrial sources, CO_2 transport and infrastructure development, commercial issues, CCS system integration, public perception and acceptance of CCS, energy and climate change policies, legal and regulatory aspects of CCS, and CO_2 storage liability. Abstracts are due no later than Friday, February 20, 2012. For more information, click: http://www.ghgt.info/docs/docs/GHGT-11/GHGT_11_CFP_FINAL_web.pdf.

EPA Issues First GHG Permit in Texas.

The Lower Colorado River Authority (LCRA) Thomas C. Ferguson Power Plant has been issued the U.S. Environmental Protection Agency's (EPA) first Texas GHG permit. The LCRA is replacing its old unit with a new natural gas powered unit. LCRA is the first company in Texas to complete the GHG permitting process, which began in January 2011 after EPA finalized national GHG regulations specifying that projects increasing their GHG emissions would require a permit. To learn more, click: http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/074af11b53976c6c85257944005ad79c!OpenDocument.

EAGE CO_2 Geological Storage Workshop Announced.

The 3rd European Association of Geoscientists and Engineers (EAGE) Geological Storage Workshop will take place at Heriot-Watt University in Edinburgh, UK, on March 26-27, 2012. All aspects of understanding the behavior of CO_2 in the subsurface will be discussed, including monitoring, modeling, mapping, and predictions. Visit the conference website at: http://www.eage.org/events/index.php?evp=6225&ActiveMenu=2&Opendivs=s3.

RGGI Secondary Market Report Now Available.

According to the Regional Greenhouse Gas Initiative's (RGGI) "Report on the Secondary Market for RGGI CO_2 Allowances: Third Quarter 2011," which is now available, 99 percent of RGGI CO_2 allowances are currently held by electricity generators and their corporate affiliates. The report, covering the period from July to September 2011, also states that secondary market CO_2 allowance prices remained stable through the third quarter, ranging from $1.85 to $1.89 (the auction reserve price). The complete report is available at: http://www.rggi.org/docs/Market/MM_Secondary_Market_Report_2011_Q3.pdf.

Science

***San Jose Mercury News*, "Bay Area Songbirds are Getting Bigger,"** and ***Examiner*, "Scientific Study Suggests Birds are Getting Bigger to Survive Global Warming."**

According to a study released by PRBO Conservative Science, potential climate change may be causing birds in central California to grow longer wings and larger bodies in order to adapt to weather conditions. The research is based partly on data that suggests over the past 40 years birds such as sparrows, chickadees, and robins are growing to respond to environmental changes. The study estimates a growth rate in central Californian birds of approximately 0.05 percent each year spanning the past four decades. According to researchers, the change in size may be due to the birds storing more fat either to prepare for the weather conditions or as an effect of an increase in food supply as changing weather patterns are resulting in more vegetation in their region. Published in the journal *Global Change Biology*, the study resulted from data collected at two long-term research stations (Palomarin at the southern end of Point Reyes National Seashore and the Coyote Creek Field Station at the southern end of San Francisco Bay) where a wide variety of birds were captured, banded with an identification tag, and weighed and measured before being released. Researchers collected data at both stations from 1971 to 2010 to draw their conclusions. November 1, 2011, http://www.mercurynews.com/science/ci_19240005, and November 13, 2011, http://www.examiner.com/green-activism-in-national/scientific-study-suggests-birds-are-getting-bigger-to-survive-global-warming.

Policy

***New York Times*, "California Adopts Limits on Greenhouse Gases,"** and ***Los Angeles Times*, "California Becomes First State to Adopt Cap-and-Trade Program."**

On October 20, 2011, the California Air Resources Board (CARB) voted unanimously to adopt the first state-administered cap-and-trade regulations in the Nation, setting limits on greenhouse gas (GHG) emissions and creating a market for industries within the state to trade carbon credits. Cap-and-trade is the centerpiece of California's AB 32, which mandates a reduction in CO_2 emissions to 1990 levels by 2020. Starting in 2013, California's largest CO_2 emitters will be required to meet the caps or buy carbon credits to offset their emissions in a carbon trading market that will be operated by CARB. The second phase of compliance, which will begin in 2015, is expected to include 85 percent of California's emissions sources. By 2016, approximately $10 billion in carbon allowances are expected to be traded through the statewide market, making it the second-largest carbon market in the world behind the EU. If successful, the program could serve as a model for future markets in other states. October 20, 2011, http://www.nytimes.com/2011/10/21/business/energy-environment/california-adopts-cap-and-trade-system-to-limit-emissions.html?_r=1, and October 21, 2011, http://www.latimes.com/news/local/la-me-cap-trade-20111021,0,1125437.story.

***IPAC-CO_2 News Release*, "Public Review of Geologic Standard for CO_2 Begins."**

A draft of a standard for geologic storage of CO_2, developed by CSA Standards and the International Performance Assessment Centre for Geologic Storage of Carbon Dioxide (IPAC-CO_2), is now available for public review on a clause-by-clause basis through the CSA Standards online public review system. When completed, the new standard will be submitted to the Standards Council of Canada and the American National Standards Institute (ANSI) in the United States for bilateral recognition. In addition to providing guidelines for regulators, industry, and others involved with scientific and commercial CCS projects, the new standard will also provide the basis for development of the international standards by the International Organization for Standardization (ISO). November 4, 2011, http://www.ipac-co2.com/news-archive/119.

"Communicating CCS: Applying communications theory to public perceptions of carbon capture and storage."

The following is the Abstract of this article: "Although prior studies provide some insight into the effects of communication factors such as source credibility and argument strength on public perceptions of CCS, comparisons and integration of insights from these studies is complicated by the multitude of different and interdependent factors that influence communication outcomes. Here [the authors] provide an overview of these factors, structured in terms of a communications matrix and drawing on experience with CCS projects and studies to date. Using the matrix [the authors] organize empirical findings of the effects of four major communication input factors (source, message, channel, receiver) on communication output factors such as, attention, interest, understanding, and attitudes. The resulting 'map' of opinion shapers may guide development of public communication, engagement, and participation in CCS projects. The key message to communicators is that by knowing how input factors influence output factors, it can be decided which features are useful to achieve an intended communication outcome. Obtaining knowledge of input–output interactions requires early public engagement to explore public needs and concerns. Critical to the communication outcome is the extent to which CCS communication is an informed, open and objective public discussion process in which different views on the technology are acknowledged." **S. Brunsting, P. Upham, E. Dütschke, M. De Best Waldhober, C. Oltra, J. Desbarats, H. Riesch, and D. Reiner**, *International Journal of Greenhouse Gas Control*, Available online October 22, 2011, doi:10.1016/j.ijggc.2011.09.012, http://www.sciencedirect.com/science/article/pii/S1750583611001824. (Subscription may be required.)

Geology

"Effects of saturation medium and pressure on strength parameters of Latrobe Valley brown coal: Carbon dioxide, water and nitrogen saturations."

The following is the Abstract of this article: "Adsorption of CO_2 into coal matrix causes significant change in its chemical and physical structure, resulting in negligible permeability values and overall strength reduction. The main objective of this study is to investigate the effects of water, nitrogen (N_2) and CO_2 saturations at different saturation pressures on the strength of brown coal using uniaxial experiments. A series of uniaxial experiments was conducted on 38 mm diameter by 76 mm height Latrobe Valley brown coal samples with different saturation media (water, N_2, CO_2) and pressures (1, 2, and 3 MPa). According to the test results, water and CO_2 saturations cause the uniaxial compressive strength (UCS) of brown coal to be reduced by about 17 [percent] and 10 [percent] respectively. In contrast, N_2 saturation causes it to increase by about [two percent]. Moreover, Young's modulus of brown coal is reduced by about [eight percent] and 16 [percent] due to water and CO_2 saturations respectively, and is increased up to 5.5 [percent] due to N_2 saturation. It can be concluded that CO_2 and water saturations cause the strength of brown coal to be reduced while improving its toughness, and N_2 saturation causes the strength of brown coal to increase while reducing its toughness. The fracture propagation pattern of each sample was then observed using advanced acoustic emission (AE). Findings indicate that CO_2 saturation causes early crack initiation due to the CO_2 adsorption-induced swelled layer and early crack damage and failure points due to lower surface energy. In contrast, N_2 saturation causes delays in crack initiation, damage and failure due to the removal of both water and naturally available CO_2 from the coal mass during the saturation." **M.S.A. Perera, P.G. Ranjith, and M. Peter**, *Energy*, Available online October 28, 2011, doi:10.1016/j.energy.2011.09.026, http://www.sciencedirect.com/science/article/pii/S0360544211006232. (Subscription may be required.)

"CO_2 sequestration through mineral carbonation of iron oxyhydroxides."

The following is the Abstract of this article: "Carbon dioxide sequestration via the use of sulfide reductants and mineral carbonation of the iron oxyhydroxide polymorphs lepidocrocite, goethite and

Geology (Continued)

akaganeite with supercritical CO_2 ($scCO_2$) was investigated using in situ attenuated total reflection Fourier transform infrared spectroscopy (ATR-FTIR), X-ray diffraction (XRD) and transmission electron microscopy (TEM). The exposure of the different iron oxyhydroxides to aqueous sulfide in contact with $scCO_2$ at ~70-100°C resulted in the partial transformation of the minerals to siderite ($FeCO_3$) and sulfide phases such as pyrite (FeS_2). The relative yield of siderite to iron sulfide bearing mineral product was a strong function of the initial sulfide concentration. The order of mineral reactivity with regard to the amount of siderite formation in the $scCO_2$/sulfide environment for a specific reaction time was goethite < lepidocrocite ≤ akaganeite. Given the presence of goethite in sedimentary formations, this conversion reaction may have relevance to the subsurface sequestration and geologic storage of [CO_2]." **Kristin D. Lammers, Riley T. Murphy, Amber Riendeau, Alexander Smirnov, Maartin Schoonen, and Daniel Russell Strongin**, *Environ. Sci. Technol.*, Available online November 8, 2011, doi: 10.1021/es202571k, http://pubs.acs.org/doi/abs/10.1021/es202571k. (Subscription may be required.)

"Seal evaluation and confinement screening criteria for beneficial carbon dioxide storage with enhanced coal bed methane recovery in the Pocahontas Basin, Virginia."

The following is the Abstract of this article: "The geological storage of [CO_2] in Appalachian basin coal seams is one possible sink for sequestration of [GHGs], with the added benefit of enhanced-coal bed methane (ECBM) recovery. The Pocahontas Basin (part of the central Appalachian Basin) of southwestern Virginia is a major coal bed methane (CBM) province with production mostly from coal beds in the Lower Pennsylvanian Pocahontas and New River formations. As part of the Southeast Regional Carbon Sequestration Partnership's Phase II research program, a CO_2-injection demonstration well was installed into Lower Pennsylvanian [CBM] producing strata in southwest Virginia. Samples of siliciclastic lithologies above coal beds in this Oakwood Field well, and from several other cores in the Nora Field were taken to establish a baseline of the basic confinement properties of overlying strata to test seal competency at local and regional scales. Strata above CBM-producing coal beds in the Pocahontas and New River formations consist of dark-gray shales; silty gray shales; heterolithic siltstones, sandstones, and shales; lithic sandstones, and quartzose sandstones. Standard measurements of porosity, permeability and petrography were used to evaluate potential [release] hazards and any possible secondary storage potential for typical lithologies. Both lithic- and quartz-rich sandstones exhibit only minor porosity, with generally low permeability (< 0.042 md). Interconnected porosity and permeability are strongly impacted by diverse cementation types and compaction. Analyzed siliciclastic lithologies are considered tight, with limited primary matrix permeability risks for [release], providing an ensemble of redundant CO_2-ECBM traps. One of the most promising confining intervals above the major [CBM] producing interval is the Hensley Shale Member. Analyses of 1500 geophysical logs in southwest Virginia indicate that this unit is moderately thick (> 50 ft, 15 m), laterally continuous (> 3000 km^2), and a homogenous shale, which coarsens upward into siltstone and sandstone, or is truncated by sandstone. Calculations from two mercury injection capillary porosimetry tests of the shale indicate that a displacement entry pressure of 207 [pounds per square inch absolute (psia)] (1427 kPa) would generate an estimated seal capacity of 1365 ft (416 m) of CO_2 before buoyant [release]. Scanning electron microscopy indicates a microfabric of narrow pore throats between quartz grains floating in a clay matrix. Modeled median pore throat size between micro-fabric matrix grains for the shale is estimated at 0.26 μm. These characteristics indicate that the shale, where fractures and joints are limited, would be an adequate regional confining interval for deeper CO_2 storage with ECBM." **Ryan P. Grimm, Kenneth A. Eriksson, Nino Ripepi, Cortland Eble, and Stephen F. Greb**, *International Journal of Coal Geology*, Available online November 17, 2011, doi: 10.1016/j.coal.2011.11.002, http://www.sciencedirect.com/science/article/pii/S016651621100245X. (Subscription may be required.)

Technology

"An evaluation of ex situ, industrial-scale, aqueous CO_2 mineralization."

The following is the Abstract of this article: "It is essential to objectively evaluate the many CO_2 mitigation strategies in order to prioritize investments of capital and research. Aqueous CO_2 mineralization is one potential strategy to permanently sequester CO_2, without the associated long-term monitoring and liability issues. Investigators are studying and optimizing aqueous CO_2 mineralization for the production of inorganic carbonates and are scaling up some of these processes. This paper adopts a life-cycle approach toward the evaluation of energy requirements and discusses other potential barriers for three CO_2 mineralization pathways: industrial caustics, naturally occurring minerals, and industrial wastes. This analysis is based on CO_2 capture from a 1 GW coal-fired power plant using one of the three mineral mineralization pathways. The investigators utilize consistent system boundaries and process-modeling assumptions, standard engineering calculations to estimate energy requirements, and publicly available data for upstream energy requirements and for the production of products/co-products. The results suggest that some industrial wastes show promise for CO_2 mineralization, but their availability is limited. The other pathways currently have large energy penalties and face other significant barriers, such as the production of large quantities of potentially hazardous waste and large-scale mining." **K.E. Kelly, G.D. Silcox, A.F. Sarofim, and D.W. Pershing**, *International Journal of Greenhouse Gas Control*, Available online October 20, 2011, doi:10.1016/j.ijggc.2011.09.005, http://www.sciencedirect.com/science/article/pii/S1750583611001757. (Subscription may be required.)

"Structural Integrity of CO_2 Transport Pipelines – A Review."

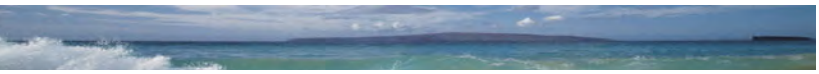
The following is the Abstract of this article: "A recent trend in the development of CO_2 pipelines is the shift from the predominance of transport of CO_2 for EOR to the transportation of CO_2 as part of the [CCS] process for global warming mitigation. Among the processes of capture, transport, and storage, less attention has been paid to transport as it is assumed to be for granted, existing technology. This paper presents a focused analysis of the problem of structural integrity of CO_2 pipelines through reviewing the state-of-the-art literature and practice, and highlights the need for a unified code of practice for

Technology (Continued)

the modeling of integrity and, due to the potentially hazardous nature of CO_2, safety, in these pipelines." **Amir Chahardehi**, *Key Engineering Materials*, Available online September 1, 2011, doi:10.4028/www.scientific.net/KEM.488-489.779, http://www.scientific.net/KEM.488-489.779. (Subscription may be required.)

"Potential influence of CO_2 release from a carbon capture storage site on release of trace metals from marine sediment."

The following is the Abstract of this article: "One of the main risks of CCS is CO_2 [release] from a storage site. The influence of CO_2 [release] on trace metals leaching from contaminated marine sediment in a potential storage area (Northern Spain) is addressed using standardized leaching tests. The influence of the pH of the leaching solution on the leachates is evaluated using deionized water, natural seawater and acidified seawater at pH = 5, 6 and 7, obtained by CO_2 bubbling. Equilibrium leaching tests were performed at different liquid–solid ratios and the results of ANC/BNC leaching test were modeled using Visual Minteq. Equilibrium tests gave values of the final pH for all seawater leachates between 7 and 8 due to the high acid neutralization capacity of the sediment. Combining leaching test results and geochemical modeling provided insight in the mechanisms and prediction of trace metals leaching in acidified seawater environment." **M. Cruz Payán, Bram Verbinnen, Berta Galan, Alberto Coz, Carlo Vandecasteele, and Javier R. Viguri**, *Environmental Pollution*, Available online November 10, 2011, doi:10.1016/j.envpol.2011.10.015, http://www.sciencedirect.com/science/article/pii/S0269749111005859. (Subscription may be required.)



Terrestrial

"An investigation into the effects of an emissions trading scheme on forest management and land use in New Zealand."

The following is the Abstract of this article: "An econometric-process simulation model was constructed to investigate the effects of an Emissions Trading Scheme (ETS) on forest management and land use in New Zealand. Profit maximizing agents which choose between forestry and agricultural land uses were simulated under carbon price scenarios of $20, $50 and $0 per tonne CO_2 equivalent. The model suggests that an ETS will lead to increased afforestation and rotation age, and decreased silviculture and deforestation. A $20 carbon price or higher led to an overall increase in carbon sequestration by the forestry sector, driven predominantly by afforestation on lower fertility sites. Higher carbon prices increase the range of available land for planting. Future carbon price expectancy was critical. Rising carbon price expectancy led to large scale afforestation, but also to significant deforestation. A falling expectancy prevented deforestation but also stifled afforestation. The most sustainable solution was a stable carbon price expectancy allowing land to consistently work towards an economically optimal use. The recommendation of this report is for policy which promotes a stable long-run carbon price and flexibility for change between land uses. Suggestions include a guaranteed maximum carbon price, or allowing a forest to be felled at reduced penalty if another is concurrently planted." **Thomas Adams and James A. Turner**, *Forest Policy and Economics*, Available online October 20, 2011, doi:10.1016/j.forpol.2011.09.010, http://www.sciencedirect.com/science/article/pii/S1389934111001651. (Subscription may be required.)

Trading

***The New York Times*, "Australian Senate Approves Emissions Trading Plan."**

The upper house of Australia's Parliament approved the government's proposal to adopt an emissions trading program that will impose a carbon tax on the country's largest emitters beginning in July 2012. The package of 18 bills that make up the carbon trading legislation passed through the Senate by a vote of 36 to 32; the legislation passed through the lower house by a 74 to 72 vote in October. Under the new regulations, the nation's 500 biggest producers of CO_2 emissions will be subject to an initial fixed carbon tax of $24.70 per tonne; the regulations will become a market-based trading program in 2015, the size of which will be second only to that of the EU. November 7, 2011, http://www.nytimes.com/2011/11/08/world/asia/australian-senate-approves-emissions-trading-plan.html?_r=3.

Recent Publications

"Communicating the Risks of CCS."

The following is from the Introduction of this document: "CCS is a technology that can be used to reduce [GHG] emissions into the Earth's atmosphere. The technology has applications across multiple industries including the oil and gas industry where it is applied in the enhanced oil and gas recovery (EOR/EGR) process. CCS involves three primary steps: (1) capturing CO_2 at large point sources; (2) transporting the CO_2 to a suitable location; and, (3) injecting the CO_2 into deep geologic formations for permanent storage. Each of these steps is based on technologies that are used in other industrial applications. Although there are not many instances where CCS has been integrated for large scale use, there are numerous pilot projects and a growing number of larger-scale projects that are being used to develop and demonstrate CCS. As these projects increase in scale, and CCS becomes a commercially viable CO_2 reduction

Recent Publications (Continued)

strategy, concerted effort has gone into systematic risk assessment and mitigation for CCS projects. The International Energy Agency Greenhouse Gas program (IEAGHG) sponsored the development of a database of more than 200 generic features, events, and processes (FEPs) potentially associated with CCS projects. The FEPs' focus on the behavior of CO_2 is with respect to the long-term performance and safety of CCS projects. The database is organized around eight categories of risk based on 'technical and scientific considerations.'" This Global CCS Institute (GCCSI) document is available for download at: http://cdn.globalccsinstitute.com/sites/default/files/communicating_the_risks_of_ccs.pdf.

"Evaluating Global CCS Communications."

The following is a summary of this University of Cambridge report: "CCS communications are likely to play a crucial part in determining what kind of role CCS eventually ends up playing in the energy and climate infrastructures currently being planned and built around the world. With CCS not yet operating on a commercial scale, CCS communications via media coverage, visits to science museums, and especially websites, make up a significant part of the 'CCS' that most people will experience. As Hammond and Shackley (2010) point out, the images and presentation of CCS, more than actual CCS infrastructure or experiences with CCS, make up what CCS means to most people at the present time. The importance therefore of questions about how CCS is being communicated becomes imperative, specifically, how such communication is, and may be, developing and where it might be enhanced and improved in the future. This report reviews the scope and key characteristics of CCS communications and primarily builds upon a comprehensive Global CCS Communications Database that was compiled for this project. The report also draws upon investigations of non-web sources, including books, articles, media reporting of CCS, educational materials and museum exhibits, to provide as varied and comprehensive an overview as possible of CCS communication practices to date." The report is available through GCCSI's publication database at: http://www.globalccsinstitute.com/publications/evaluating-global-ccs-communications.

"Carbon Capture and Storage in Developing Countries: a Perspective on Barriers to Deployment."

The following is a summary of this World Bank report: "CCS could have significant impact as a carbon mitigation technology in [GHG] emitting industries. Given the nascence of CCS technology, with only eight large-scale integrated projects in the world (Global CCS Institute 2010), significant challenges still must be overcome for large-scale deployment, such as addressing technical issues of integration and scale-up, legal and regulatory requirements to reduce investor risk, policies to create market drivers and mitigate economic impacts, including increases in electricity prices, and financing mechanisms to facilitate investment in the technology. This report does not provide prescriptive solutions to overcome these barriers, since action must be taken on a country-by-country basis, taking account of different circumstances and national policies. Individual governments should decide their priorities on climate change mitigation and adopt appropriate measures accordingly. The analyses presented in this report may take on added relevance, depending on the future direction of international climate negotiations and domestic legal and policy measures, and how they serve to encourage carbon sequestration. Both international and domestic actions can further incentivize the deployment of CCS and its inclusion in project development. Incentives to promote CCS include adopting climate change policies that could provide revenues for CCS projects, but it is likely that a combination of domestic and international mechanisms will be required, alongside carbon revenues, to kick-start CCS project development and reduce investor risk in developing countries in particular." The report is available through GCCSI's publication database at: http://www.globalccsinstitute.com/publications/carbon-capture-and-storage-developing-countries-perspective-barriers-deployment.

"The Costs of CCS and Other Low-Carbon Technologies."

The following is a summary of this GCCSI report: "Managing the risks of climate change requires the development and adoption of a wide range of low-carbon technologies across many industrial sectors. It is likely that the stringent targets of 450 ppm can only be achieved efficiently with a portfolio of technologies that include options that have the potential for removing CO_2 from the atmosphere as well as negating CO_2 emissions from industrial sources, such as CCS technologies. This paper focuses on the electric power generation industry, and examines the costs of different technologies that are expected to play a part in reducing [CO_2] emissions to the atmosphere." The report is available through GCCSI's publication database at: http://www.globalccsinstitute.com/publications/costs-ccs-and-other-low-carbon-technologies.

Legislative Activity

***BNA.com*, "Senate Passes Bill to Allocate $2 Billion for Carbon Storage, Fund Climate Service."**

A fiscal 2012 spending bill that allots $2 billion for CCS projects and provides $161.5 million to the National Oceanic and Atmospheric Administration (NOAA) climate service has been approved by the Senate and will go back to the House for consideration. The spending bill (H.R. 2112) would provide funding for the Department of Agriculture (DOA), the Department of Commerce (DOC), and the Department of Transportation (DOT), as well as other Federal departments, through September 30, 2012. Up to $2 billion in CCS funding was added to the measure in October for the construction, acquisition, or improvement of coal-fired and other fossil fuel-fired, electricity-generating plants that capture and store their CO_2 emissions. To view H.R. 2112, visit: http://www.govtrack.us/congress/billtext.xpd?bill=h112-2112. November 2, 2011, http://www.bna.com/senate-passes-bill-n12884904101/.

EVENTS

December 5-6, 2011, **The Future of Fossil-Fired Plants: Risks and Opportunities in Light of Regulatory and Economic Uncertainty**, *Hyatt Regency Crystal City, Arlington, Virginia, USA*. This conference will provide a forum for discussions with leading industry participants and analysts who are facing challenges ranging from impending EPA regulations, low gas prices, and uncertain prospects for CO_2 regulation. For more information, visit: https://www.euci.com/events/?ci=1470&t=O.pdf.

December 6-7, 2011, **Introduction to Carbon Capture and Storage**, *London, United Kingdom*. This two-day course will provide an overview of the capture, transport, and storage aspects of CCS, assessing the technical and safety requirements of each stage. Case studies and real examples will be used to demonstrate, among other topics, the importance of large-scale global CCS implementation, understanding the characteristics and challenges of CO_2 within the CCS chain, the design and operation of CO_2 pipelines, and the selection and lifecycle management of CO_2 storage sites. For more information, visit the course website at: http://www.energyinst.org/events/view/533#attached-1.

December 13-15, 2011, **POWER-GEN International 2011**, *Las Vegas Convention Center, Las Vegas, Nevada, USA*. POWER-GEN International is the industry leader in providing comprehensive coverage of trends, technologies, and issues facing the generation sector. This year's program consists of a variety of tracks, including: industry trends, power generation, environmental issues, fossil technologies, gas turbine technologies, renewable energy, on-site power, and plant performance. Conference details are available at: http://www.power-gen.com.

December 14-15, 2011, **International Conference on Climate Change & Social Issues**, *Colombo, Sri Lanka*. This conference offers a forum that stimulates discussions from multi-sectoral stakeholder groups to share practical knowledge/experience, exchange ideas, develop collaborations, and set up working groups in order to take actions for climate change mitigation and adaptation. This conference will bring together interdisciplinary researchers and practitioners to meet, discuss, and debate the global impacts of climate change. Detailed information can be found at: http://www.ihdt.org/Intro.html.

December 19-20, 2011, **The Carbon Congress 2011**, *New Delhi, India*. A two-day industry and investment meeting, The Carbon Congress 2011 (TCC) is designed to increase understanding of current efforts underway in the carbon market, as well as to provide an understanding in areas such as potential climate change, impacts of carbon tax, strategies to reduce GHG emissions, and Clean Development Mechanism (CDM) projects. Included are discussions on the international carbon market, GHG accounting standards, and carbon financing. For more information, go to: http://www.cinbcorp.com/carboncongress.html.

January 25-26, 2012, **Coal Symposium: Responding to Regulations, Enhancing Operational Efficiency & the Latest Word on Clean Coal Technology**, *Calgary TELUS Convention Center, Calgary, Alberta, Canada*. This symposium offers strategies for responding to provincial and Federal emissions regulations, information for building new and retrofitting old coal power plants, proactive public engagement tactics for the long-term viability of coal power generation in Canada, and insight on groundbreaking economical and technological advancements for clean energy in Canada and around the world. More details are available at: http://www.canadianinstitute.com/2012/324/coal-symposium.

February 7-9, 2012, **Carbon Management Technology Conference**, *Caribe Royale Hotel & Convention Center, Orlando, Florida, USA*. This inaugural conference draws professionals from all engineering disciplines to share their expertise on the reduction of GHG emissions and adaptation to changing climate. The conference will focus on engineering perspectives regarding key issues, including technologies, strategies, policies, and management systems. More information is located at: http://www.spe.org/events/cmtc/2012/index.php.

March 12-14, 2012, **Optimising Enhanced Oil Recovery**, *Venue to be Determined, Abu Dhabi, United Arab Emirates*. While the focus of this conference is on maximizing oil production by discussing efficient EOR strategies used worldwide, it commences with a one-day session dedicated to the development, technology, investment, and strategy of making CCS a reality. Topics covered include deployment of CCS facilities, CO_2 capture and EOR case studies, and CO_2 transportation strategies. For more information, go to: http://v11.vuturevx.com/exchange-sites/Whitmore%20Group/59/events-pdfs-eu/eor2-mktg-agenda.pdf.

Events (Continued)

April 24-25, 2012, **Carbon Capture and Storage Conference**, *Venue to be Determined, Calgary, Alberta, Canada*. This event provides an opportunity for attendees to hear from regulators, scientists, and industry players on the latest in CCS-related legislation, overcoming geologic challenges, devising business models for commercialization, gaining public acceptance, and other topics. Visit: http://www.canadianinstitute.com/2012/338/carbon-capture-and-storage-conference/ for more details.

April 30-May 3, 2012, **Carbon Capture, Utilization, and Sequestration Conference**, *David L. Lawrence Convention Center, Pittsburgh, Pennsylvania, USA.* The 2012 conference focuses on CCS systems and technologies that are being or could be deployed in the United States and North America. The conference will provide a forum for the exchange of experiences; facilitate dialogue between technology developers, industry, and the public; and engage discussion on developing the necessary capacity within the public and private sector to move the technology base forward. For more information, please visit: http://www.carbonsq.com/pdf/2012/call_for_papers_2011.pdf.

November 18-22, 2012, **International Conference on Greenhouse Gas Technologies 11 (GHGT-11)**, *Kyoto International Conference Center, Japan*. This will be the second visit to Kyoto by the GHGT conference series, with more than 1,600 delegates expected to attend. A formal agenda has not yet been developed; however, planning for GHGT-11 is underway, with a call for papers open through February, 20, 2012. Visit: http://www.ghgt.info/index.php/Content-GHGT11/ghgt-11-overview.html for more details.

For subscription details...

Please visit http://listserv.netl.doe.gov/mailman/listinfo/sequestration, enter your email address, and create a password. This will enable you to receive a pdf version of the Carbon Sequestration Newsletter at no cost.
To view an archive with past issues of the newsletter, see: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/subscribe.html.

To learn more about DOE's Carbon Sequestration Program, please contact John Litynski at john.litynski@netl.doe.gov, or Dawn Deel at dawn.deel@netl.doe.gov.