Carbon Sequestration Newsletter

October 2009

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,* "First-of-a-Kind Sequestration Field Test Begins."**

In West Virginia." In August 2009, a U.S. Department of Energy-(DOE) sponsored project initiated the injection of carbon dioxide (CO_2) for enhanced coalbed methane (ECBM) recovery with simultaneous CO_2 sequestration in an unmineable coal seam in Marshall County, West Virginia. The goal of the project is to help mitigate potential climate change by providing an effective and economic means to permanently store CO_2 in unmineable coal seams. Prior to the injection, horizontal coalbed methane (CBM) wells were drilled approximately 1,200 to 1,800 feet underground in a five-spot pattern over a 200-acre area in the unmineable Upper Freeport coal seam. As part of this $13 million field trial, which is being conducted under the collaboration of the National Energy Technology Laboratory (NETL), West Virginia University, and CONSOL Energy, Inc., CO_2 will be injected at a pressure of up to 700 pounds per square inch (psi) and a rate of approximately 27 short tons per day over the next two years. Researchers will then monitor the impacts of the injection on the production and composition of the CBM produced. The injection will conclude once 20,000 short tons have been injected or the CBM becomes contaminated with CO_2. Numerous site characterization and monitoring activities are planned in order to ensure the safety of the injection. The field test is funded by DOE's Office of Fossil Energy (FE) and is being managed by NETL. September 8, 2009, http://www.fossil.energy.gov/news/techlines/2009/09063-First-of-a-Kind_Sequestration_Fiel.html.

***Fossil Energy Techline,* "DOE Selects Projects to Monitor and Evaluate Geologic CO_2 Storage."**

DOE selected 19 projects to enhance the capability to simulate, track, and evaluate the potential risks of CO_2 storage in geologic formations. The projects will help improve DOE's ability to monitor the movement of CO_2 into, through, and out of the targeted geologic storage area; verify the location of CO_2 that has been placed in geologic storage; account for the entire quantity of CO_2 that has been transported to geologic storage sites; mathematically simulate the placement, storage, movement, and release of CO_2 into, through, and from geologic formations; and assess the risks associated with the placement of CO_2 in geologic formations and the potential release of CO_2 from these formations. The total value of the projects, which will be managed by NETL, is approximately $35.8 million over four years, with $27.6 million of DOE funding and $8.2 million of non-Federal cost sharing. The projects cover three topic areas: monitoring, verification, and accounting (MVA); simulation; and risk assessment. To learn more about DOE's Carbon Sequestration Research Program, visit: http://www.fossil.energy.gov/programs/sequestration/index.html, or click on the following link to view the complete list of projects. August 24, 2009, http://www.fossil.energy.gov/news/techlines/2009/09059-DOE_Selects_CO2_Monitoring_Project.html.

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Sequestration in the News

***Fossil Energy Techline*, "Energy Department Advances Carbon Capture and Storage Research on Two Fronts."**

On September 16, 2009, DOE announced $12.7 million in funding for 43 research projects to advance carbon capture and sequestration (CCS) technologies by providing graduate and undergraduate student training opportunities at universities across the United States. The projects will provide advanced research training in simulation and risk assessment; MVA; geological related analytical tools; methods to interpret geophysical models; and CO_2 capture. The three-year projects, which are funded through the 2009 American Reinvestment and Recovery Act (ARRA), will be managed by FE's NETL. Project details are available at: http://www.fossil.energy.gov/recovery/projects/geologic_sequestration_training.html. September 16, 2009, http://www.fossil.energy.gov/news/techlines/2009/09066-DOE_Advances_CCS_Training.html.

***Fossil Energy Techline*, "DOE Research Projects to Examine Promising Geologic Formations for CO_2 Storage."**

On September 16, 2009, DOE announced it will contribute $75.5 million for 11 projects aimed at increasing scientific understanding about the potential of geologic formations to safely and permanently store CO_2. The projects will examine the usefulness of potential geologic storage sites and supplement existing data; in addition, project participants will participate in technical working groups on best practices for site characterization and storage site selection. Funding for the projects includes $49.75 million from ARRA to promote employment opportunities for local and regional organizations over the next three years. Project details are available at: http://www.fossil.energy.gov/recovery/projects/site_characterization.html. September 16, 2009, http://www.fossil.energy.gov/news/techlines/2009/09065-DOE_Awards_Site_Characterization_P.html.

***Fossil Energy Techline*, "Department of Energy Awards $71 Million to Accelerate Innovative Carbon Capture Project."**

On September 15, 2009, DOE announced that Arizona Public Service (APS) has been awarded $70.5 million from ARRA to expand an existing industrial and innovative reuse carbon mitigation project to include testing with a coal-based gasification system. APS will scale up a concept for coproduction of electricity and substitute natural gas via coal gasification, while scaling up a technology where power plant CO_2 emissions are captured by algae and processed into liquid transportation fuels. The funding will enable APS to scale up its algae cultivation and hydrogasification concept. Researchers expect that the algae farm will reuse CO_2 at a rate of 70 metric tons per acre per

Sequestration in the News (Continued)

year. The APS project is one of two already existing projects in the industrial carbon capture program administered by DOE's FE; the other is a Ramgen PoweSystems' project to scale up a device that uses supersonic shockwaves to compress CO_2 for capture and storage. The host facility for this project is the Cholla Power Plant located in Holbrook, Arizona. September 15, 2009, http://www.fossil.energy.gov/news/techlines/2009/09064-APS_to_Scale_Up_CCS_Project.html.

***Fossil Energy Techline,* "DOE Announces More Than $8.4 Million for Regional Sequestration Technology Training Projects."**

DOE Secretary Steven Chu awarded more than $8.4 million in funding to develop seven regional sequestration technology training projects. The funding, which includes $6.9 million from DOE as part of ARRA, will aid the United States in achieving their goal to develop near-zero emission technologies to reduce CO_2 emissions from power plants. The seven projects will facilitate the transfer of knowledge and technologies required for site development, operations, and monitoring of commercial CCS projects by focusing on CCS engineering and science for site developers, geologists, engineers, and technicians. The selected projects will fund the following: an organized sponsorship development program; short courses on CCS technologies; regional training; regional/basin technology transfer services; and regional programs' planning and management. The funding will span three years and will be managed by NETL. To learn more about the selected projects, click on the following link. August 27, 2009, http://www.fossil.energy.gov/news/techlines/2009/09062-DOE_Awards_CCS_Training_Projects.html.

***Dominion News Release,* "Carbon Capture and Storage Demonstration Proposed at Dominion's Virginia City Hybrid Energy Center."**

A coalition led by Virginia Tech's Virginia Center for Coal and Energy Research (VCCER) has applied for funding to finance a CCS demonstration project proposed for a power station currently under construction in Wise County, Virginia. The grant is sought to cover approximately half of the potential $580 million cost of the proposed project. Under the plan, the CO_2 would be transported by pipeline for permanent storage in unmineable coal seams and underground saline formations in the region. The carbon capture portion of the project, which would be led by Dominion Virginia Power, will be capable of removing up to 1,500 tons of CO_2 per day. The project is designed to meet DOE's goals by proving CCS on a commercial scale and achieving a minimum of 50 percent carbon capture efficiency. Subject to funding approval, as well as several company and regulatory approvals, construction for the demonstration project could be completed by April 2015, with the injection and monitoring phases of the project running through April 2021. August 25, 2009, http://dom.mediaroom.com/index.php?s=43&item=790.

***WA Today*, "Gorgon to Lead Nation's Biggest Carbon Injection Effort."**

ExxonMobil will contribute multi-billion dollar contracts to supply India and China with liquefied natural gas (LNG) from the Gorgon Project at Barrow Island, off of Western Australia's Pilbara Coast. The total amount of LNG involved in those contracts will account for only 25 percent of the Chevron-led Gorgon Project's potential output, which is nearly 15 million tonnes of LNG per year. It is estimated that an average of 70,000 tonnes of CO_2 must be separated for every 1 million tonnes of gas extracted at Barrow Island. When operating at full capacity, the Chevron plant will inject 3.5 million tonnes of CO_2 per year 2.3 kilometers underground. Officials said that the project goal is to store 120 million tonnes per annum (mtpa) in a large, underground reservoir. August 20, 2009, http://www.watoday.com.au/wa-news/gorgon-to-lead-nations-biggest-carbon-injection-effort-20090820-es1j.html.

Announcements

Carbon Sequestration Documentary Wins Coveted Aurora Award.

A DOE-supported film about carbon sequestration received a 2009 Gold Aurora Award in the documentary category for nature/environment. The film, titled, "Out of the Air – Into the Soil: Land Practices That Reduce Atmospheric Carbon Levels," discusses the effects that proper landscape management can have on carbon absorption. To learn more, go to: http://www.fossil.energy.gov/news/techlines/2009/09061-CCS_Documentary_Wins_Award.html. To view the documentary, visit: http://www.undeerc.org/pcor/documentary/.

EPA Seeks Comments on CO_2 Storage.

The U.S. Environmental Protection Agency (EPA) is requesting comments on new information received under the Safe Drinking Water Act (SDWA) that would create a new injection well classification. The new information would supplement EPA's proposed rule by establishing requirements under the authority of the SDWA to ensure that geologic sequestration activities do not endanger underground sources of drinking water (USDWs). For more information, visit: http://www.carboncapturejournal.com/displaynews.php?NewsID=440&PHPSESSID=69g7vmp35a55m5kgqaasp7df02.

Announcements (Continued)

CO_2 Geological Storage: Latest Progress.
The European Science Foundation (ESF) will hold a conference on November 22-27, 2009, at Obergurgl University Centre in Obergurgl, Austria, aimed at outlining future challenges facing the industrial implementation of geological CO_2 storage. The conference will examine modeling techniques; risk assessment; site monitoring; and site design, injection, and closure practices. To learn more, visit the conference website at: http://www.esf.org/activities/esf-conferences/details/2009/confdetail293.html#c28304.

CCS Technical Forum Launched.
TUV NEL launched a new CCS technical forum to address issues and challenges associated with CCS. The forum will bring together CCS developers, operators, support services, and measurement specialists and regulators; support CCS deployment; establish solutions and options; help industry meet their CCS regulatory monitoring and reporting requirements; and provide up-to-date information on technological and legislative developments. The forum is available at: http://ccs.tuvnel.com/default.asp.

CCS Short Course.
The Centre for Innovation in Carbon Capture and Storage (CICCS) will hold a short course on November 10-11, 2009, at the Jury's Inn, in Nottingham, United Kingdom. Topics include climate change; carbon markets; an overview of carbon capture transport and storage, geological storage and monitoring; and pre-, post-, and oxy-combustion technologies. Visit http://www.nottingham.ac.uk/ciccs/courses.php for more information.

Science

***Science Daily*, "Sierra Nevada Birds Move In Response to Warmer, Wetter Climate."**

According to a new study by biologists from the University of California, Berkeley, 48 out of 53 bird species studied over the last decade in California's Sierra Nevada mountains have adjusted to climate change by moving to sites with more favorable temperature and precipitation conditions. Researchers collected data from a survey of 82 sites in the Sierra Nevada to detail the changes in birds' geographic range over the course of a century. On average, the sites have seen a 1.4°F increase in temperature and nearly a quarter of an inch increase in rainfall during the breeding season since the early 1900s. Even though some species moved toward warmer temperatures, while others preferred cooler climates, scientists predicted the majority of their responses by using models to predict the impact of climate change. Researchers compared their findings with earlier records to eliminate the chance of calculating false absences. The findings claim that the several species that did not relocate due to climate change, such as the Anna's Hummingbird and the Western Scrub-Jay, were able to adapt more easily to urban or suburban areas. The journal article, titled, "Birds track their Grinnellian niche through a century of climate change," is available at: http://www.pnas.org/content/early/2009/09/14/0901562106.abstract. September 14, 2009, http://www.sciencedaily.com/releases/2009/09/090914151625.htm.

***BBC News*, "'Artificial Trees' to Cut Carbon,"** and ***Institute of Mechanical Engineers Press Release*, "Geo-Engineering – Cooling the Planet?"**

A recent study revealed that a forest of 100,000 "artificial trees" could deployed within 10 to 20 years to help absorb the world's carbon emissions. The findings are part of a newly published report that highlights three geo-engineering ideas that could be put into effect to address potential climate change. The trees would capture CO_2 from the air through a filter, removed, and stored. The report states a tree manufactured at a cost of $20,000 could remove as much as 10 tonnes of CO_2 per day. The prototype artificial tree is approximately the size of a shipping container and could remove thousands of times more atmospheric CO_2 than a real tree of the same size. The authors, who believe geo-engineering should be used in conjunction with efforts to reduce carbon emissions and adapt to the effect(s) of potential climate change, studied hundreds of different options before settling on the three most practical and feasible given today's technology. The full report, titled, "Geo-Engineering – Giving Us the Time to Act," is available at: http://www.imeche.org/NR/rdonlyres/448C8083-F00D-426B-B086-565AA17CB703/0/IMechEGeoengineeringReport.pdf. August 27, 2009, http://news.bbc.co.uk/2/hi/science/nature/8223528.stm, and August 27, 2009, http://www.imeche.org/media/press/GeoEngineeringReport.htm.

Policy

***Carbon Capture Journal*, "Australian Government Accepts Liability for Gorgon LNG."**

The Australian and Western Australian Governments have agreed to accept the long-term liability associated with the storage of CO_2 in geological formations under Barrow Island as part of the Gorgon LNG project. Officials said the decision to accept a portion of the long-term CO_2 storage liability acknowledges the scale of the Gorgon LNG project, the opportunity it provides to demonstrate CCS technology at industrial scale, and the environmental significance of Barrow Island. The

Policy (Continued)

Gorgon CCS operation will be a major part of the global portfolio of CCS projects supported by the Australian-led Global Carbon Capture and Storage Institute (GCSSI). The project, which will receive $60 million in funding from the Australian Government, would be the world's largest demonstration of CCS technology. The multi-billion dollar Gorgon LNG project will be the biggest single investment ever made in Australia, surpassing the $12 billion Pluto LNG project now under construction in Western Australia. The Gorgon Project is a joint venture between Chevron, ExxonMobil, and Shell. For more information about the Gorgon Project, click: http://www.gorgon.com.au/; several project fact sheets can be found at: http://www.gorgon.com.au/01gp_factsheets.html#frames(content=01gp_factsheets_body.html). August 19, 2009, http://www.carboncapturejournal.com/displaynews.php?NewsID=426&PHPSESSID=pok6e6i4hprlc4c3sf1sdh0740.

"Policy modeling on the GDP spillovers of carbon abatement policies between China and the United States."

The following is the Abstract of this article: "This paper simulates the GDP spillover effects between China and U.S. caused by the implementation of different climate protection policies. It is based on a combination of several climate protection models, which are the State-contingent Model and the Demeter Model, and the GDP Spillovers Model, known as the Mundell–Fleming model. From the simulation results, it is concluded that whether the United States implements policies on increasing carbon sink or not makes very little difference on the total output in the U.S. and the GDP spillovers toward China. However, the spillover impact of American carbon abatement policies on China experiences a varying trend that rises from negative to positive. These simulation results show that the climate protection policies of one country will have positive impact on the GDP spillovers of another country in the long term. This paper is focused on two conditions while simulating the GDP for both China and the U.S. Condition A within the simulations ignores the impact of GDP spillovers of foreign countries, while condition B takes the impact of GDP spillovers of foreign countries into consideration. Furthermore, this paper presents the simulated GDP of China and the U.S. under different scenarios and analyzes the level of GDP spillovers between the two countries. This paper concludes that carbon abatement policies in the U.S. have a larger and more noticeable GDP spillover effects to China." **Zheng Wang, Hua-Qun Li, Jing Wu, Yi Gong, Huan-Bo Zhang, and Chen Zhao**, *Economic Modeling*, Available online August 21, 2009, doi:10.1016/j.econmod.2009.07.011, http://www.sciencedirect.com/science/article/B6VB1-4X24C50-2/2/6ed6f71ec9e927c06a848c5e945f2fac. (Subscription may be required.)

Geology

"Short-Range Atmospheric Dispersion of Carbon Dioxide."

The following is the Abstract of this article: "[The authors] present a numerical study aimed at quantifying the effects of concentration-dependent density on the spread of a seeping plume of CO_2 into the atmosphere such as could arise from a leaking geologic carbon sequestration site. Results of numerical models can be used to supplement field monitoring estimates of CO_2 seepage flux by modeling transport and dispersion between the source emission and concentration-measurement points. [The authors] focus on modeling CO_2 seepage dispersion over relatively short distances where density effects are likely to be important. [The authors] model dense gas dispersion using the steady-state Reynolds-averaged Navier-Stokes equations with density dependence in the gravity term. Results for a two-dimensional system show that a density dependence emerges at higher fluxes than prior estimates. A universal scaling relation is derived that allows estimation of the flux from concentrations measured downwind and vice versa." **Andrea Cortis and Curtis M. Oldenburg**, *Boundary-Layer Meteorology*, Available online August 20, 2009, doi: 10.1007/s10546-009-9418-y, http://www.springerlink.com/content/725h341984k04585/?p=1d42a0507fd548f1b9f0802e886580e7&pi=1. (Subscription may be required.)

"On Mobilization of Lead and Arsenic in Groundwater in Response to CO_2 Leakage from Deep Geological Storage."

The following is the Abstract of this article: "If [CO_2] stored in deep saline aquifers were to leak into an overlying aquifer containing potable groundwater, the intruding CO_2 would change the geochemical conditions and cause secondary effects mainly induced by changes in pH. In particular, hazardous trace elements such as lead and arsenic, which are present in the aquifer host rock, could be mobilized. In an effort to evaluate the potential risks to potable water quality, reactive transport simulations were conducted to evaluate to what extent and mechanisms through which lead and arsenic might be mobilized by intrusion of CO_2. An earlier geochemical evaluation of more than 38,000 groundwater quality analyses from aquifers throughout the United States and an associated literature review provided the basis for setting up a reactive transport model and examining its sensitivity to model variation. The evaluation included identification of potential mineral hosts containing hazardous trace elements, characterization of the modal bulk mineralogy for an arenaceous aquifer, and augmentation of the required thermodynamic data. The reactive transport simulations suggest that CO_2 ingress into a shallow aquifer can mobilize significant lead and arsenic, contaminating the groundwater near the location of intrusion and further downstream. Although substantial increases in aqueous concentrations are predicted compared to the background values, the maximum permitted concentration for arsenic in drinking water was exceeded in only a few cases, whereas that for lead was never exceeded." **Liange Zheng, John A. Apps, Yingqi Zhang, Tianfu Xu, and Jens T. Birkholzer**, *Chemical Geology*, Available online September 14, 2009, doi: 10.1016/j.chemgeo.2009.09.007, http://www.sciencedirect.com/science/article/B6V5Y-4X77HKX-1/2/01d02efee1c243b35262087c5a3aa0df. (Subscription may be required.)

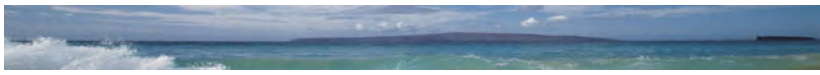
TECHNOLOGY

"Near-surface monitoring for the ZERT shallow CO_2 injection project."

The following is the Abstract of this article: "As part of a collaborative effort operated by the Zero Emission Research and Technology Center (ZERT), a series of two shallow releases of CO_2 was performed at a test site in Bozeman, MT. The purpose of the experiment was to simulate possible leakage scenarios from a [CCS] operation in order to further develop and verify monitoring technologies used to characterize and quantify the release of CO_2. The project included collaboration with several research groups and organizations. Presented here are the results of soil-gas monitoring conducted by researchers from [NETL], including CO_2 flux measurement, soil-gas analysis, perfluorocarbon tracer monitoring, and soil resistivity measurements. Together, these methods proved to be effective in detecting and characterizing leakage in the near-surface." **Brian R. Strazisar, Arthur W. Wells, J. Rodney Diehl, Richard W. Hammack, and Garret A. Veloski**, *International Journal of Greenhouse Gas Control*, Available online September 10, 2009, doi:10.1016/j.ijggc.2009.07.005, http://www.sciencedirect.com/science/article/B83WP-4X6DBSP-1/2/81951c72053928267b24d24b6cf545c4. (Subscription may be required.)

"The influence of membrane CO_2 separation on the efficiency of a coal-fired power plant."

The following is the Abstract of this article: "In this paper, the influence of membrane separation of CO_2 from flue gases and the impacts of the whole CCS process (CO_2 separation and compression) on the performance of a coal-fired power plant are studied. First, the effects of the characteristics of the membrane (selectivity and permeability) and the parameters of the process (feed and permeate pressure) on two indices, CO_2 recovery rate and CO_2 purity are analyzed. Next, a method for determining the minimum power loss and efficiency loss of the power plant as a function of these calculated indices is described. Then, the power requirements and efficiency loss (up to 15.4 percentage points) because of the CCS installation are calculated. A method for reducing these losses through the integration of the CCS installation with the power plant is also proposed. The main aims of the integration are heat exchange between media and a decrease in the CO_2 temperature before compression. Implementing this process can result in a significant reduction of the efficiency loss by [eight] percentage points." **Janusz Kotowicz, Tadeusz Chmielniak, and Katarzyna Janusz-Szymańska**, *Energy*, Available online September 2, 2009, doi: 10.1016/j.energy.2009.08.008, http://www.sciencedirect.com/science/article/B6V2S-4X4RCH0-2/2/e5e1acc1f5ba738477c4a6bce23da781. (Subscription may be required.)



TERRESTRIAL

"Forest carbon sequestration changes in response to timber harvest."

The following is the Abstract of this article: "Forest succession contributes to the global terrestrial carbon (C) sink, but changes in C sequestration in response to varied harvest intensities have been debated. The forests of the Central Appalachian region have been aggrading over the past 100 years following widespread clear-cutting that occurred in the early 1900s and these forests are now valuable timberlands. This study compared the history of ecosystem C storage in four watersheds that have been harvested at different frequencies and intensities since 1958. [The authors] compared NPP, NEP, and component ecosystem C fluxes (g C m−2 year−1) in response to the four different harvest histories (no harvest, clear-cutting, single tree selection cutting, and 43 cm diameter-limit cutting). Clear-cutting had short-term negative effects on NEP but harvest did not significantly impact long-term average annual C sequestration rates. Average plant C (g C m−2) since 1950 was about 33 [percent] lower in response to a clear-cut event than plant C in an un-harvested forest, suggesting that the C sequestration associated with clear-cutting practices would decline over time and result in lower C storage than diameter-limit cut, selective cut, or un-harvested forests. Total C stored over a 55-year period was stimulated ~37 [percent] with diameter-limit cutting and selective cutting relative to un-harvested forests." **Sarah C. Davis, Amy E. Hessel, Carrie J. Scott, Mary Beth Adams, and Richard B. Thomas**, *Forest Ecology and Management*, Available online September 1, 2009, doi: 10.1016/j.foreco.2009.08.009, http://www.sciencedirect.com/science/article/B6T6X-4X4G2NG-1/2/6b6a4cfc45dad50bfdba39dd1776a32e. (Subscription may be required.)

Carbon Market Update, September 16, 2009	
CCX-CFI 2009 ($/tCO$_2$) $0.25 (Vintage 2009)	EU ETS-EUA DEC 2009 ($/tCO$_2$) $20.71 (Converted from € to US$)

TRADING

***RGGI News Release*, "Market for RGGI CO_2 Allowances Competitive and Efficient."**

The secondary market for Regional Greenhouse Gas Initiative (RGGI) CO_2 allowances saw a significant increase in the number of market participants and the volume of allowances traded throughout the second quarter of 2009, according to a report released by the 10 Northeast and Mid-Atlantic states participating in RGGI. The report, titled, "Report on the Secondary Market for RGGI CO_2 Allowances," was prepared by Potomac Economics. In addition to this finding, the report also states that during the reporting period the number of participants in the market for RGGI allowance derivatives increased; futures contract trading

Trading (Continued)

saw a five-fold increase from the end of the first quarter of 2009; prices for RGGI futures stabilized; and the ownership of allowances more than doubled from the end of the first quarter of 2009. The conclusions are based on the analysis of data reported to the Commodity Futures Trading Commission, the Chicago Climate Futures Exchange, the New York Mercantile Exchange, and other data. The complete report is available at: www.rggi.org/Secondary_Market_Report_September_2009.pdf. September 4, 2009, http://www.rggi.org/docs/Secondary_Market_Report_September_2009.pdf.

Recent Publications

"**A Technical Basis for Carbon Dioxide Storage." The following is from the Introduction of this document: "**

The geological storage of CO_2 may enable real progress in the global effort to make meaningful near-term reductions in greenhouse gas (GHG) emissions especially from large-point source emitters such as power plants, refineries, cement plants and steel mills. CCS is not a panacea, but it does offer a tangible means to deal with large volumes of gas emissions by using technologies already in-hand, and improving them. CCS is a bridging technology during the transition to an alternative energy future. Optimism for its success is based on industrial experience, but even proponents acknowledge that there are several issues that need to be addressed before it can achieve widespread application. Typically, CCS or CO_2 capture and storage is defined as the integrated process of gas separation at industrial plants, transportation to storage sites, and injection into subsurface formations. US government agencies will use the word 'sequestration' instead of 'storage,' but the meaning is the same and the acronym for all, including many international organizations, is CCS. When CO_2 is stored or sequestered, it is injected into the pore space of rocks deep in the earth's subsurface (at depths typically greater than 1,000 meters) and carefully designed operational protocols are observed to provide for safe operations. Once the CO_2 is safely injected in the ground, it is expected to remain there for a geological period of time. Drawing on the wide variety of practical experience in the oil and gas industry, this document addresses key technical aspects and technological innovations used in the geological storage of CO_2. The text cites numerous examples of projects comparable in size and scope to large CCS operations. The document is not a comprehensive review of geological storage or industry best practice, but in its four chapters addresses frequently discussed areas where there is likely to be particular value in sharing industry knowledge." To view the rest of this document, visit: http://www.cplccp.net/co2_storage_technical_book.html#Contents. (Subscription may be required.)

"A Technical Appraisal of the Feasibility for CO_2 Sequestering Operations for the Gorgon Gas Field Development Proposal – Phase IV."

The following is from the Executive Summary of this document: "The Greater Gorgon Area gas fields lie off the northwest coast of Australia in an area known geologically as the Carnarvon Basin. These gas fields represent a world class gas resource containing approximately 25 [percent] of all the natural gas discovered to date in Australia. It is proposed that the exploitation of these fields will commence with the development of the Gorgon and Jansz-Io fields with the natural gas piped to [an LNG] processing facility to be constructed on Barrow Island some 60 km off the northwest coast of Western Australia. The natural gas in the Gorgon field contains approximately 14 [percent] CO_2 while the natural gas in the Jansz-Io field contains less than [one percent] CO_2. This CO_2 will be produced with the hydrocarbon gases as the fields are developed. Along with minor concentrations of other substances, the CO_2 will be separated from the hydrocarbon gases at the proposed LNG processing facility to be built on Barrow Island. Established global practice is for the reservoir CO_2 to be vented to the atmosphere; however the Gorgon Joint Venturers plan to dispose of this reservoir [CO_2] by injecting it underground into the Dupuy Formation beneath Barrow Island. Chevron, as Operator of the Gorgon Joint Venture (GJV), propose to utilize the Dupuy Formation beneath Barrow Island as the host reservoir for the permanent (i.e., >1,000 years) disposal of the 1.5-3.1 trillion standard cubic feet (TCF) of CO_2 which is expected to be produced in conjunction with hydrocarbon gases from the Gorgon and Jansz-Io gas fields. The objective of permanently disposing of the CO_2 in this deep underground reservoir is to prevent it entering the atmosphere, where it would act as a greenhouse gas and potentially contribute to global climate change. The Gorgon CO_2 disposal project will be potentially the largest such project in the world, and has attracted international attention." The complete Executive Summary is available at: https://extra.co2crc.com.au/modules/pts2/download.php?file_id=3505&rec_id=1826.

Legislative Activity

***U.S. Senator John Kerry News Release*, "Kerry, Boxer Introduce 'Clean Energy Jobs and American Power Act.'"**

On September 30, 2009, Senators John Kerry and Barbara Boxer introduced "The Clean Energy Jobs and American Power Act" to create clean energy jobs, reduce pollution, and protect American security by enhancing domestic energy production and addressing global climate change. The Clean Energy Jobs and American Power Act seeks to reduce carbon emissions by 20 percent by 2020 and 80 percent by 2050 from 2005 levels. The reductions will be possible through a "Pollution Reduction and Investment" system that allows companies to reduce carbon emissions at a minimal cost; rewards companies that have already taken action; and creates incentives for the companies that are most efficient in their actions in the future. In particular, the bill would: (1) provide $10 billion over 10 years to support research and development (R&D) of new CCS technologies for the next generation of coal-fired power plants; (2) provide additional funding to those who quickly implement carbon CCS technology on new or retrofitted plants; and set performance standards to provide guidance to the industry on advanced technology implementation. A summary of the bill is available at: http://kerry.senate.gov/cleanenergyjobsandamericanpower/pdf/Summary.pdf. September 30, 2009, http://kerry.senate.gov/cfm/record.cfm?id=318435.

Events

October 4-7, 2009, **Gasification Technologies Conference**, *Colorado Springs, Colorado, USA*. This conference will provide participants with information, analysis, and networking opportunities to better understand the gasification market. One of the major topical sessions will include a discussion on carbon management, liability, incentives, and regulations. For more information, visit: http://www.gasification.org/conferences/annual_conferences.aspx.

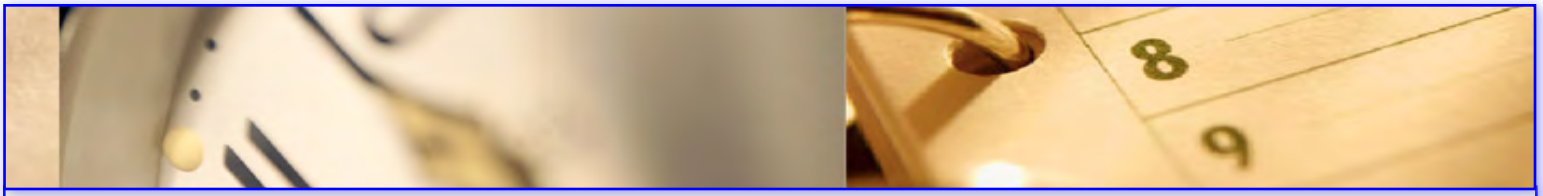
October 6-7, 2009, **Gearing Up for a Low Carbon Economy**, *The Fairmont Palliser Hotel, Calgary, Alberta, Canada*. Hosted by The Canadian Institute, this conference will provide a forum for networking and discussions revolving around a future carbon emissions framework in North America. Attendees will also be provided with up-to-date carbon policy information from both the United States and Canada. For registration information, visit the conference website at: http://www.canadianinstitute.com/carbonmgmt.htm.

October 27-28, 2009, **2009 Clean Carbon Policy Summit**, *AT&T Conference Center - UT Austin, Austin, Texas, USA*. Government officials and industry leaders from Texas will gather for this event to examine the issues involved with ultra clean technologies. Included is a session focused on CO_2 capture, transportation, and cleanup. To download the full agenda, visit the conference website at: http://www.iemshows.com/cleancarbon/.

October 28, 2009, **Greenhouse Gas and Sustainability Symposium**, *I Hotel and Conference Center, Champaign, Illinois, USA*. Sponsored by the Illinois Sustainable Technology Center, this free event includes discussions and presentations on the potential impact of climate change, the business of carbon, the cost of GHG mitigation, GHG reporting, and updates on carbon sequestration projects. For more information, click: http://www.istc.illinois.edu/special_projects/greenhouse-gas-sustainability-symposium.cfm.

November 2-4, 2009, **Carbon Market Insights Americas 2009**, *Marriott Marquis Hotel, New York City, New York, USA*. This conference will focus on international negotiations and domestic legislation in the carbon market. The program will also focus on the trading and market dynamics of carbon as an emerging commodity. To download a detailed program, visit the conference website at: http://www.pointcarbon.com/events/conferences/cmia09/.

November 5-6, 2009, **3rd International Symposium: Capture and Geological Storage of CO_2 - Accelerating Deployment**, *Paris, France*. This symposium takes a global and cross-disciplinary approach that focuses on the industrial deployment of CCS. Included in the agenda is a discussion on DOE's RCSPs. For more information, including a detailed program, visit the conference website at: http://www.co2symposium.com/.



Events (Continued)

November 9-11, 2009, **Carbon Capture and Storage for Utilities**, *Omni Hotel at CNN Center, Atlanta, Georgia*. This conference will discuss and review how to accurately estimate reliable capacities of CO_2 storage; examine developing pore space ownership issues from leading law firms; interpret strategies from current CCS project developers; and analyze critical public outreach, water issues, technological advancements and MVA best practices. For more information, go to: http://www.euci.com/conferences/1109-ccs/index.php?ci=824, or click: http://www.co2symposium.com/CO2symposium-2009_Registration-Form.pdf to view the registration form.

November 9-10, 2009, **Climate Change - Measuring and Reducing Your Carbon Footprint in a Changing Regulatory Environment**, *Courtyard Marriott, Toronto, Canada*. This two-day program will include climate change experts and Federal and provincial government representatives to guide attendees through the changing regulatory and reporting requirements, as well as provide tools for businesses to become carbon neutral. To download a brochure, visit the CSA Standards' website at: https://learningcentre.csa.ca/lc_site/be.asp?gid=50016245&tid=50041499.

November 22-27, 2009, **CO_2 Geological Storage: Latest Progress**, *Universitätszentrum Obergurgl, Ötz Valley, Innsbruck, Austria*. The aim of this conference is to examine the last decade of CO_2 geological storage research and outline the future challenges. On the final day of the event, a summary of the CO_2 geological storage project cycle, from design to injection, closure, and then abandonment, will be presented. To learn more about this event, visit the conference website at: http://www.esf.org/index.php?id=5253.

December 11-12, 2009, **Carbon Credit International Conference**, *New Delhi, India*. Attendees of this international conference will develop knowledge of the clean development mechanism (CDM) through the trading of carbon credits. In addition, attendees will be provided with carbon financing opportunities and have the chance to network with individuals working in the CDM market. To learn more, visit the conference website at: http://www.onlinecarbonfinance.com/.

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 Sean Plasynski at sean.plasynski@netl.doe.gov, or Dawn Deel at dawn.deel@netl.doe.gov.