Carbon Sequestration Newsletter

May 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

NETL Releases Updated Version of the Carbon Sequestration Website.

The U.S. Department of Energy's (DOE) National Energy Technology Laboratory (NETL) released a new, user-friendly version of the Carbon Sequestration Program website in early May. The Carbon Sequestration Program website contains both introductory and in-depth information about sequestration fundamentals, supporting technologies, sequestration applications, environmental benefits, and the status of the latest research and development (R&D) activities. In addition, the website, which is accessible from the NETL homepage, contains updated material on the program's Core R&D, Infrastructure, and Global Collaborations elements; a modified Frequently Asked Questions (FAQ) section; a section highlighting the National Carbon Sequestration Database and Geographic Information System (NATCARB); and an updated Reference Shelf. NETL's Carbon Sequestration Program is developing a technology portfolio of safe, cost-effective, commercial-scale carbon dioxide (CO_2) capture, storage, and mitigation technologies that will be available for commercial deployment beginning in 2020. The updated website can be viewed at: http://www.netl.doe.gov/technologies/carbon_seq/index.html.

Sequestration in the News

***University of Wyoming News Release,* "Drilling to Begin at Carbon Storage Project Site."**

Phase I of the Wyoming Carbon Underground Storage Project (WY-CUSP) was scheduled to begin on the Rock Springs Uplift in Sweetwater County, Wyoming, in late April. The $16.9 million Phase I project, co-sponsored by DOE's Office of Fossil Energy (FE), is expected to lay the groundwork for Wyoming's first successful carbon capture and storage (CCS) project and produce a detailed characterization of two saline formations for potential pilot- and commercial-scale CO_2 storage. Drilling the 2,000-foot top hole, the first stage of the 14,000-foot stratigraphic test well, is expected to take in the range of 30 to 60 hours to complete. Once a large rig is onsite, the remainder of the drilling will take approximately 100 days. According to preliminary data from prior research, the Rock Springs Uplift has the potential to store 26 billion tons of CO_2 over 50 years. The project's initial phase began in December 2009; project completion is scheduled for December 2012. April 22, 2011, http://www.uwyo.edu/uw/news/2011/04/drilling-to-begin-sunday-at-carbon-storage-project-site.html.

***Energy Central,* "Government Approves $1.24 Billion Carbon Capture Project."**

The Government of Saskatchewan has approved a $1.24 billion Integrated Carbon Capture and Storage (CCS) Demonstration Project at SaskPower's Boundary Dam Power Station. The project will transform a generating unit at Boundary Dam into a producer of reliable, clean electricity while

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Sequestration in the News (Continued)

reducing greenhouse gas (GHG) emissions by approximately 1 million tonnes per year and capturing CO_2 for enhanced oil recovery (EOR). The project received $240 million in Federal funding. SNC Lavin, an engineering and construction company, will oversee the engineering, procurement, and construction activities, while Cansolv, subsidiary of Shell Global Solutions, will supply the carbon capture process. The new generating unit is expected to begin operations in 2014 and have the capacity to generate 110 megawatts (MW) of electricity. April 26, 2011, http://www.energycentral.com/functional/news/news_detail.cfm?did=19778297. (Subscription may be required.)

***Carbon Capture Journal*, "Oil Refinery CO_2 Capture Pilot in Brazil."**

An oxy-combustion capture test has been initiated by the CO_2 Capture Project (CCP) on a pilot-scale Fluid Catalytic Cracking (FCC) unit at a Petrobras research complex in Parana state, Brazil. The test is expected to progress a technology capable of capturing up to 95 percent of FCC CO_2 emissions (potentially equivalent to 20 to 30 percent of emissions from a typical refinery). The demonstration will test start-up and shut-down procedures and different operational conditions and process configurations. The testing is expected to confirm the technical and economic viability of retrofitting an FCC unit to enable CO_2 capture through oxy-combustion. The testing is scheduled for completion at the end of May 2011. To view the project fact sheet, click: http://www.co2captureproject.com/media/CCP_Project_Factsheet_FCC_March2011_Final.pdf. April 8, 2011, http://www.carboncapturejournal.com/displaynews.php?NewsID=776.

ANNOUNCEMENTS

NETL Releases Worldwide CCS Database – Version 3.

In April 2011, NETL released Version 3 of its CCS Database, including updated information on active, proposed, canceled, and terminated CCS projects worldwide. The 254 projects in the CCS Database include 65 capture, 61 storage, and 128 capture and storage projects in more than 27 countries across 6 continents. While most of the projects are still in the planning and development stage, or have recently been proposed, 20 are actively capturing and injecting CO_2. Access to the database requires Google Earth. To view NETL's CCS Database, please visit: http://www.netl.doe.gov/technologies/carbon_seq/global/database/index.html.

NETL's 2011 Carbon Sequestration Project Portfolio Available Online.

DOE/NETL's 2011 Carbon Sequestration Project Portfolio contains selected Carbon Sequestration Program papers and publications; NETL's Best Practices Manuals (BPMs); Infrastructure fact sheets (Regional Carbon Sequestration Partnership [RCSP] Validation and Development Phases); and Carbon Sequestration Core R&D fact sheets (pre-combustion capture; geologic carbon storage; monitoring, verification, and accounting [MVA]; simulation and risk assessment; and CO_2 utilization). The portfolio is available at: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/project%20portfolio/2011/index.html.

Second Issue of Fossil Energy Today Released.

The second issue of "Fossil Energy Today," a free quarterly newsletter published by DOE's FE, has been released, providing updates on important activities, progress, and other developments within FE. For more information, as well as links to the first two issues, visit: http://www.fossil.energy.gov/news/energytoday.html.

Global CCS Institute Launches CCS Regulatory Test Toolkit.

The Global CCS Institute released a toolkit that provides a blueprint for nations to ensure they use best practice regulations and permitting processes for CCS projects. To access the toolkit, visit: http://globalccsinstitute.com/CCSRegToolkit. For more information, click: http://globalccsinstitute.com/institute/news/global-ccs-institute-launches-ccs-regulatory-test-toolkit.

Taiwan Unveils Carbon Capture and Storage Alliance.

Taiwan's Environmental Protection Administration (EPA) has launched a CCS alliance as part of their government's efforts to reduce GHG emissions. According to officials, a key alliance pilot program involves the removal, capture, and storage of 10,000 tons of CO_2 in geologic formations. The alliance includes the Bureau of Energy, Council for Economic Planning and Development, National Science Council, CPC Corp, and Taiwan Power Co. To learn more about the CCS alliance, click: http://www.taiwantoday.tw/ct.asp?xItem=158133&ctNode=445.

SCIENCE

***International Union for Conservation of Nature*, "Degraded Coastal Wetlands Contribute to Climate Change."**

According to a new report, drainage and degradation of coastal wetlands emit amounts of CO_2 into the atmosphere, leading to decreased carbon storage. The report highlights the current rates of degradation and loss of coastal wetlands, which are up to four times those of tropical forests. A total of 15 coastal deltas were studied, with seven found to have each released more than 500 million tons of CO_2 since the wetlands were drained – mostly within the past 100 years. Mangroves, tidal marshes, and sea-grass meadows remove CO_2 from the atmosphere and store it in soil. When they are degraded as a result of drainage or conversion for agriculture, they emit CO_2 into the atmosphere. The report also calls for coastal wetlands to be protected and for the improving of their restoration to be included in CO_2 reduction strategies. April 11, 2011, http://www.iucn.org/?7239/Degraded-Coastal-Wetlands-Contribute-to-Climate-Change.

***Oregon State University News Release*, "Carbon Sequestration Estimate in U.S. Increased – Barring a Drought."**

According to a study published in the journal Agricultural and Forest Meteorology, forests and other terrestrial ecosystems in the lower 48 U.S. states have the potential to store up to 40 percent of U.S. fossil fuel carbon emissions, which is larger than the previously estimated amount. However, the scientists also note that major disturbances – such as droughts, wildfires, and hurricanes – can affect the amount of CO_2 stored in a given year. For example, large droughts that happened twice in the United States in the past decade reduced carbon storage approximately 20 percent (compared to a "normal" year). The research, which was compiled by scientists from 35 institutions, found that the temperate forests in the eastern United States absorbed carbon because of forest regrowth following the abandonment of agricultural lands, while some areas of the Pacific Northwest absorbed carbon during much of the year due to the region's mild climate. April 14, 2011, http://oregonstate.edu/ua/ncs/archives/2011/apr/carbon-sequestration-estimate-us-increased-%E2%80%93-barring-drought.

POLICY

***Reuters*, "German Cabinet Relaunches Carbon Storage Bill,"** and ***PhysOrg*, "German Cabinet Approves CO_2 Storage Bill."**

The Federal Environment Ministry of Germany has relaunched legislation to back development of CCS technology needed for coal-fired power generation. The draft bill will lay the foundation for testing and demonstration efforts, allowing pilot and demonstration projects to move forward ahead of a viability assessment in 2017. The bill implements a directive from the European Union (EU), and also includes a clause giving Germany's 16 states input on where potential storage sites will be located. If passed by the lower house of parliament, the law would then need to be approved by the upper house, which represents states. April 13, 2011, http://www.reuters.com/article/2011/04/13/us-germany-carbon-storagebill-idUSTRE73C2F520110413, and April 13, 2011, http://www.physorg.com/news/2011-04-german-cabinet-co2-storage-bill.html.

"Carbon capture and storage policy in the United States: A new coalition endeavors to change existing policy."

The following is the Abstract of this article: "CCS is considered by some to be a promising technology to reduce [GHG] emissions, and advocates are seeking policies to facilitate its deployment. Unlike many countries, which approach the development of policies for geologic storage (GS) of CO_2 with nearly a blank slate, the [United States] already has a mature policy regime devoted to the injection of CO_2 into deep geologic formations. However, the existing governance of CO_2 injection is designed to manage EOR, and policy changes would be needed to manage the risks and benefits of CO_2 injection for the purpose of avoiding GHG emissions. [The authors] review GS policy developments at both the U.S. [Federal] and state levels, including original research on state GS policy development. By applying advocacy coalition framework theory, [the authors] identify two competing coalitions defined by their beliefs about the primary purpose of CO_2 injection: energy supply or GHG emission reductions. The established energy coalition is the beneficiary of the current policy regime. Their vision of GS policy is protective: to minimize harm to fossil energy industries if climate policy were to be enacted. In contrast, the newly formed climate coalition seeks to change existing GS policy to support their proactive vision: to maximize GHG reductions using CCS when climate policy is enacted. [The authors] explore where and at what scale legislation emerges and examine which institutions gain prominence as drivers of policy change. Through a detailed textual analysis of the content of state GS legislation, [the authors] find that the energy coalition has had greater success than the climate coalition in shaping state laws to align with its policy preferences. It has enshrined its view of the purpose of CO_2 injection in state legislation, delegated authority for GS to state agencies aligned with the existing policy regime, and protected the EOR status quo, while creating new opportunities for EOR operators to profit from the storage of CO_2. The climate coalition's objective of proactively putting GS policy in place has been furthered, and important progress has been made on commonly held concerns, such as the resolution of property rights issues, but the net result is policy change that does not significantly revise the existing policy regime." **Melisa Pollak, Sarah Johnson Phillips, and Shalini Vajjhala**, *Global Environmental Change*, Available online March 25, 2011, doi:10.1016/j.gloenvcha.2011.01.009, http://www.sciencedirect.com/science/article/B6VFV-52G1RVM-1/2/6d935921b13797f5d23a956261a5088c. (Subscription may be required.)

"The socio-political context for deploying CCS in China and the U.S."

The following is the Abstract of this article: "Together, the [United States] and China emit roughly 40 [percent] of world's [GHG] emissions, and these nations have stated their desire to reduce absolute emissions (U.S.) or reduce the carbon intensity of the economy (China). However, both countries are dependent on coal for a large portion of their energy needs, which is projected to continue over the next several decades. They also have large amounts of coal resources, coal-dependent electricity production, and in China's case, extensive use of coal in the industrial sector, making any shift from coal socio-politically difficult. Both nations could use CCS technologies to simultaneously decrease [GHG] emissions and continue the use of domestic coal resources; however, the socio-political context for CCS deployment differs substantially between the two countries and potentially makes large-scale CCS deployment challenging. Here, [the authors] examine and compare the political and institutional contexts shaping CCS policy and CCS deployment, both for initial pilot projects and for the creation of large-scale CCS technology deployment, and analyze how the socio-political context for CCS in China and the United States aligns with national climate, energy security, and economic priorities." **Elizabeth Wilson, Dongjie Zhang, and Li Zheng**, *Global Environmental Change*, Available online March 26, 2011, doi:10.1016/j.gloenvcha.2011.01.012, http://www.sciencedirect.com/science/article/B6VFV-52G7HR6-1/2/d71d91ba05b0e46d31dc45aeb342d8ff. (Subscription may be required.)

"Analysis of Carbon Capture and Sequestration Pore Space Legislation: A Review of Existing and Possible Regimes."

The following is the Abstract of this article: "State-level CCS legislation, especially related to pore space designation, has blossomed over the last few years. However, the legislation that has passed does not yet provide an environment that would lead to the successful commercialization of CCS. Allowing the [Federal] government to assume pore space ownership would not solve all the problems, but would certainly simplify some of them by reducing the amount of future litigation." **Elizabeth Lokey Aldrich and Cassandra Koerner**, *The Electricity Journal*, Available online March 29, 2011, doi:10.1016/j.tej.2011.03.001, http://www.sciencedirect.com/science/article/B6VSS-52GWV1V-2/2/afb27ac92c284e6b1b51815b049459f0. (Subscription may be required.)

GEOLOGY

"Enhancing serpentine dissolution kinetics for mineral carbon dioxide sequestration."

The following is the Abstract of this article: "Mineral [CO_2] sequestration binds [CO_2] by reacting it with magnesium silicate minerals to form solid magnesium carbonates that are ready for disposal. Research on mineral sequestration has focused on enhancing

Geology (Continued)

process kinetics in aqueous processing schemes. High costs of these processes are associated with mineral processing, such as ultrafine grinding, or the consumption of acids and bases, which are required to speed up silicate mineral dissolution kinetics. Neutral organic salts such as sodium oxalate, and citrate enhance dissolution kinetics of serpentine in the circum-neutral pH range appropriate for mineral carbonate precipitation and have potential for use in an enhanced carbonation process. Concentration and temperature dependencies for the dissolution of antigorite serpentine in the presence of the citrate ion are experimentally derived under weakly acidic conditions. Rates are shown to be several orders of magnitude higher in the presence of citrate than in the weakly acidic solution alone." **Samuel C.M. Krevor and Klaus S. Lackner**, *International Journal of Greenhouse Gas Control*, Available online February 8, 2011, doi:10.1016/j.ijggc.2011.01.006, http://www.sciencedirect.com/science/article/B83WP-524FFMD-1/2/e8cc3058889d7334225bedd24be056ba. (Subscription may be required.)

"Effect of impurity gases in carbon dioxide on sorption behavior and mineral matter in an Australian bituminous coal."

The following is the Abstract of this article: "Injection of CO_2 into coal seams is considered a potential approach for sequestering it. However, the [CO_2] that is injected into seams may contain other gases that could potentially react with the coal and change its sorption behavior. Here [the authors] exposed samples of a moistened bituminous coal to small amounts of [sulfur dioxide (SO_2), hydrogen sulfide (H_2S), nitrogen dioxide (NO_2), ammonia (NH_3)] and a number of potential amine capture agents in sealed containers for up to two years, evacuated them and measured their sorption behavior and determined their mineralogy using low temperature ashing followed by quantitative X-ray diffraction analysis of the residue. Exposure of the coal to amines, H_2S or NO_2 had no effect on the sorption characteristics of the coal. However, SO_2 markedly reduced the CO_2 sorption capacity of the coal (by 25 [percent]). The minerals in the coal consisted mainly of quartz, kaolinite, illite and carbonates. Of the gases tested, only SO_2 modified the mineral matter extensively. It attacked the clays as well as carbonates, producing a range of sulfate minerals and amorphous material. This shows that the effects of SO_2 on sorption behavior and mineralogy of the coals need to be included in any prediction of sorption potential of coals if it is present in the CO_2 that is to be injected into the coal." **Richard Sakurovs, Steve Weir, David French, and Stuart Day**, *International Journal of Greenhouse Gas Control*, Available online April 9, 2011, doi:10.1016/j.coal.2011.04.001, http://www.sciencedirect.com/science/article/B6V8C-52K9DMB-1/2/84bb42ee88592ecbfbe68ff6e7b7ee51. (Subscription may be required.)

Technology

"Techno-economic evaluation of coal-to-liquids (CTL) plants with carbon capture and sequestration."

The following is the Abstract of this article: "Coal-to-liquids (CTL) processes that generate synthetic liquid fuels from coal are of increasing interest in light of the substantial rise in world oil prices in recent years. A major concern, however, is the large emissions of CO_2 from the process, which would add to the burden of atmospheric [GHGs]. To assess the options, impacts and costs of controlling CO_2 emissions from a CTL plant, a comprehensive techno-economic assessment model of CTL plants has been developed, capable of incorporating technology options for CCS. The model was used to study the performance and cost of a liquids-only plant as well as a co-production plant, which produces both liquids and electricity. The effect of uncertainty and variability of key parameters on the cost of liquids production was quantified, as were the effects of alternative carbon constraints such as choice of CCS technology and the effective price (or tax) on CO_2 emissions imposed by a climate regulatory policy. The efficiency and CO_2 emissions from a co-production plant also were compared to the separate production of liquid fuels and electricity. The results for a 50,000 barrels/day case study plant are presented." **Hari Chandan Mantripragada and Edward S. Rubin**, *Energy Policy*, Available online March 5, 2011, doi:10.1016/j.enpol.2011.02.053, http://www.sciencedirect.com/science/article/B6V2W-529Y854-2/2/cee1a6b7e2efe77ba24d1d760d0a362e. (Subscription may be required.)

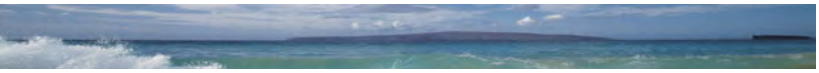
"Investigation of gridding effects for numerical simulations of CO_2 geologic sequestration."

The following is the Abstract of this article: "Potential errors caused by grid shape and resolution are investigated for numerical simulations of CO_2 geologic sequestration. The spatial orientation of finite difference grids can strongly influence the calculated shapes of CO_2 fronts due to so-called 'grid orientation effect'. A coarse vertical discretization of a reservoir can impede gravity override (i.e., less-dense CO_2 flows over denser groundwater) of CO_2 plumes, resulting in underestimation of the maximum plume size. It is known that injection of CO_2 into a saline [formation] may cause formation dry-out and precipitation of solid salt near the injection well, which may reduce porosity and permeability of the [formation]. Numerical simulation of salt precipitation may require very fine grid size near the injection well, because dry-out would be greatly underestimated in a large grid block containing a large amount of water. In this study, these gridding effects are demonstrated using one-dimensional and two-dimensional idealized models as well as a three-dimensional field-scale simulation model of a large-volume CO_2 injection in a saline formation in California's Central Valley. For the field-scale modeling, [the authors] generated a high-resolution grid model utilizing Voronoi tessellation. To solve the high-resolution model efficiently TOUGH-MP, a parallelized version of general purpose multi-phase flow simulator TOUGH2, was used. [The authors'] results indicate that (1) the use of higher-order Voronoi tessellation significantly reduces the 'grid-orientation effects'; (2) coarse grids considerably underestimate gravity override, and thus the maximum lateral extent of a CO_2 plume is also underestimated to a few tens of percent; (3) a fine gridding in the vicinity of the injection well may be needed to simulate near-well phenomena accurately, especially when the capillary-driven backflow to the well is significant." **Hajime Yamamoto and Christine Doughty**, *International Journal of Greenhouse Gas Control*, Available online March 16, 2011, doi:10.1016/j.ijggc.2011.02.007, http://www.sciencedirect.com/science/article/B83WP-52D4JW2-2/2/de4f8ccec13b3e9df4229bfb7f25ab04. (Subscription may be required.)

Technology (Continued)

"Feasibility of Distributed Carbon Capture and Storage (DCCS)."

The following is the Abstract of this article: "The concept of Distributed Carbon Capture and Storage (DCCS) for small scale CO_2 sources, such as Distributed Energy Systems (DES), is proposed, and Carbon Storage in a Shallow Aquifer (CSSA), in which CO_2 is stored in shallow [formations] as aqueous solution, is also studied as a technique for the DCCS. A conceptual design for the CSSA have been performed and the fundamental calculations in this study show that the dissolution capacity, that is, the amount of CO_2 which can be dissolved into unit volume of water in a shallow [formation] is 10-35 kg-CO_2/m^3 in the range of the storage depth of 100-500 m. The dissolution capacity of the CSSA is less than 10 [percent] of the possible amount of CO_2 stored by the ordinary CCS technique in which CO_2 is stored in the supercritical condition. However, the CSSA is estimated to allow the CO_2 storage at less than ¥3000/t-CO_2 of the storage cost and more than 20 years of the injection period for CO_2 sources of 1800-39,000 t-CO_2/year, which correspond to the CO_2 emissions from 0.1 to 10 MW DES. The required energy for the CSSA is estimated to be less than 10 [percent] of the energy generated by the CO_2 sources." **Tatsuki Tokoro, Tohru Kato, Yohei Tanaka, Ken Kato, Akira Negishi, and Ken Nozaki**, *Energy Conversion and Management*, Available online March 23, 2011, doi:10.1016/j.enconman.2011.01.016, http://www.sciencedirect.com/science/article/B6V2P-52FKTJ9-6/2/89fe9cda9a15903bfc3d70dc75272ba8. (Subscription may be required.)



Terrestrial

"Sensitivity to information upscaling of agro-ecological assessments: Application to soil organic carbon management."

The following is the Abstract of this article: "Upscaling of agro-ecological indicators applied in regional analyses is sensitive to scale issues of the input data. This study develops a methodology to quantify this sensitivity for an indicator of soil organic carbon (SOC) dynamics at the farming system level. A reference case consists of seven fully described farms in northern Italy. Both upscaling in complexity by substituting measured input with estimated input and upscaling in space by extending the methods to farms not included in the reference case are addressed. The indicator increased with 3-107 [percent] at four farms after substituting measured management input with that estimated by an expert, whereas it remained unchanged or decreased at the other three farms. Taking the modal value from a cluster of pedological input did not lead to additional uncertainty in most cases, and only slightly increased it in others. [The authors] evaluated spatial upscaling by including 733 farms divided in 18 clusters that were described with less information as compared to the reference farms. Within each cluster, [the authors] observed relevant variability of the indicator (coefficients of variation of 12-43 [percent]), as a consequence of the heterogeneity of farms comprised in each cluster. In each cluster [the authors] calculated the indicator for one virtual farm, defined by using modal values for basic farm inputs. In this case the indicator was highly correlated ($R^2 = 0.98$) with the average of the values obtained using measured basic farm inputs. [The authors] conclude that upscaling in complexity and space introduces uncertainty in the values of the indicator compared to the reference case. The extent of such differences depends on the variability of the systems under analysis and on indicator sensitivity." **Luca Bechini, Nicola Castoldi, and Alfred Stein**, *Agricultural Systems*, Available online April 20, 2011, doi:10.1016/j.agsy.2011.03.005, http://www.sciencedirect.com/science/article/B6T3W-52NKD6M-1/2/8a065dc226505fedbb39d608ae03c786. (Subscription may be required.)

Trading

***RGGI News Release*, "RGGI States Issue Notice for June 2011 CO_2 Allowance Auction."**

The 10 Northeast and Mid-Atlantic states participating in the Regional Greenhouse Gas Initiative (RGGI) released the Auction Notice and application materials for CO_2 Allowance Auction 12, providing potential auction participants the information needed to submit a Qualification Application and indicate their intent to bid. To be held June 8, 2011, CO_2 Allowance Auction 12 will offer 42,034,184 CO_2 allowances for sale for the current control period (2009-2011) and 2,144,710 CO_2 allowances for the future control period (2012-2014); a reserve price of $1.89 will be used for all allowances in the June auction. Since the debut of the RGGI auctions on September 25, 2008, the participating states have auctioned more than 360 million CO_2 allowances. For more information about previous auction results, including prices, bids, and participation, visit: http://www.rggi.org/market/co2_auctions/results. April 8, 2011, http://www.rggi.org/docs/Auction_12_Notice_News_Release.pdf.

***Industrial Fuels and Power*, "China to Launch Emissions Trading in Six Regions."**

According to government officials, China will launch pilot emissions trading schemes in six areas before 2013 to prepare for a nationwide trading platform by 2015. The pilot schemes will be launched in the cities of Beijing, Chongqing, Shanghai, and Tianjin, as well as the provinces of Hubei and Guangdong. Over the 2011 through 2015 period, the Chinese government plans to cut energy intensity by 16 percent and carbon intensity by 17 percent to meet their target of reducing carbon intensity by 40 to 45 percent based on 2005 levels by the end of 2020. Local targets have been issued to provinces and regions, but have yet to be made public. April 14, 2011, http://www.ifandp.com/article/0010690.html.

Recent Publications

"The East Irish Sea CCS Cluster: A Conceptual Design – Technical Report."

The following is from the Introduction of this document: "The Intergovernmental Panel on Climate Change (IPCC) states that there is now a high confidence (>90 [percent]) that the net effect of human activities has contributed to climate change. As such, it is important that overall levels of GHG emissions from human activities are reduced. In the United Kingdom (UK), GHG emission reduction targets are encapsulated within the Climate Change Act 2008, where a legally binding target of at least an 80 percent cut in GHG emissions by 2050 (compared to levels in 1990) is required. Carbon Dioxide accounts for around 85 percent of total UK GHGs (574.6 million tonnes of CO_2e in 2009). The largest contributor to the UK's portfolio of emissions is the energy sector, which is responsible for approximately 40 [percent] of UK's CO_2 emissions. It is therefore vital, that this sector is able to decarbonize and reduce its overall level of emissions in order to achieve the targets. One method of decarbonization will undoubtedly be the use of renewable energy sources. Whilst these will continue to be an increasing feature of the energy mix in the UK and beyond, the intermittent nature and practical limitations of renewable energies such as wind, wave and solar mean that 'base-load' and flexible power generation will remain essential to any modern economy for the foreseeable future. Both the age of the existing UK fleet of power stations and EU environmental regulations are such that significant new such generating capacity is needed. Whilst the UK Coalition Government has indicated an intention that nuclear energy should continue to have a role to play, in the interests of energy security (through diversity of supply) it has also stated its belief that fossil fuels, including coal, will need to continue to play a vital role in energy generation for decades to come." To view the document in its entirety, visit: http://www.eunomia.co.uk/shopimages/The%20East%20Irish%20Sea%20CCS%20Cluster%20-%20A%20conceptual%20Design%20-%20Technical%20Report.pdf.

"Annual Report on the Market for RGGI CO_2 Allowances: 2010."

The following is the Executive Summary of this document: "RGGI began full operation on January 1, 2009, becoming the first mandatory cap-and-trade program to limit CO_2 emissions in the United States. Currently, approximately 95 percent of the CO_2 emissions from the electric power generation sector in [10] states in the northeast and mid-Atlantic regions are regulated under the program. RGGI distributes CO_2 emissions allowances to the market primarily through auctions, making it distinctive among existing cap-and-trade programs. [Ninety-four] percent of the CO_2 allowances in circulation at the end of 2010 initially entered the market through one of the auctions. By the end of 2010, the RGGI participating states conducted [10] successful auctions, selling a total of 319 million CO_2 allowances for $777 million. This report evaluates activity in the market for RGGI CO_2 allowances in 2010, focusing on the following areas: allowance prices, trading and acquisition of allowances in the auctions and the secondary market, participation in the market by individual firms, and market monitoring." The complete marketing report, prepared by independent market monitor Potomac Economics, is available at: http://www.rggi.org/docs/MM_2010_Annual_Report.pdf.

"The UK Carbon Plan."

The following is from the Foreward of this document: "This Carbon Plan sets out a vision of a changed Britain, powered by cleaner energy used more efficiently in [the UK's] homes and businesses, with more secure energy supplies and more stable energy prices, and benefting from the jobs and growth that a low carbon economy will bring…[Bringing change in many areas, most critically and fundamentaly]: (1) in the way [they] generate [their] electricity, where [they] must see a dramatic shift away from fossil fuels and towards low carbon alternatives – renewable energy, new unsubsidized nuclear power and fossil fuel power stations fitted with [CCS]; (2) in the way [they] heat [their] homes and businesses, where a step change is needed in how well [their] homes are insulated and in the use of low carbon energy alternatives, such as heat pumps; (3) and in the way [they] travel. This means better public transport, reducing emissions from petrol and diesel engines and moving towards alternative technologies such as electric vehicles." The full Carbon Plan is available at: http://www.decc.gov.uk/assets/decc/What%20we%20do/A%20low%20carbon%20UK/1358-the-carbon-plan.pdf.

Legislative Activity

***Platts*, "CO_2 Pipeline Bill Passes Indiana House of Representatives."**

A bill containing eminent domain language sought by the developer of a proposed CO_2 pipeline has been approved by the Indiana House of Representatives and sent to a conference committee. The bill, S.B. 251, was amended prior to being voted on by the House to authorize companies to condemn private property for a CO_2 pipeline that would move CO_2 from coal plants in the Midwest to the Gulf Coast for EOR use. The bill contains a provision for the law to expire in 10 years. To view S.B. 251, click: http://www.in.gov/legislative/bills/2011/SB/SB0251.3.html. April 21, 2011, http://www.platts.com/RSSFeedDetailedNews/RSSFeed/Coal/6023905.

EVENTS

June 19-22, 2011, **Carbon Capture and Sequestration**, *Novotel Twin Waters Resort, Brisbane, Queensland, Australia*. This workshop will review scientific, technical, and stakeholder issues associated with CCS. Among the topics to be discussed are: advances in carbon capture technologies; existing and planned CO_2 storage projects; status and predictions of GHG emissions regulations; industrial efforts in combating CO_2 emissions; advanced technologies for monitoring CO_2 injection and retention; issues regarding long-term liability; and funding of CCS projects. To learn more, visit: http://www.spe.org/events/10adel/index.php.

June 20-22, 2011, **Second International Conference on Energy Process Engineering: Efficient Carbon Capture for Coal Power Plants**, *DECHEMA-Haus, Frankfurt, Germany*. The conference will provide attendees with technical information on CO_2 capture options and their efficiencies. Session topics include, but are not limited to: chemical absorption materials, chemical looping, oxyfuel combustion, post-combustion capture, physical absorption materials, and organic/inorganic membranes. A detailed program is available at: http://www.processnet.org/index.php?id=1601&site=processnet_media&lang.

June 23, 2011, **The UK Energy Summit 2011**, *The Dorchester, London, United Kingdom*. This one-day summit will discuss what is needed to affordably, securely, and sustainably meet the UK's energy needs. Included is a session on a political approach to address potential climate change issues. To view the full program, go to: http://www.economistconferences.co.uk/event/uk-energy-summit-2011/4536.

July 11-14, 2011, **Global Conference on Global Warming 2011**, *Calouste Gulbenkian Congress Center, Lisbon, Portugal*. This international conference discusses potential solutions to climate change issues and provides a forum for the exchange of the latest developments and technical information. To view a complete list of conference-related topics, click: http://www.gcgw.org/gcgw11/documents/poster_GCGW11.pdf.

July 18-20, 2011, **Carbon Capture and Storage: Science, Technology, and Policy**, *MIT, Cambridge, Massachusetts, USA*. This energy short course covers the science, technology, and policy aspects of CCS, focusing on the role of CCS in the climate change mitigation portfolio; the technical approaches to CO_2 capture; the science behind geologic storage, site selection, and risk evaluation; and the role of policy in establishing a market and business opportunities for CCS. For more information, visit the course website at: http://web.mit.edu/professional/short-programs/courses/carbon_capture_storage.html.

July 19-21, 2011, **Society of Petroleum Engineers (SPE) Enhanced Oil Recovery Conference**, *InterContinental Kuala Lumpur, Kuala Lumpur, Malaysia*. This conference brings together global experts to share successes and lessons learned in evaluating and implementing the full range of EOR techniques. More information on the Technical Program is available at: http://www.spe.org/events/eorc/pages/schedule/tues_technical_programme.php.

July 21-22, 2011, **Third International Conference on Climate Change**, *JW Marriot, Rio De Janeiro, Brazil*. This conference will examine, among other topics, natural and human-generated causes of potential climate change, as well as CCS technological responses and carbon and taxes offsets. In addition, the conference will explore other social, ethical, and political responses to potential climate change. To learn more, visit: http://on-climate.com/conference-2011/.

August 17-19, 2011, **COAL-GEN**, *Greater Columbus Convention Center, Columbus, Ohio, USA*. Covering the latest topics affecting the design, development, upgrading, operation, and maintenance of coal-fired power plants, COAL-GEN is the industry's largest event focused on the present and future of coal-fired generation. Visit the conference website at: http://www.coal-gen.com/index.html.

August 22-26, 2011, **NETL CO_2 Capture Technology Meeting**, *Sheraton Station Square Hotel, Pittsburgh, Pennsylvania, USA*. This DOE-hosted conference will present CO_2 capture technology development status and accomplishments made under NETL's Innovations for Existing Plants (IEP), Carbon Sequestration, and Demonstration Programs. Topics to be discussed include post-, oxy-, and pre-combustion carbon capture, as well as chemical looping and CO_2 compression technologies. For more information, click: http://www.netl.doe.gov/events/11conferences/co2capture/.

Events (Continued)

October 9-11, 2011, **Reservoir Characterization and Simulation Conference and Exhibition**, *Beach Rotana Hotel, Abu Dhabi, UAE*. The Society of Petroleum Engineers (SPE) is hosting the third edition of the Reservoir Characterization and Simulation Conference and Exhibition (RCSC). The conference focuses on reservoir applications and different technologies for characterizing, modeling, and simulating reservoir characteristics. To learn more, visit: http://www.spe.org/events/rcsc/2011/.

October 9-14, 2011, **CO_2 Storage: Will we be ready in time?**, *The Algarve, Portugal*. This forum, designed for professionals in the oil and gas, power, and alternative energy industries who focus on CCS schemes, will address the opportunities and challenges related to the development of CO_2 geologic storage activities that would be several orders of magnitude larger than current demonstration projects. For more information, visit: http://www.spe.org/events/11fse3/pages/about/index.php.

November 15-16, 2011, **Low-Carbon Energy Technologies: Innovations in Efficiency and Greenhouse Gas Reduction Science and Technology Seminar**, *Southwest Research Institute, San Antonio, Texas, USA*. This seminar will focus on alternative energy technologies, carbon reduction through improvements in efficiency, and carbon conversion and storage. Topics include: efficiency improvements to reduce carbon footprint, alternative power (wind, solar, and energy storage), low-carbon emission power plant cycles, CO_2 compression and storage, and CO_2 conversion and utilization. For more information, go to: http://www.swri.org/mailer/Div18/2011/IndLectureFlyr-4.pdf.

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.

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