



Carbon Sequestration Newsletter



see page 3

JULY 2008

WHAT'S INSIDE?

Sequestration in the News

Announcements

Science

Policy

Geology

Technology

Terrestrial/Ocean

Trading

Recent Publications

Legislative Activity

Events

Subscription Information

Carbon Sequestration

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

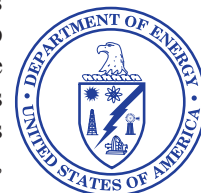
Fossil Energy Techline, "IEA Finds U.S. CO₂ Sequestration Program World's Most Ambitious."

The International Energy Agency Greenhouse Gas R&D Programme (IEA GHG), an international collaborative research program set up under the auspices of the IEA, validated the US Department of Energy's (DOE) Regional Carbon Sequestration Partnerships (RCSP) and their large-scale carbon dioxide (CO₂) tests as the world's most "ambitious" program to advance the field of carbon capture and storage (CCS). A panel of

scientific experts selected by IEA GHG found that the seven RCSPs are unique in that no other country or region has initiated a similar effort. IEA GHG's report says that the projects are realistic, achievable, and should be implemented immediately; the projects serve as a major research initiative; and Phase III seeks to achieve significant results for the United States and the international community. The RCSP Program is a Federal, state, and private sector collaboration intended to determine the requisite technologies, regulations, and infrastructure needed for future CCS in different geological regions of North America. RCSPs include more than 350 state agencies, universities, and private companies within 42 states, three Indian nations, and four Canadian provinces. DOE launched the three-phase RCSP Program in 2003 as the centerpiece of their efforts to commercialize CCS technologies. During the first phase of the program, RCSPs identified more than 3,000 billion metric tons of potential storage capacity in North American geologic formations, equivalent to more than 1,000 years of storage capacity. The second phase involved implementing some 25 small-scale geologic storage tests to evaluate whether different geologic formations have the ability to safely sequester CO₂ over the long term. RCSPs are currently engaged in Phase III, which will examine the long-term storage of more than one million tons of CO₂ in several large-scale tests. The RCSPs encompass 96 percent of the total land mass in the United States, which is home to 97 percent of coal-fired CO₂ emissions, 97 percent of industrial CO₂ emissions, and nearly all of the geologic sequestration sites available for CO₂ storage. (See Recent Publications section for abstract and link to IEA GHG's "Expert Review of Regional Carbon Sequestration Partnerships Phase III.") To learn more about the RCSP Program, visit: <http://www.fossil.energy.gov/programs/sequestration/partnerships/index.html>, or click: <http://www.ieagreen.org.uk> for IEA GHG information. June 5, 2008, http://www.fossil.energy.gov/news/techlines/2008/08019-IEA_Finds_US_CCS_Plans_Ambitious.html.

Fossil Energy Techline, "Hawaii Joins DOE's Carbon Sequestration Regional Partnership Program."

Hawaii became the 42nd state to join DOE's RCSP Program on May 6, coinciding with funding awarded to the West Coast Carbon Sequestration Partnership (WESTCARB) for a Phase III large-scale test in California. The sequestration efforts in Hawaii will involve site characterization, or "source sink matching," of CO₂ emission point sources and the terrestrial and/or geologic sinks that could safely store CO₂. Under the leadership of the University of Hawaii, scientists will examine and update an inventory of Hawaiian GHG sources as mandated by a new state law. Hawaii joins California, Arizona, Nevada, Oregon, Washington, Alaska, and British Columbia in the California



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HIGHLIGHTS (CONTINUED)

Energy Commission-managed WESTCARB, which will conduct a geologic storage project in the San Joaquin Basin in Central California as part of their Phase III efforts. To learn more about WESTCARB's activities, click: <http://www.westcarb.org/>. June 9, 2008, http://www.fossil.energy.gov/news/techlines/2008/08021-Hawaii_Joins_WESTCARB.html.

SEQUESTRATION IN THE NEWS

Springfield News-Leader, "City Utilities to Test Plan for Clean Coal."

After receiving a \$2.46 million Federal grant and \$98,000 from each of five utility partners, City Utilities (CU) of Springfield, Missouri, is preparing to inject food-grade CO₂ from its Southwest Power Station into a 2,000-foot deep saline formation. CU will work with Missouri State University, Missouri University of Science and Technology, and the Missouri Department of Natural Resources over the next three years to determine whether the geological storage of CO₂ is an economic and safe method for reducing GHG emissions. CU's Southwest Power Station generates 3,562 tons of CO₂ per day and their 300-megawatt Southwest 2 power plant will generate 6,052 tons of CO₂ per day once it comes online in 2010. CU officials hope that successful testing will free the utility from the cost of building pipelines to transport CO₂ to injection sites in northern states. A presentation outlining the particulars of the "Missouri Carbon Sequestration Project" is available at: <http://www.cityutilities.net/community/missouricarbonproject.pdf>, or click <http://www.cityutilities.net/community/missouricarbonproject-hi.wmv> for a project video. May 21, 2008, <http://www.news-leader.com/apps/pbcs.dll/article?AID=2008805280465>.

Reuters, "Spectra Eyes Big Carbon Capture Project in Canada," and *Vancouver Sun*, "Study Examines Underground Carbon Dioxide Storage in B.C."

Spectra Energy Corporation plans to examine the viability of building a large-scale carbon sequestration facility at its natural gas plant in northeastern British Columbia that would store CO₂ in a depleted natural gas reservoir 1.3 miles (2 kilometers) underground. The reservoir could potentially store one million tons of CO₂ annually – a figure equivalent to the plant's CO₂ production over the next 20 to 50 years. Spectra has previously captured and stored 200,000 tonnes of CO₂ in depleted natural gas reservoirs. The provincial government provided \$3.4 million (\$3.5 million Canadian) toward the project's \$11.8 million (12.1 million Canadian) budget as part of their effort to reduce GHG emissions by 33 percent by 2020. May 26, 2008, <http://www.reuters.com/article/marketsNews/idUSN2629605920080526>, and May 26, 2008, <http://www.canada.com/vancouvernews/business/story.html?id=28b15589-844e-46f4-9d26-c265c15b5c15>.

Regional Carbon Sequestration Partnerships



SEQUESTRATION IN THE NEWS (CONTINUED)

The Chronicle-Herald, “Search for Places to Store CO₂ Emissions Set to Begin.”

A CCS project led by the Carbon Storage Research Consortium of Dalhousie University, Nova Scotia Power, and Nova Scotia’s Energy Department will be initiated this summer by searching for potential CO₂ storage sites in Cape Breton and northern Nova Scotia. The four-phase project, which recently received \$4.87 million (\$5 million Canadian) in Federal research funds, will also examine the regulatory issues and economic impacts facing CO₂ storage, in addition to assessing the geology of northern Nova Scotia’s oil reservoirs and deep coalbeds. Officials said that only certain locales are deemed feasible for geologic storage in Canada – mainly Alberta, southern Saskatchewan, and Nova Scotia. Nova Scotia emits about 20 million tonnes of GHGs annually, with coal-fired power plants serving as the largest point source of GHGs at about 10 million tonnes annually. If the project succeeds, it is believed that Nova Scotia could be storing up to 10,000 tonnes of CO₂ per day by 2018 to 2020. June 5, 2008, <http://thechronicleherald.ca/Business/1060298.html>.

Reuters, “Vattenfall to Build Carbon Capture Test Plant,” and *Vattenfall Press Release*, “Vattenfall Will Build CCS Demonstration Plant in Jämschalde.”

Vattenfall plans to build a demonstration plant equipped with CCS technology at one of their 500-megawatt blocks at the Jämschalde facility in the State of Brandenburg, Germany. Following an investment estimated at around \$1.57 billion (1 billion euros), the Swedish-owned utility said it expects full-scale operation no later than 2015. The CCS-equipped block will house two boilers: a newly built boiler with Oxyfuel technology and a boiler retrofitted with post-combustion technology. Gaz de France Production and Exploration GmbH will collaborate with Vattenfall to test technology for storing the captured CO₂ in a depleted natural gas field in Altmark, Germany. Vattenfall will open the world’s first pilot-scale plant – a \$108.2 million (70 million euro), 30-megawatt effort – for CO₂ separation at Schwarze Pumpe power station in the State of Brandenburg this summer. May 23, 2008, <http://www.reuters.com/article/environmentNews/idUSL2385285020080523>, and May 23, 2008, http://www.vattenfall.com/www/vf_com/vf_com/370103press/558539press/index.jsp?pmid=91724.

ANNOUNCEMENTS

Job Opportunity.

The Illinois State Geological Survey is looking to fill the position of full-time Environmental Geochemist. The candidate will manage and direct the monitoring, mitigating, and verification (MMV) program; facilitate and conduct research activities; and develop new monitoring approaches and research ideas related to geological CO₂ sequestration. To read more about the available position, click: <http://www.igs.uiuc.edu/about-igs/employment/regular.shtml>.

Call for Abstracts.

Organizers for the “Climate Change: Global Risks, Challenges, and Decisions” conference, scheduled for March 10-12, 2009, in Copenhagen, Denmark, have put out a request for original research into topics relevant to the conference themes. Topics include: CO₂ sinks and emissions; CCS technologies; and approaches to cap-and-trade programs. The deadline for abstract submission is September 1, 2008. To submit an abstract, go to: <https://www.ics-online.com/ei/getdemo.ei?id=370&s=2P00V60DO>.

Energy Analysis Firm Debuts GHG Reduction Database.

Point Carbon unveiled its online database, “Carbon Project Manager North America,” in an attempt to organize information on GHG reduction projects. The online database provides figures on more than 500 projects in North America that reduce GHG emissions through renewable energy and sequestration methods. For more information, go to: <http://www.eenews.net/climatewire/2008/05/19/6/>.

CCS Network Launched.

IEA launched the International CCS Regulators’ Network at IEA Headquarters in Paris, France, to discuss the importance of CCS in mitigating climate change. The network will meet regularly to aide the development of a legal and regulatory framework for CCS. To learn more about the launch of the regulators’ network, visit: http://www.iea.org/Textbase/work/workshopdetail.asp?WS_ID=361.



SCIENCE

Baltimore Sun, “Outlook is Bleak for State Shoreline.”

A recent report by the National Wildlife Federation (NWF) says rising sea levels caused by global warming could destroy more than half the beaches on Maryland’s Eastern Shore. The study states that recent developments along the shoreline have prevented beaches from shifting inward as water levels rise. According to the study’s authors, the cause of the rising water levels is due to GHGs melting glaciers and causing bodies of water to expand. NWF’s analysis predicts that 415 square miles of open water will replace beaches and coastal land. The report also says that 161,000 acres of marsh will be destroyed over the next century, disrupting the breeding of fish and birds. Higher water temperatures also could result in low-oxygen dead zones in the Chesapeake Bay, leading to less aquatic vegetation. The report is based on calculations from the Intergovernmental Panel on Climate Change (IPCC) that predicted global sea levels will rise up to 27 inches by 2100. Specifically, an NWF consultant employed a computerized model based on these predictions to calculate what the data could mean for marshes and shorelines around the Chesapeake Bay. The report concluded that by 2100, 69 percent of the beach acreage and 58 percent of oceanfront beaches in the area could be washed out. To view NWF’s technical report, titled, “Sea-Level Rise and Coastal Habitats of the Chesapeake Bay,” go to: http://www.nwf.org/sealevelrise/pdfs/SeaLevelRiseandCoastalHabitats_ChesapeakeRegion.pdf, or visit: <http://www.nwf.org/sealevelrise/chesapeake.cfm> for more information. May 23, 2008, <http://www.baltimoresun.com/sports/outdoors/bal-md.shore23may23,0,1010861.story>.

The Independent, “Warmer Seas Blamed for Rapid Decline of Scottish Puffin Colony,” and *MSNBC.com*, “Decline of Scottish Puffins Seen as Climate Sign.”

Researchers on the Island of May, home to the largest Atlantic puffin colony in the North Sea, revealed new data that shows after 40 years of steady increase, the resident population of puffins has plummeted by nearly one-third in the past five years. The last time researchers surveyed the birds, in 2003, there were 69,300 breeding pairs and the population was growing at 10 percent a year; today, however, there are only 41,000 pairs. Researchers have not been able to determine the exact cause of the decline, but the emeritus professor for Britain’s Center of Ecology and Hydrology (CEH) believes climate change could possibly be at fault. According to CEH, as the sea temperature rises, the number of fish available for the puffin to eat drops. Research shows that many of the pairs that survived the winter were under their typical weight. Sand eels, puffins’ staple food source, have also seen a population decline. Since the puffin sits near the top of the Atlantic Ocean’s food chain, researchers believe they are excellent bio-indicators for the health of the environment and this decline could signal a national trend. The Scottish island has been the focal point of the United Kingdom’s research for three decades. To view more of CEH’s research, go to: http://www.ceh.ac.uk/news/news_archive/2008_news_item_16.html. June 4, 2008, <http://www.independent.co.uk/environment/nature/warmer-seas-blamed-for-rapid-decline-of-scottish-puffin-colony-839600.html>, and June 5, 2008, <http://www.msnbc.msn.com/id/24986904/>.

POLICY

Reuters, “IEA Urges \$45 Trln ‘Energy Revolution’ To Halve CO₂,” and *Energy Current*, “G8 Aims for 20 Carbon Capture Projects by 2010.”

In a new report, titled, “Energy Technology Perspectives 2008,” IEA recommended a \$45 trillion “energy technology revolution” to raise the cost of producing CO₂. According to the IEA report commissioned three years ago by the Group of Eight (G-8), failure to do so by 2050 could result in a surge in GHG emissions. IEA claims that without a multilateral government policy, emissions would rise by 130 percent and oil demand would increase by 70 percent. The report calls for a 15-year research and development (R&D) plan that would cost anywhere from \$10 billion to \$100 billion per year. Under this scenario, the power sector would need to build 32 new nuclear power plants and install CCS technology at 35 coal-fired and 25 gas-fired power plants per year from 2010 to 2050. In addition, nations not participating in the IEA program would need to conserve energy to achieve the target. At a meeting held June 6-7 in Aomori, Japan, G-8 members agreed to launch 20 large CCS demonstration projects by 2010. DOE pledged to provide funding for the addition of CCS technology at several commercial-scale Integrated Gasification Combined Cycle (IGCC) plants. To read a fact sheet highlighting the two future sustainable energy scenarios presented in the report, click: http://www.iea.org/Textbase/techno/etp/fact_sheet_ETP2008.pdf. June 6, 2008, <http://www.reuters.com/article/environmentNews/idUSSP11179420080606?pageNumber=1&virtualBrandChannel=0>, and June 9, 2008, <http://www.energycurrent.com/index.php?id=3&storyid=11052>.



“Effective EU and Member State policies for stimulating CCS.”

Although CO₂ capture and storage (CCS) is widely recognized as an option to mitigate climate change, consistent and effective EU policies to advance CCS are still absent. This paper discusses policy instruments for advancing large-scale deployment of CCS in the European Union, and evaluates them in a multi-criteria analysis. The EU Emissions Trading Scheme (EU-ETS) is a cost-effective instrument for limiting greenhouse gas emissions, but it is questionable whether its currently limited time horizon and short-trading periods will lead to substantial CCS [operations] Complementary policies at the EU and the Member State level may repair this and provide sufficient incentives for CCS. Potential policies include financial instruments such as investment subsidies, a feed-in scheme, or a CO₂ price guarantee, as well as a CCS mandate or a low-carbon portfolio. These policy options differ with respect to their environmental effectiveness, possible interaction with the EU-ETS, costs and financial risk involved, and their competition with other mitigation options. Interactions between Member State policies and the EU-ETS are smaller in scope than those of EU-wide policies, but they are more likely to lead to displacement of financial resources from other low-carbon technologies. In addition, national policies may pose a significant part of the financial risk of CCS operations with Member States, reducing the operator’s incentive to innovate. Overall, structural policies at the EU level, such as a mandate or a low-carbon portfolio

POLICY (CONTINUED)

standard would be more conducive for realizing large-scale deployment of CCS across the EU as well as more acceptable to environmental organizations. **Heleen Groenberg and Heleen de Coninck**, *International Journal of Greenhouse Gas Control*, Available online June 2, 2008, doi:10.1016/j.ijggc.2008.04.003, <http://www.sciencedirect.com/science/article/B83WP-4SN92PX-1/1/af4f908886178f3a6b03573c04afbdce>. (Subscription may be required.)

GEOLOGY

“Intermediate storage of carbon dioxide in geological formations: A technical perspective.”

The following is the abstract of this article: “Enhanced oil recovery (EOR) through CO₂ flooding has been practiced on a commercial basis for the last 35 years and continues today at several sites, currently injecting in total over 30 million tons of CO₂ annually. This practice is currently exclusively for economic gain, but can potentially contribute to the reduction of emissions of greenhouse gases provided it is implemented on a large scale. Optimal operations in distributing CO₂ to CO₂-EOR or enhanced gas recovery (EGR) projects (referred to here collectively as CO₂-EHR) on a large scale and long time span imply that intermediate storage of CO₂ in geological formations may be a key component. Intermediate storage is defined as the storage of CO₂ in geological media for a limited time span such that the CO₂ can be sufficiently reproduced for later use in CO₂-EHR. This paper investigates the technical aspects, key individual parameters and possibilities of intermediate storage of CO₂ in geological formations aiming at large scale implementation of carbon dioxide capture and storage (CCS) for deep emission reduction. The main parameters are thus the depth of injection and density, CO₂ flow and transport processes, storage mechanisms, reservoir heterogeneity, the presence of impurities, the type of the reservoirs and the duration of intermediate storage. Structural traps with no flow of formation water combined with proper injection planning such as gas-phase injection favor intermediate storage in deep saline aquifers. In depleted oil and gas fields, high permeability, homogeneous reservoirs with structural traps (e.g. anticlinal structures) are good candidates for intermediate CO₂ storage. Intuitively, depleted natural gas reservoirs can be potential candidates for intermediate storage of carbon dioxide due to similarity in storage characteristics.” **Semere Solomon, Michael Carpenter and Todd Allyn Flach**, *International Journal of Greenhouse Gas Control*, Available online May 20, 2008, doi:10.1016/j.ijggc.2008.04.004, <http://www.sciencedirect.com/science/article/B83WP-4SJGWYJ-2/1/5fbc2f7b28fe54d48c43ec6825849e03>. (Subscription may be required.)



TECHNOLOGY

“Modeling of carbon sequestration in coal-beds: A variable saturated simulation.”

Storage of carbon dioxide in deep coal seams is a profitable method to reduce the concentration of green house gases in the atmosphere while the methane as a byproduct can be extracted during carbon dioxide injection into the coal seam. In this procedure, the key element is to keep carbon dioxide in the coal seam without escaping for a long term. It is depended on many factors such as properties of coal basin, fracture state, phase equilibrium, etc., especially the porosity, permeability and saturation of the coal seam. In this paper, a variable saturation model was developed to predict the capacity of carbon dioxide sequestration and coal-bed methane recovery. This variable saturation model can be used to track the saturation variability with the partial pressures change caused by carbon dioxide injection. Saturation variability is a key factor to predict the capacity of carbon dioxide storage and methane recovery. Based on this variable saturation model, a set of related variables including capillary pressure, relative permeability, porosity, coupled adsorption model, concentration and temperature equations were solved. From results of the simulation, historical data agree with the variable saturation model as well as the adsorption model constructed by Langmuir equations. The Appalachian basin, as an example, modeled the carbon dioxide sequestration in this paper. The results of the study and the developed models can provide the projections for the CO₂ sequestration and methane recovery in coal-beds within different regional specifics. **Guoxiang Liu and Andrei V. Smirnov**, *Energy Conversion and Management*, Available online April 28, 2008, doi:10.1016/j.enconman.2008.03.007, <http://www.sciencedirect.com/science/article/B6V2P-4SCTVNW-4/1/fl1e78915263fa188483ea4b3963fe4a6>. (Subscription may be required.)

“Techno-economic study of CO₂ capture and storage in coal fired oxygen fed entrained flow IGCC power plants.”

The attractiveness of fossil fuel as a feedstock for power generation depends on the development of energy conversion systems that are efficient, clean and economical. Coal fired power plants are generally considered to be “dirty” since they have high CO₂ emissions, with the exception of those coal fired power plants that employ CO₂ capture technology. Among the coal fired options, Integrated Gasification Combined Cycle (IGCC) systems have the best environmental performance and are potentially suitable candidates. The objective of this work is to provide an assessment and analysis of the potential for reduction of the output of greenhouse gas from the oxygen fed entrained flow gasifier systems, including the cost and cost-effectiveness of each likely conceptual scheme. The ECLIPSE process simulator was used successfully to perform technical, environmental and economic assessment studies for a wide range of IGCC power generation systems. Two IGCC power generation designs were selected, the Shell dry feed and GE (previously called Texaco) wet feed entrained flow gasifiers. As a reference fuel input, the American Federal coal was also used in IGCC systems. The performance of two IGCC systems was optimized within the constraint of being based on one particular advanced gas turbine and using a subcritical steam system. In this work, several IGCC plant attributes such as the fuel consumption, utility usages, plant performance as well as the

TECHNOLOGY (CONTINUED)

specific CO₂ generation and capture rates were simulated and weighed against each other. Factors affecting the IGCC plant performance, specifically net power output, process efficiency, power consumption coming from the Air Separation Unit (ASU) and CO₂ removal and overall emissions were also evaluated and discussed. Finally, an economic evaluation of the system was conducted and the costs of CO₂ capture plus transport are illustrated. This case study shows that the option of using IGCC for capturing CO₂ could be technically feasible and cost-effective. **Y. Huanga, S. Rezvania, D. McIlveen-Wrighta, A. Minchenerb and N. Hewitta**, *Fuel Processing Technology*, Available online May 2, 2008, doi:10.1016/j.fuproc.2008.03.002, <http://www.sciencedirect.com/science/article/B6TG3-4SDNK8G-1/1/26d5579ee4cd205d95a127776530de08>. (Subscription may be required.)



TERRESTRIAL/OCEAN

“Combining remote sensing data with process modeling to monitor boreal conifer forest carbon balances.”

Approaches combining satellite-based remote sensing data with ecosystem modeling offer potential for the accurate assessment of changes in forest carbon balances, for example, in support of emission credits under the Kyoto Protocol. [The authors] investigate the feasibility of two alternative methods of using satellite-derived data to constrain the behavior of a dynamic ecosystem model, in order to improve the model’s predictions of the net primary production (NPP) of conifer forests in northern Europe (4–30 [degrees] E, 55–70 [degrees] N). The ecosystem model incorporates a detailed description of forest stand structure and biogeochemical processes. The satellite product comprises multi-spectral reflectance data from the VEGETATION sensor. The first method combines satellite-based estimates of FPAR, the fraction of incoming photosynthetically active radiation absorbed by vegetation, with the model’s predictions of the efficiency with which trees use the incoming radiation to fix carbon. Results obtained using this method averaged 0.22 kg [carbon] m⁻² yr⁻¹ for the NPP of conifer and mixed forests across the study area, and compared well with forest-inventory-based estimates for Sweden. The second method uses forest stand descriptions derived by application of an inverse radiation transfer scheme to VEGETATION data to prescribe stand structure in the ecosystem model simulations. Predictions obtained by this method averaged 0.31 kg [carbon] m⁻² yr⁻¹, somewhat high compared to forest inventory data for central and northern Sweden. Simulations by the ecosystem model when driven only by climate, CO₂ and soils data, but unconstrained by satellite information, yielded an average NPP of 0.41 kg [carbon] m⁻² yr⁻¹, which is likely to be an overestimate. Summed over the study area, the NPP estimates amounted to 0.16–0.23 Gt [carbon] yr⁻¹, around 6–9 [percent] of the NPP of all boreal forest globally or 0.3–0.4 [percent] of terrestrial NPP globally. The investigated methods of combining process modeling and products derived from remote sensing data offer promise as a step towards the development of operational

tools for monitoring forest carbon balances at large scales. **Benjamin Smith, Wolfgang Knorr, Jean-Luc Widlowski, Bernard Pinty and Nadine Gobron**, *Forest Ecology and Management*, Available online May 21, 2008, doi:10.1016/j.foreco.2008.03.056, <http://www.sciencedirect.com/science/article/B6T6X-4SJR2DV-4/1/e4b1cab97c473d9e9fc4a4b828805f1c>. (Subscription may be required.)



TRADING

Carbon Market Update, June 16, 2008

CCX-CFI 2008 (\$/tCO ₂)	EU ETS-EUA DEC 2008
\$5.70 (Vintage 2008)	(\$/tCO ₂) \$42.10

(Converted from € to US\$)

***The Montreal Gazette*, “Montreal Climate Exchange is Launched,” and *CTV*, “Montreal Exchange for Emission Trading Opens.”**

The Montreal Exchange (MX), in collaboration with the Chicago Climate Exchange, launched the Montreal Climate Exchange (MCeX) to initiate trading in future contracts based on GHG emissions. Experts predict that MCeX is the first of what could soon be many environmental markets throughout Canada as more legislation is passed for regulating CO₂ emissions. The exchange allows industries that lack the technology needed to cut GHG emissions to comply with government-mandated standards by buying CO₂ credits from other industries that are able to meet emissions targets. The MCeX will initiate with three market makers posting prices and participants joining as prices begin to set. Beginning in 2010, Canadian industry will have to start reducing their GHG emissions by 20 percent over the following decade. To visit the MX website, go to: http://www.m-x.ca/accueil_en.php. May 31, 2008, <http://www.canada.com/montrealgazette/news/business/story.html?id=8b776d55-a2b2-4679-85ce-5d43af3d6f33>, and May 30, 2008, http://www.ctv.ca/servlet/ArticleNews/story/CTVNews/20080530/carbon_trading_080530/20080530?hub=TopStories.

RECENT PUBLICATIONS

“Expert Review of Regional Carbon Sequestration Partnerships Phase III.”

The Regional Carbon Sequestration Partnerships Program (Partnerships Program) is a multi-million dollar research program which is underway in the USA. The Partnerships Program is being carried out in three phases: (1) Phase I – Characterization (2003-2005); (2) Phase II – Validation (2005-2009); and (3) Phase III – Deployment (2008-2017). The USDOE requires that an independent technical review of the Phase III program should be undertaken at the outset of the program. The USDOE approached the IEA Greenhouse Gas R&D Programme (IEA GHG) to undertake the Phase III technical review. IEA GHG has extensive experience of CO₂ injection projects worldwide and has organized a number of independent technical reviews on behalf of member organizations such as USDOE. To review the Partnerships Program and the Phase III activities IEA GHG appointed an independent international panel of experts. The experts were drawn from on-shore CO₂ injection projects underway in Canada, Europe and Australia, many of the experts were involved in the IPCC Special Report on CO₂ Capture and Storage or the IPCC 2006 Inventories Guidelines report. The complete expert review is available at: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/Expert_Review_of_DOE_Regional_Patnrships_Phase_III_-_ExecS.pdf.

“Getting the Most Greenhouse Gas Reductions for Our Money.”

One of the [House Committee on Energy and Commerce and its Subcommittee on Energy and Air Quality’s] goals in designing a comprehensive climate change program is to achieve the necessary greenhouse gas reductions for the least cost and with the least economic disruption. Reducing greenhouse gas emission will be an expensive proposition, but scientists tell us that not reducing emissions will leave future generations with serious problems that will cost even more to address. This White Paper discusses ways to keep costs as low as feasible while still achieving out environmental goals. The most important way to keep costs down is to establish a system that will achieve lowest-cost reductions. The climate change debate often focuses on the need for expensive measures. If the program is structured properly, however, significant reductions can be achieved by economically beneficial measures (i.e. measures with savings that exceed costs). In large part, these measures are improvements in energy efficiency and productivity. The decision to have a cap-and-trade regulatory program as the cornerstone of a mandatory climate change program is driven in large part by the ability of such a program to reduce greenhouse gas emissions to a specified level at the lowest possible overall cost to society and to lower the cost for regulated entities. As compared to more traditional forms of regulation, a well-designed cap-and-trade program generally should achieve the same environmental results at a lower cost because it provides flexibility to emitters, creates incentives for sources to use low-cost compliance strategies, and provides incentives for technological advances. To read the complete White Paper, issued by the House Committee on Energy and Commerce and its Subcommittee on Energy and Air Quality, go to: http://energycommerce.house.gov/Climate_Change/Climate%20Change%20White%20Paper-Cost%20Containment.052708.pdf.

“Capturing King Coal.”

Coal is a key fuel source for current and future electric power generation. Coal becomes even more critical when cost of electricity and security of supply issues are viewed in light of other fuel sources such as gas or uranium. Yet coal combustion produces about 1.9 billion tons of CO₂ per year in the U.S., roughly equivalent to all CO₂ emissions from U.S. transport per annum. The burning of coal, with more CO₂ emissions per unit of energy produced than any other fossil fuel, has significant adverse climate change impacts. One way to reduce carbon emissions from coal-fired power plants is to capture and store it permanently underground, a process called carbon capture and storage (CCS), also called carbon sequestration. CCS has captured the attention of policymakers, power generators, and environmentalists because of its potential as a bridging technology that will permit the continued use of coal as a fuel source while not contributing to a further destabilization of the climate. A great deal of work is underway to develop and improve the technologies, legal frameworks, and policies required for wide-scale deployment of CCS systems. To view the full report about deploying CCS systems in the United States, click: http://pdf.wri.org/capturing_king_coal.pdf.

LEGISLATIVE ACTIVITY

ClimateWire, “Landmark Local Emissions Fee Passed in N. Calif.,” and *MSNBC.com*, “It’s a First: Bay Area Businesses to Pay CO₂ Fee.”

The Bay Area Air Quality Management District (BAAQMD) imposed the first carbon fee in the United States, approving a 4.4 cent charge per metric ton of CO₂ equivalent on businesses within the nine-county region in northern California. BAAQMD worked with California’s Air Resources Board to integrate the local fee with already existing state laws and regulations, such as the “California Global Warming Solutions Act of 2006” (AB 32). According to data compiled by the air district, of the 2,500 stationary sources that are subject to the fee, seven of the sources would have to pay more than \$50,000 to comply, with most

of the regulated emitters paying less than one dollar. The new rule will go into effect on July 1 and the money raised in fiscal year 2009, which BAAQMD predicts will total around \$1.1 million, will finance the district’s climate protection program. California passed AB 32 on August 31, 2006, to cost-effectively reduce GHGs. A fact sheet for AB 32 is available at: <http://www.ef.org/documents/AB-32-fact-sheet.pdf>. To browse the BAAQMD website, click: <http://www.baaqmd.gov/>. May 22, 2008, <http://www.eenews.net/climatewire/2008/05/22/2/>, and May 21, 2008, <http://www.msnbc.msn.com/id/24762980/>.

Greenwire, “Markey Unveils Bill for Slashing Emissions 85 Percent.”

On June 4, Massachusetts Representative Edward J. Markey introduced legislation, called the “Investing in Climate Action and Protection Act (iCAP), H.R. 6186,” which proposes cutting CO₂ and other GHG

LEGISLATIVE ACTIVITY

emissions by 85 percent through a cap-and-trade system that would go into effect in 2012. Under the proposed bill, 94 percent of the billions of dollars in emissions credits would be auctioned off, with the proceeds used for energy technology research, tax cuts, and energy efficiency programs. United States manufacturers most vulnerable to trade competition would receive the remaining six percent. The cap-and-trade program transition would result in 100 percent of emissions credits being auctioned by 2020; countries that do not implement similar policies by that time would need to purchase emission allowances to import CO₂-intensive goods into the United States. If the proposed bill reaches its fruition, all coal-fired power plants built after January 2009 would need to capture and store 85 percent of their GHG emissions. To read the executive summary of iCAP, click: http://markey.house.gov/docs/icap_exec_sum.pdf, or browse <http://markey.house.gov/> for complete information. May 28, 2008, <http://www.eenews.net/Greenwire/2008/05/28/1/>.

Greenwire, “Bipartisan House Bill would Create Carbon Sequestration Fund.”

Legislation was introduced on June 12 by a US House of Representatives coalition to create a multibillion-dollar fund aimed at speeding up the deployment of CCS technologies. The bill, backed by the House Energy and Air Quality Subcommittee, would set up a \$1 billion annual fund paid for by power companies that use coal, natural gas, and oil. Under the legislation, a newly created Carbon Storage Research Corporation would manage the fund as an affiliate of the Electric Power Research Institute (EPRI) and distribute grants and contracts to various private, academic, and governmental bodies to help commercialize technologies that capture and store CO₂. Electric utilities believe the bill will help them survive under a future US regulatory system that places a limit on GHG emissions. According to the bill’s sponsors, the legislation will add around \$10 to \$12 to residential customers’ annual rates. To read the bill, go to: http://www.eenews.net/features/documents/2008/06/12/document_gw_01.pdf. June 12, 2008, <http://www.eenews.net/Greenwire/2008/06/12/>.



EVENTS

July 1-3, 2008, **COAL-GEN Europe**, *EXPO XXI, Warsaw, Poland*. This conference offers attendees presentations about the latest issues affecting the design, development, upgrading, and operation and maintenance of coal-fired power plants. Attendees have the option of taking one of three different tracks, including, “Environmental Technologies and Issues,” which includes presentations on CO₂ reduction and technical issues. A detailed Pre-Show Guide is available for download at: http://downloads.pennnet.com/events/cge08/1108_cge08preshowguide.pdf.

July 6-10, 2008, **Global Conference on Global Warming 2008**, *Dedeman Hotel Istanbul, Istanbul, Turkey*. At the Global Conference on Global Warming 2008, attendees will exchange information, present new technologies and developments, and discuss the future direction, strategies, and priorities in the field of global warming and climate change. Some of the many topics to be covered include: carbon sequestration; clean technologies; and GHGs. To learn more about the conference, go to: <http://www.gcgw.org/ocs/index.php?conference=gcgw&schedConf=>.

July 10-12, 2008, **22nd Annual Conference on Fossil Energy Materials**, *Omni William Penn Hotel, Pittsburgh, Pennsylvania, USA*. This National Energy Technology Laboratory-hosted conference will provide attendees with technical briefings on the research projects supported by the Advanced Research Materials Program of DOE’s Office of Fossil Energy. During the three-day event, there will be four different sessions covering three main topics: advanced alloys and concepts, coating and protection of materials, and functional materials. For the complete agenda, visit: <http://www.netl.doe.gov/events/08conferences/fem/Agenda.pdf>.

July 13-18, 2008, **Carbon 2008**, *Hotel Metropolitan Nagano, Nagano, Japan*. The Science Council of Japan has teamed with the Carbon Society of Japan to put together this six-day conference focusing on current and future carbon science technologies. The conference has several tracks, including one highlighting the role of carbon in the environment and energy production. To view the conference website, which includes registration information and a program agenda, go to: <http://endomoribu.shinshu-u.ac.jp/carbon2008/>.

August 18-20, 2008, **4th Australia-New Zealand Climate Change Business Conference**, *SKYCITY Convention Centre, Auckland, New Zealand*. This conference will focus on the risks and opportunities posed to businesses by climate change. Sessions discussing voluntary carbon markets, regulating carbon markets, carbon market compliance, a post-Kyoto roadmap, and carbon sequestration developments will be included. To browse the conference website, which includes a draft agenda, visit: <http://www.climateandbusiness.com/program.html>.



EVENTS (CONTINUED)

September 16-17, 2008, **Carbon Markets USA**, *Kellogg Conference Hotel, Washington DC, USA*. The second edition of Carbon Markets USA brings together key players in the US carbon industry to examine and explore the latest market developments and methods to accelerate market growth. Attendees have the opportunity to question experts on carbon trading, carbon offsetting, CCS, and voluntary carbon markets. To view the conference website, go to: http://greenpowerconferences.com/carbonmarkets/carbonmarkets_USA_2008.html.

September 24-25, 2008, **US Carbon Finance Forum**, *The Metropolitan Club, New York City, New York, USA*. This forum unites investors with representatives from finance, industry, government bodies, and international organizations to examine how carbon legislation will affect stakeholders in the United States. More than 40 high-level speakers will lead the discussion about existing opportunities in carbon markets worldwide. To learn more, visit the conference website: <http://www.uscarbonfinance.com/index.htm>.

September 29-October 2, 2008, **The 25th Annual International Pittsburgh Coal Conference**, *The Westin Convention Center, Pittsburgh, Pennsylvania, USA*. This conference focuses on the development of future coal-based energy plants as they strive to achieve near-zero emissions of pollutants while reducing costs. Some of the topics to be discussed: combustion, gasification, and environmental control technologies; synthesis of liquid fuels; and coal chemistry. A complete program outline is available at: <http://www.engr.pitt.edu/pcc/2008%20Conference.htm#SESSIONS%20and%20TOPICS>.

November 16-20, 2008, **9th International Conference on Greenhouse Gas Technologies**, *The Omni Shoreham Hotel, Washington, DC, USA*. The Michigan Institute of Technology and IEA Greenhouse Gas R&D Programme have teamed with DOE to present this conference series on GHG mitigation technologies. Held every two years, this conference has become a focal point of CCS efforts. Attendees will be presented with 50 technical sessions that examine absorption processes for CO₂ capture, treating flue gas from oxyfuel combustion systems, and strategies for CO₂ transport infrastructure development. To learn more, click: <http://mit.edu/ghgt9/index.html>.

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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.