



Carbon Sequestration Newsletter



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FEBRUARY 2008



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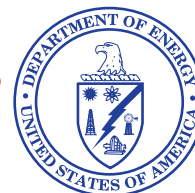
Fossil Energy Techline, “Energy Department Awards \$66.7 Million for Large-Scale Carbon Sequestration Project.”

Following three awards granted through the US Department of Energy (DOE) Regional Carbon Sequestration Partnership Program in October 2007 totaling \$318 million, DOE awarded \$66.7 million to the Midwest Geological Sequestration Consortium (MGSC) on December 18, 2007, to conduct DOE’s fourth large-scale carbon sequestration project. Led by the Illinois State Geological Survey, the partnership will demonstrate the safe, permanent, and economic storage of more than one million tons of carbon dioxide (CO₂) in the Mount Simon Sandstone Formation, a massive geologic formation that spans Illinois, Kentucky, Indiana, and Ohio. The formation has the potential to store an estimated 100 years of CO₂ emissions from major sources in the region, which MGSC plans to test by injecting one million tons of CO₂ into the formation at a rate of 1,000 tons per day. The CO₂ will be injected for three years, after which the injection site will be closed and the effectiveness of the storage reservoir evaluated. The entire CO₂ injection process will be carried out in association with the Archer Daniels Midland (ADM) Company, whose Decatur, Illinois-based ethanol plant will serve as the primary source

for the project’s CO₂. ADM will share the CO₂ production costs and DOE will fund the dehydration, compression, short pipeline, and related facility costs to deliver the CO₂ to the wellhead. The grant is the fourth of seven awards to be made under the Regional Carbon Sequestration Partnerships Program’s Deployment Phase. To learn more about DOE’s Regional Carbon Sequestration Partnerships, click: http://www.netl.doe.gov/technologies/carbon_seq/partnerships/partnerships.html. For further information about MGSC, go to: <http://www.sequestration.org/>. December 18, 2007, http://www.fossil.energy.gov/news/techlines/2007/07084-Illinois_Basin_Sequestration_Proje.html.

Reuters, “FutureGen Picks Illinois for Coal Project,” and Greenwire, “Industry Group Picks Illinois Site for FutureGen.”

On December 18, 2007, the FutureGen Alliance selected Mattoon, Illinois as the location to build FutureGen, a \$1.5 billion, near-zero emissions, coal-fired power plant that will demonstrate carbon capture and sequestration technologies. After considering more than 100 site-related factors, such as land, water, and geology, the Alliance selected Mattoon over three other site finalists – Tuscola, Illinois; Jewett, Texas; and Odessa, Texas – because of the ability to pump CO₂ directly underground from the plant. FutureGen Alliance officials announced the site decision earlier than initially agreed upon with DOE. Originally, DOE was to publish the final environmental impact statements on each of the four sites, let a 30-day waiting period pass before the declaration that each of the four sites was or was not suitable for the project, and then the FutureGen Alliance would announce its final site decision. However, the FutureGen Alliance publicized its decision sooner, and consequently, the decision to build in Mattoon will remain tentative until DOE announces its Record of Decision on the site’s suitability. The next challenge for the 275-megawatt plant, which is anticipated to be online in 2012, is to obtain more government funding as costs continue rise. The latest cost estimate for the project has increased to \$1.76 billion, which will be funded according to a cost-sharing agreement that states the FutureGen Alliance must pay 26 percent of the cost, with DOE funding the remaining 74 percent. The 13-member FutureGen Alliance, formed in 2003, includes US companies such as American Electric Power and Peabody Energy, along with international businesses Anglo American, BHP Billiton, and China’s largest coal-based power company, China Huaneng Group. To read the FutureGen Alliance’s Final Site Selection Report, click: http://www.futuregenalliance.org/news/fg_final_site_selection_report.pdf. December 18, 2007, <http://www.reuters.com/article/bondsNews/idUSN1849317620071218?sp=true> and December 18, 2007, <http://www.eenews.net/Greenwire/2007/12/18/1/#1>.



SEQUESTRATION IN THE NEWS

Business Week, “FutureGen Developers Propose Cost Change.”

Less than one month after the designation of Mattoon, Illinois as the future location of FutureGen, DOE threatened to delay or rescope the project into several research sites across the country in light of ever



increasing construction costs. Government projections show the plant’s projected cost has risen from \$950 million to \$1.8 billion, boosting DOE’s obligation to around \$1.3 billion – significantly up from the \$800 million originally projected in 2003. Consequently, DOE has offered to lower the government’s contribution to the same level as when the project was announced, leaving the FutureGen Alliance to cover the remaining cost and assume any further cost increases, more than likely funded through a combination of bank financing and repayments from plant-generated revenue. In response, FutureGen Alliance officials have been receptive to dialogue and offered to increase their contribution, because adding sites would delay the project by another two to five years due to further environmental reviews and other testing to prove site suitability. DOE has yet to issue its Record of Decision for the Mattoon site – a requirement before the department can spend taxpayer money on the project. January 11, 2008, <http://www.businessweek.com/ap/financialnews/D8U419PG0.htm>.

Houston Business Journal, “Proposed Freeport Plant Will Capture, Re-use Waste,” and Dow Chemical Company News Release, “Dow Signs MOU for Gasification Facility.”

Houston-based Hunton Energy and Michigan-based Dow Chemical Company announced the signing of a 15-year Memorandum of Understanding (MOU) that will result in the construction of a capture-ready synthetic natural gas plant in Freeport, Texas. Under the terms of the MOU,



the plant will manufacture syngas by mixing oxygen with petroleum coke and biomass and then convert it to methane, liquid sulfur, and slag – in addition to capturing 100 percent of CO₂ emissions. Hunton Energy would own, build, and operate the plant, which would be located on Dow’s Oyster Creek property, and once the gasification plant is completed, Dow would purchase synthetic natural gas and steam from Hunton for transport to its large Texas Operations manufacturing site, located in Freeport as well. Over the course of the project, Hunton plans to use steam turbines to produce additional power, sell CO₂ for enhanced oil recovery use, and sell byproduct sulfur and slag to fertilizer and concrete manufacturers, respectively. Groundbreaking for the plant is expected to take place in late 2008, giving Dow seven years to fulfill their company initiative to reduce greenhouse gas emissions by 20 percent by 2015. December 17, 2007, <http://www.bizjournals.com/houston/stories/2007/12/17/daily8.html> and December 13, 2007, http://news.dow.com/dow_news/corporate/2007/20071213c.htm.

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This newsletter 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.

SEQUESTRATION IN THE NEWS (CONTINUED)


Total Press Release, "Total and Indonesia Sign a Memorandum of Understanding on CO₂ Capture and Storage," and Energy Business Review, "Total and Indonesia Sign Carbon Capture and Storage Deal."

On December 17, Total announced the signing of a Memorandum of Understanding (MOU) by Total E&P Indonesia and the Indonesian Ministry of Energy and Mineral Resources, allowing for Indonesia's Agency of Research and Development for Energy and Mineral Resources to access Total's data from a CO₂ pilot project taking place near Lacq in southwest France. The project, dubbed as one of the first in the world to encompass the complete sequence from fuel combustion to geological storage, is anticipated to prove the viability of an integrated carbon capture and storage methodology. The agreement provides Indonesia with the opportunity to evolve its economical and technical knowledge of geologic CO₂ storage mechanisms and assist the Indonesian Government in the establishment of proper regulatory framework for comparable projects. Total, Indonesia's leading gas producer, supplies a portion of the domestic market and foreign


markets in Japan, Korea, and Taiwan. December 17, 2007, http://www.total.com/en/press/press_releases/pr_2007/071217-indonesia-co2-capture-storage_14383.htm and December 17, 2007, http://www.energy-business-review.com/article_news.asp?guid=E1C793B2-00F3-446F-9040-F7C888F8F0FC.



ANNOUNCEMENTS



The 7th Annual Conference on Carbon Capture & Sequestration, scheduled for May 5-8, 2008 in Pittsburgh, Pennsylvania, is seeking abstracts addressing liability for long-term CO₂ sequestration, regulatory oversight, infrastructure requirements, retrofitting fossil fuel-based plants, and several other topics. The deadline for abstract submissions is February 12, 2008. For abstract details and guidelines, click: http://www.carbonsq.com/pdf/2008/call_for_papers.pdf or go to: <http://www.signup4.net/Public/ap.aspx?EID=08CS11E> to submit abstracts.



9th International Conference on Greenhouse Gas Control Technologies. The call for papers is now open for GHGT-9, scheduled to be held in Washington, DC on November 16-20, 2008. The conference is aimed to provide information on the latest developments on CCS, with one of the key themes designated as building awareness of the current technical status of CCS and addressing issues that we need to consider for future wide-scale implementation. Abstracts for papers or posters can be submitted online until March 28, 2008. Details can be found at: <http://mit.edu/ghgt9/papers/index.html>.

Chicago Climate Futures Exchange Announces New Records in 2007.

The Chicago Climate Futures Exchange (CCFE) announced that 283,756 contracts were traded in 2007, compared to 28,924 contracts in 2006 – a record-setting 881 percent increase. In addition, open interest on CCFE rose 719 percent, growing from 3,822 contracts at the start of 2007 to 31,290 contracts at year's end. For further details, click: http://www.chicagoclimateexchange.com/news/press/release_20080110_CCFE_endyearrecord.pdf or visit: <http://www.chicagoclimateexchange.com/>.

Carbon Management Council Formed.

A group of eight companies formed the Carbon Management Council (CMC) on December 17 to help organizations develop solutions for managing their carbon emissions. CMC offers decision makers information for creating a carbon management program and discovering market opportunities created by reducing their carbon footprint. Members include representatives from Fortune 1000 companies, public utilities, and venture capital firms. To view the website, go to: <http://www.carboncouncil.org/>.

SCIENCE

Science Daily, “Penguins In Peril As Climate Warms.”



According to a World Wildlife Fund (WWF) report, the four penguin populations that breed on the Antarctic continent – the Adélie, Emperor, Chinstrap and Gentoo – are facing increasing pressure to survive as global warming shrinks both their food supply and the ground where their young are raised. Data show that the Antarctic Peninsula is warming five times faster than the average rate of global warming. The vast Southern Ocean has warmed to a depth of 3,000 meters, which has significantly reduced the area’s krill population. In regards to the West Antarctic Peninsula, sea ice covers 40 percent less area than it did 26 years ago, which has decreased the Chinstrap penguin population by as much as 30 percent to 66 percent in some colonies. Moreover, the Emperor penguin has seen some of its colonies decrease 50 percent over the past half century, as warmer winter temperatures and stronger winds cause sea ice to prematurely break off, sending many eggs and chicks away before they can survive on their own. The Antarctic Peninsula’s northwestern coast has been affected most by warming, causing Adélie penguin population to drop by 65 percent over the past 25 years. To view the report, titled “Antarctic Penguins and Climate Change,” click: http://assets.panda.org/downloads/folleto_penguins.pdf. December 15, 2007, <http://www.sciencedaily.com/releases/2007/12/071213203604.htm>.

Reuters, “2008 to be in Top 10 Warmest Years Say Forecasters.”

Projections by experts at the Met Office and the University of East Anglia show 2008 will be slightly cooler than recent years, but still rank among the top 10 warmest years on record since 1850. The forecasters said global average temperatures would be 0.37 of a degree Celsius above the long term 1961 to 1990 average of 14 degrees – the coolest since 2000. In comparison, from 2001 to 2007 the rate of warming averaged 0.44 degrees Celsius above the 1961 to 1990 average and 0.21 degrees Celsius warmer than corresponding values for 1991 to 2000. The projections take into account the annual Pacific Ocean La Nina weather phenomenon, which is expected to be strong this year and consequently limit the warming trend, and rising atmospheric concentrations of greenhouse gases, solar variations, and natural changes in the ocean currents. Due to the current La Nina reducing the sea surface temperature by around 0.5 degrees Celsius, the global surface temperature response to the cooling effect is expected to be slightly greater in 2008 than it was in 2007. In December 2007, the World Meteorological Organization (WMO) said that the 10 years from 1998 to 2007 were the hottest decade on record. The Met Office Hadley Centre added that the top 11 warmest years have all occurred over the past 13 years. January 3, 2008, <http://uk.reuters.com/article/environmentNews/idUKL0314515220080103?sp=true>.

POLICY

Reuters, “Bali Breakthrough Launches Climate Talks,” and *Reuters*, “U.S. Drops Opposition to U.N. Climate Deal.”

Following pleas from other nations, the United States dropped its opposition to a global warming plan and will participate in future talks regarding a new United Nations climate treaty that would replace the Kyoto Protocol, which is set to expire in 2012. The agreement signals a shift in the United States’ climate policy stance after six years of disagreement with major allies caused by President George W. Bush withdrawal from the Kyoto Protocol. The Bali meeting creates a “roadmap” for two years of talks, which will ideally lead to the adoption of a new treaty at a global meeting in Copenhagen in late 2009. The deal came when the United States dropped opposition to a proposal presented by the Group of 77 (G77) – the United Nations’ main developing nation bloc – that called for rich nations to do more to help the developing world fight rising greenhouse emissions. As the world’s leading greenhouse gas emitter, the United States maintained its uncertainty over future talks despite dropping their opposition. If a global climate agreement can be reached by 2009, governments would have sufficient time to ratify the pact and assure confidence in markets and investors wanting to switch to cleaner energies. Under the Kyoto Protocol, all industrial nations besides the United States are required to cut emissions between 2008 and 2012. A new climate deal would seek to include developing nations that are currently exempt from emissions standards. December 15, 2007, <http://www.reuters.com/article/environmentNews/idUSL1412327320071215> and December 15, 2007, <http://www.reuters.com/article/environmentNews/idUSL1513238120071215>.

“Analysis of the impacts of combining carbon taxation and emission trading on different industry sectors.”

Application of price mechanisms has been the important instrument for carbon reduction, among which the carbon tax has been frequently advocated as a cost-effective economic tool. However, blanket taxes applied to all industries in a country might not always be fair or successful. It should therefore be implemented together with other economic tools, such as emission trading, for CO₂ reduction. This study aims to analyze the impacts of combining a carbon tax and emission trading on different industry sectors. Results indicate that the “grandfathering rule (RCE2000)” is the more feasible approach in allocating the emission permit to each industry sector. Results also find that the accumulated GDP loss of the petrochemical industry by the carbon tax during the period 2011–2020 is 5.7 [percent]. However, the accumulated value of GDP will drop by only 4.7 [percent] if carbon taxation is implemented together with emission trading. Besides, among petrochemical-related industry sectors, up-stream sectors earn profit from emission trading, while down-stream sectors have to purchase additional emission permits due to failure to achieve their emission targets. **Cheng F. Lee, Sue J. Lin and Charles Lewis**, *Energy Policy*, Available online December 3, 2007, doi:10.1016/j.enpol.2007.10.025, <http://www.sciencedirect.com/science/article/B6V2W-4R8M9HG-2/2/5b143cec4352e8d62001ac30dd65c5bb>. (Subscription may be required.)

GEOLOGY

“Heat optimization of a staged gas–solid mineral carbonation process for long-term CO₂ storage.”

Carbonation of magnesium silicates offers an interesting option for CO₂ emission mitigation in Finland, a country with large resources of serpentine-type minerals. Wet processes using aqueous solutions show reasonable chemical kinetics combined with poor energy economy. A dry, gas–solid process with slower chemical kinetics (demonstrated previously), but better energy economy could be an alternative. This paper addresses the energy economy of a two- or three-stage gas–solid process for magnesium silicate carbonation. It involves production of reactive magnesium as magnesium oxide or hydroxide in an atmospheric pressure step, followed by carbonation at elevated pressures that allow for reasonable carbonation reaction kinetics under conditions where magnesium carbonate is thermodynamically stable. For a feasible large-scale process the kinetics in the individual reactors must be fast enough, while the heat produced in the carbonation step must be sufficient to compensate for energy inputs to the preceding step(s). Results give reactor temperature combinations that allow for operation at a negative or zero energy input, for given carbonation reactor pressure and degree of carbonation conversion, and other process energy requirements. Softwares used were HSC and Aspen Plus. Also, some results from gas–solid kinetics studies with magnesium oxide-based materials at the pressures considered are included. **Ron Zevenhoven, Sebastian Teir and Sanni Eloneva**, *Energy*, Available online December 21, 2007, doi:10.1016/j.energy.2007.11.005, <http://www.sciencedirect.com/science/article/B6V2S-4RDB8T4-1/2/bc2dec6bca60068666fb0839b0f2abf8>. (Subscription may be required.)

“Experimental evaluation of interactions in supercritical CO₂/water/rock minerals system under geologic CO₂.”

The hydrothermal autoclave experiments were conducted to simulate the interactions in the [Supercritical] CO₂/water/rock minerals (quartz, biotite and granite) reaction systems using a Hastelloy [carbon] reaction cell at 100 [degrees Celsius]. The dissolution characteristics of rock minerals and their surface texture alternation after hydrothermal treatment were examined by ICP-AES and SEM/EDX investigation, respectively. The results suggested that the hydrolysis of plagioclase phase should be mainly responsible for the elements dissolved from the Iidate granite samples. The dissolution was encouraged by the introduction of CO₂ in the water/granite system, and generated an unknown aluminosilicate. No distinct chemical alternations occurred in the water-free scCO₂/granite system, which indicated that rock minerals should be chemically stable in the water-free scCO₂ fluids under the current mild experimental conditions. Both the highest concentration of Ca existing in the scCO₂/vapor/granite system and the SEM observation results of calcite deposit, suggested that a meaningful CO₂ minerals trapping process should be potential in the CO₂-rich field during a short physicochemical interaction period. **Hongfei Lin, Takashi Fujii, Reisuke Takisawa, Toru Takahashi and Toshiyuki Hashida**, *Journal of Materials Science*, Available online December 22, 2007, DOI: 10.1007/s10853-007-2029-4, <http://www.springerlink.com/content/116857412745p8l3/?p=bc1e6c1e9a1f478a80629085f14f242d&pi=1>. (Subscription required.)

TECHNOLOGY

“Fast CO₂ sequestration by aerogel composites.”

The increasingly evident impact of anthropogenic CO₂ emissions on climate change and associated environmental effects is stimulating the search for viable methods to remove this gas. One of the most promising strategies is the long-term storage of CO₂ in inert, insoluble and thermodynamically-stable materials. This strategy mimics the natural reactions that transform silicates into carbonates regulating the cycle of CO₂ on the surface of the Earth, operating on a geological time-scale. Consequently, the aim is to accelerate these reactions to be applicable on the timescale of human lives. [The authors] present the various technologies developed or proposed to date, based on this particular approach. The principal limiting factor is that high pressures and temperatures are required to produce appropriate materials capable of CO₂ sequestration and storage. Nevertheless, the synthetic materials known as aerogels can be modified in shape, size and chemical functionality so as to catalyze the process of CO₂ elimination through silicates (of Ca or Mg), considerably reducing the reaction time and working at atmospheric pressure and temperature. **Alberto Santos, Mohamed Ajbary, Abdelhak Kherbeche, Manuel Piñero, N. De la Rosa-Fox and Luis Esquivias**, *Journal of Sol-Gel Science and Technology*, Available online December 25, 2007, DOI:10.1007/s10971-007-1672-1, <http://www.springerlink.com/content/w23315054r0422v6/?p=fdce916b125f45e1b45bdaf04e1882ae&pi=1>. (Subscription required.)

“Cycle Development and Design for CO₂ Capture from Flue Gas by Vacuum Swing Adsorption.”

CO₂ capture and storage is an important component in the development of clean power generation processes. One CO₂ capture technology is gas-phase adsorption, specifically pressure (or vacuum) swing adsorption. The complexity of these processes makes evaluation and assessment of new adsorbents difficult and time-consuming. In this study, [the authors] have developed a simple model specifically targeted at CO₂ capture by pressure swing adsorption and validated our model by comparison with data from a fully instrumented pilot-scale pressure swing adsorption process. The model captures non-isothermal effects as well as nonlinear adsorption and nitrogen coadsorption. Using the model and our apparatus, [the authors] have designed and studied a large number of cycles for CO₂ capture. [The authors] demonstrate that by careful management of adsorption fronts and assembly of cycles based on understanding of the roles of individual steps, [the authors] are able to quickly assess the effect of adsorbents and process parameters on capture performance and identify optimal operating regimes and cycles. [The authors] recommend this approach in contrast to exhaustive parametric studies which tend to depend on specifics of the chosen cycle and adsorbent. [The authors] show that appropriate combinations of process steps can yield excellent process performance and demonstrate how the pressure drop, and heat loss, etc. affect process performance through their effect on adsorption fronts and profiles. Finally, cyclic temperature profiles along the adsorption column can be readily used to infer concentration profiles – this has proved to be a very useful tool in cyclic function definition. [The authors’] research reveals

TECHNOLOGY (CONTINUED)

excellent promise for the application of pressure/vacuum swing adsorption technology in the arena of CO₂ capture from flue gases. **Jun Zhang and Paul A. Webley**, *Environmental Science & Technology*, Available online December 7, 2007, DOI:10.1021/es0706854, <http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2008/42/i02/abs/es0706854.html>. (Subscription required.)



TERRESTRIAL/OCEAN

“Microbial activity and soil C sequestration for reduced and conventional tillage cotton.”

Crop management practices, such as tillage and diversified crop rotations, impact microbial activity, organic matter turnover, and ultimately soil [carbon] and [nitrogen] sequestration. The objectives of this study were to determine the impacts of tillage on soil microbial biomass, mineralized C and N, and soil organic C (SOC) and N (SON) contents for different cotton (*Gossypium hirsutum* L.) cropping systems in a south-central Texas silt loam soil. Tillage influenced SOC and SON, but most effects were observed at 0–5 cm rather than 5–15 cm. Reduced tillage (RT) in a continuous cotton monoculture increased SOC by 24 [percent] and SON by 27 [percent] compared to conventional tillage (CT) at 0–5 cm, but tillage had no effect at 5–15 cm. Crop rotation increased soil C and N contents compared to continuous cotton, as a cotton-corn (*Zea mays* L.) rotation under CT increased SOC by 28 [percent] and SON by 26 [percent] at 0–5 cm compared to CT continuous cotton. Soil organic C and SON were both 18 [percent] greater for cotton-corn than continuous cotton at 5–15 cm. For the 0–15 cm depth interval, the CT cotton-corn rotation increased SOC by an average of 518 kg C [per hectare per year] and SON by 57 kg N [per hectare per year] compared to CT continuous cotton. Cotton under RT sequestered 254 kg C [per hectare per year] and 33 kg N [per hectare per year] more than cotton under CT. Reduced tillage increased soil microbial biomass C (MBC) by an average of 11 and 18 [percent] compared to CT continuous cotton and the cotton-corn rotation, respectively, while microbial biomass N (MBN) for RT was 62 [percent] greater than for CT. Tillage decreased mineralized C and N at both depth intervals, while cotton-corn showed higher mineralized C than continuous cotton. Soils for cropping systems that sequestered the most C and N also had the highest microbial biomass and mineralized C and N, indicating close relationships between microbial activity and soil C and N sequestration. Beneficial effects of RT and intensive cropping were enhanced soil C and N sequestration rates and potentially lower N fertilizer requirements for crops. **Alan L. Wright, Frank M. Hons, Robert G. Lemon, Mark L. McFarland and Robert L. Nichols**. *Applied Soil Ecology*, Available online December 3, 2007, doi:10.1016/j.apsoil.2007.10.006, <http://www.sciencedirect.com/science/article/B6T4B-4R8KT1N-1/2/0b2f0233272db32ed47626f66e88b50c>. (Subscription may be required.)

TRADING

Carbon Market Update, Jan. 16, 2008

CCX-CFI 2008 (\$/tCO₂)
\$2.15 (Vintage 2008)

EU ETS-EUA DEC 2008
(\$/tCO₂) \$33.42

(Converted from € to US\$)

Reuters, “Tokyo Seen Eyeing China’s Carbon Credits.”

According to the Japanese newspaper Yomiuri Shimbun, Japanese and Chinese officials have agreed to a deal where Japan would purchase carbon credits yielded by its investments in emissions-cutting projects in China. The agreement will be formally signed when Chinese President Hu Jintao visits Japan in late March and selects specific emissions-cutting projects. Although the price of the credits was not revealed, government sources project that six projects could generate emissions reductions equivalent to 10 million tons to 15 million tons of CO₂ over the next five years. Japan is the only Asian country obligated under the Kyoto Protocol to cut its greenhouse gas levels and has been lagging behind its commitment to a 6 percent cut from 1990 levels during the 2008 to 2012 period. Late last year, Japanese officials finalized a list of measures to cut roughly 35 to 36 million tons of CO₂ through voluntary industrial agreements and energy conservation programs. In addition to purchasing credits from China under Kyoto’s Clean Development Mechanism, which allows rich polluters to buy developing nations’ emissions reductions to put toward their domestic quotas, Japan agreed to buy credits from Hungary in December and is also engaged in talks with Poland, the Czech Republic, and Ukraine about similar deals. January 3, 2008, <http://uk.reuters.com/article/oilRpt/idUKT22551420080103>.

Times Online, “Tighter European Limits Set to Push Up Price of Carbon Emissions,” and *Times Online*, “EU Cracks Down on Carbon Emissions Trading.”

According to Andrei Marcu, president of the International Emissions Trading Association (IETA), the value of the global carbon trading emissions market could reach \$100 billion this year, which would exceed the



estimated \$60 billion to \$70 billion figure in 2007. The bulk of the estimated total would come from the European Union Emissions Trading Scheme (EU ETS), whose second phase went into effect on January 2, 2008 and lasts until 2012. The second phase is expected to prosper much more than the first phase, because there will be a 5 percent to 10 percent reduction in the number of emissions permits

TRADING (CONTINUED)

granted. Launched in 2005, the first phase was widely dismissed as a failure, because too many permits were granted by member states to individual polluters, causing market prices to plunge as low as \$1.46 (€1) per tonne. Deutsche Bank and UBS expect forward prices to rise from the present level of about \$33.77 (€23) a tonne to \$51.39 (€35) and \$44.05 (€30) a tonne, respectively. Critics believe EU ETS needs to

auction off a much larger portion of the permits, so that big polluters are not tempted to sell any excess permits that they originally received for free. January 3, 2008, <http://business.timesonline.co.uk/tol/business/markets/europe/article3123564.ece> and January 2, 2008, http://business.timesonline.co.uk/tol/business/industry_sectors/utilities/article3121968.ece.

RECENT PUBLICATIONS

“Near-Term Opportunities for Carbon Dioxide Capture and Storage.”

Today, fossil fuels provide about 80 [percent] of global energy demand and the outlook is that they will remain the dominant source of energy for decades to come. Consequently global energy-related CO₂ emissions increase 55 [percent] between 2004 and 2030 in a business-as-usual outlook. It is increasingly clear that this development path is not sustainable. Carbon dioxide capture and storage (CCS) is a critical technology to significantly reduce CO₂ emissions. In a global CO₂ emissions stabilization scenario, CCS in power generation, industry and fuel transformation could account for 20 [percent] of CO₂ savings (6.5 Gt of CO₂ captured and stored annually in 2050). Accelerating investment in R&D and demonstration projects will be needed if CCS is to make a significant contribution. CCS along with other mitigation measures could significantly reduce the costs of stabilizing greenhouse gas concentrations and increase the flexibility to achieve that goal. To read the complete International Energy Agency (IEA) summary report on near-term carbon dioxide capture and storage (CCS) opportunities, click: http://www.iea.org/textbase/work/2007/oslo/summary_report.pdf.

“Liability and Financial Responsibility Frameworks for Carbon Capture and Sequestration.”

This issue brief examines existing federal and state liability and financial responsibility frameworks that may be applicable for carbon dioxide capture and geological sequestration (CCS). Many of the potential risks involved with CCS have been successfully managed under existing state and federal regimes. However, the long time scales associated with CCS projects present unique risks that must be addressed before CCS technology can be widely deployed. Establishment of reliable risk profiles will help to create the appropriate financial responsibility framework to minimize and manage such risks. Significant jurisdictional differences in the existing state liability frameworks will likely influence the siting, construction and operation of CCS projects. Options to address these differences include establishing minimum standards for financial responsibility and/or an indemnity program. To view the World Resource Institute issue brief, click: <http://pdf.wri.org/liability-and-financial-responsibility.pdf>.

“Reducing U.S. Greenhouse Gas Emissions: How Much at What Cost?”

The United States could reduce greenhouse gas emissions in 2030 by 3.0 to 4.5 CO₂e using tested approaches and high potential emerging technologies. These reductions would involve pursuing a wide array of abatement options available at marginal costs less than \$50 per ton, with the average net cost to the economy being far lower if the nation can capture sizable gains from energy efficiency. Achieving these reductions at the lowest cost to the economy, however, will require strong, coordinated, economy-wide action that begins in the near future. Although our research suggests the net cost of achieving these levels of GHG abatement could be quite low on a societal basis, issues of timing and allocation would likely lead various stakeholders to perceive the costs very differently – particularly during the transition to a lower carbon economy. Costs will tend to concentrate more in some sectors than others, and involve “real” up-front outlays that would be offset by “avoided” future outlays. Given the timing of investments relative to savings, the economy might well encounter periods of significant visible costs, with the costs and benefits shared unequally among stakeholders. Nonetheless, a concerted, nationwide effort to reduce GHG emissions would almost certainly stimulate economic forces and create business opportunities that we cannot foresee today and that may accelerate the rate of abatement the nation can achieve, thereby reducing the overall cost. To read the complete executive report from the US Greenhouse Gas Abatement Mapping Initiative, go to: http://www.mckinsey.com/clientervice/ccsi/pdf/US_ghg_final_report.pdf.

LEGISLATIVE ACTIVITY

New York Times Online, “Bush Signs Broad Energy Bill.”

On December 19, President George W. Bush signed the Energy Independence and Security Act of 2007, which will increase fuel economy standards for the first time in 32 years, phase out incandes-

cent light bulbs within 10 years, and require the production of 36 billion gallons of renewable fuels by 2022. The landmark legislation passed in the House on a bipartisan vote of 314 to 100, but critics contend the potential exists for farmland to be used for ethanol feedstock and raise the cost of food due to increased competition for corn and grain. Proponents say that the legislation has the potential to significantly reduce dependence on foreign oil imports and greenhouse gas emissions. In regards to carbon sequestration, the legislation

LEGISLATIVE ACTIVITY (CONTINUED)

provides up to \$30 million for a national assessment of capacity for CO₂, up to \$200 million per year for the demonstration of technologies exhibiting the large-scale capture of CO₂ from industrial sources, and up to \$240 million per year for research and development (R&D). To view the Energy Bill's Title VII, highlighting carbon capture and sequestration plans, click: <http://www.govtrack.us/data/us/bills/text/110/h/h6.pdf> and view pages 213-225. December 19, 2007, <http://www.nytimes.com/2007/12/19/washington/19cnd-energy.html?ex=1355720400&en=8b630cb48ce08ed5&ei=5088&partner=rssnyt&emc=rss>.

***Gillette News Record*, “Legislator: Greenhouse Gases Must Be Managed.”**

Wyoming State Representative Tom Lubnau announced that three separate carbon sequestration bills, supported by House Speaker Roy Cohee and Governor Dave Freudenthal, will go before the Wyoming



Legislature in February 2008. The legislation would create a legal framework for pumping CO₂ underground by addressing ownership, regulation, and “condemnation” issues – although Lubnau admitted sequestration projects could cause up to a 40 percent increase in consumers’ electric bills. The draft bill contains the following: pore space would be owned by the surface owners, while the gas would be owned by whoever injects it; Wyoming’s Department of Environmental Quality and Oil and Gas Conservation Commission would both play a role in regulating the gas; and condemnation issues, such as how to manage CO₂ that moves from under one person’s property to another or into a neighboring state, because underground chambers can stretch for hundreds of miles. At the Federal level, Wyoming Senator John Barrasso said that he recently voted against the Lieberman-Warner (S. 2191) bill that would cap greenhouse gases, but would consider each greenhouse gas bill that comes before him. January 9, 2008, http://www.gillette newsrecord.com/articles/2008/01/09/news/recent_articles/news07.txt.



EVENTS

February 5-6, 2008, **Voluntary Carbon Markets**, *Park Central Hotel, New York City, New York, USA*. Voluntary Carbon Markets is the United States’ only event that focuses solely on the US-based voluntary carbon market and offers participants the opportunity to learn from practical case studies and interactive panel discussions. Topics include finance, investment, technology, market evolution, standards and registries, and buying and selling credits. For conference agenda and registration, visit: http://www.greenpowerconferences.com/carbonmarkets/voluntary_newyork08.html.

February 11-12, 2008, **European Gas Storage**, *Le Meridien Budapest, Budapest, Hungary*. The 2nd Annual European Gas Storage conference unite regulators, project operators, academics, and market players to debate the next step in the regulatory, building, and investment processes involving gas storage and offers insight to making strategic business decisions. For general conference information, visit: <http://www.platts.com/Events/2008/pc862/index.xml> or click <http://www.platts.com/Events/2008/pc862/agenda.pdf?S=n> for conference agenda.

February 26-27, 2008, **The Future of the Carbon Market**, *Le Méridien Piccadilly, London, England*. In an industry where regulatory and economic developments are driving change, The Future of the Carbon Market strives to aid participants with their preparation for Phase II of the EU Emission Trading Scheme and its increasingly strict emissions cap. Discussion will focus on market liquidity and the price of carbon, the adaptation of businesses to the new regime, making sound, long-term strategic decisions, and the regulatory uncertainty as political leaders negotiate a follow up to the soon expiring Kyoto Protocol. For conference registration and agenda, go to: <http://www.marketforce.eu.com/carbon/>.

February 26-27, 2008, **Carbon Forum America**, *Moscone Center, San Francisco, California*. Carbon Forum America is the first US industry event that combines a trade fair with a conference, creating a unique opportunity for attendees to mingle with key players in the carbon community. Presentations will cover subjects ranging from new solutions and technologies for carbon abatement, the market’s use of voluntary carbon standards, new energy sources and their effects on energy pricing, and the interaction of Green Investment Schemes with the CDM. To view a PDF version of the conference brochure, go to: http://www.carbonforumamerica.com/documents/CFAExhibit10_11_07.pdf.



EVENTS (CONTINUED)

February 27-28, 2008, **4th Annual Brussels Climate Change Conference**, *The Management Centre Europe, Brussels, Belgium*. The 4th Annual Brussels Climate Change Conference will examine the obstacles facing negotiations for a post-2012 global climate change agreement. The issues open for discussion include: EU and global priorities to address climate change, financing climate change and clean energy, pathways to financing of a low-carbon economy, financing energy efficiency, proposals to reduce CO2 emissions from cars and airplanes, and a review of the EU Emissions Trading Scheme. For further information, click: <http://www.climate-policy.eu/>.

March 11-13, 2008, **Carbon Market Insights 2008**, *Bella Center, Copenhagen, Denmark*. This annually successful event provides attendees with unrivaled insight into everything carbon markets, including several “streams” based on: Carbon Trading, Carbon Projects, Carbon and Energy, and the Voluntary Market. For this year’s event, Point Carbon is offering participants the opportunity to hold side events during designated times, with preference given to those offering a fresh view on climate policy and the carbon market. To view a detailed conference brochure, visit: <http://www.pointcarbon.com/Events/Carbon%20Market%20Insights/category401.html>.

March 12-14, 2008, **Globe 2008**, *Vancouver Convention and Exhibition Centre, Vancouver, British Columbia, Canada*. Globe 2008 brings together some 2,000 delegates from all over the world to access strategic business issues influencing global economic and environmental agenda. This conference is highly recommended for corporate executives, policymakers, environmental industry executives, international agency representatives, urban leaders and design professionals, and financial executives. To browse the Preliminary Conference Program, containing agenda and registration information, go to: http://www.globe2008.ca/documents/GL08_PreProgram_single.pdf.

April 5-11, 2008, **8th International Conference on Environmental Compliance and Enforcement**, *Cape Town, South Africa*. With participants from more 80 countries and organizations across the globe, this conference brings together environmental enforcement practitioners to discuss compliance with international and domestic environmental laws. The agenda includes a segment about climate change and compliance composed of discussions about integrity in emissions trading, energy efficiency, the Clean Development Mechanism, and Post-2012 compliance mechanisms. For more information, visit: <http://www.inece.org/conference/8/>.

April 11-12, 2008, **2008 MIT Energy Conference**, *Marriott Hotel in Kendall Square, Cambridge, Massachusetts, USA*. The 2008 MIT Energy Conference is the ideal forum for assembling technology, policy, and industry leaders to develop solutions for capitalizing on the opportunities present in modern energy markets. The two-day event opens with a showcase for energy research and inventive businesses to the community, followed by a one-day conference that opens with a panel discussion about carbon capture and sequestration. For general conference details, click <http://www.mitenergyconference.com/>.

April 17, 2008, **Living in a Low Carbon World**, *Geographical Society, London, England*. The participants in Living in a Low Carbon World 2008 will examine how the development, property, finance, transport, energy and retail sectors can collaborate to communicate more effectively with the public about climate change. Through panel discussions, interactive voting, case studies, and keynote speeches, several United Kingdom-based strategic developments to combat climate change will be addressed. To browse the conference website, click: <http://conference.lowcarbonworld.net/main.php?pid=80>.

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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.