



Office of Fossil Energy

Carbon Sequestration Newsletter



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OCTOBER 2012

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Carbon Sequestration

could potentially arise from carbon dioxide (CO₂) storage sites. The risk profiles have a detailed methodology for quantifying risk potential at underground carbon storage sites that will help support safe, large-scale CCUS projects. The risk profiles are a product of the National Risk Assessment Partnership (NRAP), led by the Office of Fossil Energy's (FE) National Energy Technology Laboratory (NETL) and the NETL-Regional University Alliance (RUA). The five national laboratories that form the partnership include: Lawrence Berkeley National Laboratory (LBNL) and Los Alamos National Laboratory (LANL), both of which contributed expertise in monitoring for risk assessment; Pacific Northwest National Laboratory (PNNL), contributing expertise in risks to groundwater systems; Lawrence Livermore National Laboratory (LLNL), offering expertise in natural seal integrity; and NETL, contributing expertise in wellbore integrity. The first-generation risk profiles are part of NRAP's Phase I, during which three different generations of risk profiles will be developed, each improving the technical complexity and reducing uncertainty compared to the previous generation. In Phase II, NRAP researchers will identify and develop risk management approaches that include strategic monitoring to verify system performance and lower uncertainty. NRAP may also include a Phase III, which would involve gaining additional data from field tests. NRAP is one of several simulation and modeling efforts conducted under the Carbon Capture and Storage Simulation Initiative. September 18, 2012, http://fossil.energy.gov/news/techlines/2012/12043-Risk_Profiles_Aid_CO2_Storage.html.

INTRODUCTION

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

HIGHLIGHTS

Fossil Energy Techline, "First-Generation Risk Profiles Help Predict CO₂ Storage Site Obstacles."

A collaboration of five U.S. Department of Energy (DOE) national laboratories has completed first-generation risk profiles in support of large-scale carbon capture, utilization, and storage (CCUS) projects. The collaboration offers a means to predict the probability of complications that

Fossil Energy Techline, "Energy Department Announces Major Milestones for Decatur, Ill. Clean Coal Project."

DOE announced two major milestones in their first large-scale Industrial Carbon Capture and Storage (ICCS) project in Decatur, Illinois: progress made on construction of the project's storage facility was marked by the Archer Daniels Midland Company (ADM), and the National Sequestration Education Center was opened to the public. The Illinois project will be able to store 1 million tons of CO₂ per year once fully operational in 2013, and will also help demonstrate the feasibility and reduce the cost of clean coal and CCUS technologies. Funded in partnership with the Richland Community College, the Education Center contains classrooms, training, and laboratory facilities, and offers students associate degrees in [carbon storage] technology. The Illinois ICCS project is led by ADM, a member of the Midwest Geological Sequestration Consortium (MGSC), one of seven DOE Regional Carbon Sequestration Partnerships (RCSPs), and is designed to store approximately 2,500 metric tons of CO₂ per day in the Mount Simon Sandstone saline formation at approximate depths of 7,000 feet. According



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HIGHLIGHTS (CONTINUED)

to researchers' estimates, the sandstone formation has the potential to store all of the more than 250 million tons of CO₂ produced each year by industry in the Illinois Basin region. The Illinois ICCS project includes the design, construction, and demonstration of a CO₂ compression and dehydration facility that will enable the high-pressure stream of CO₂ available to the pipeline and injection well. The operations phase of the project is expected to begin in late-summer 2013 and will create approximately 260 jobs and add to the understanding of long-term CO₂ storage in saline formations. September 19, 2012, http://www.fossil.energy.gov/news/techlines/2012/12044-Sequestration_Education_Center_Ope.html.

SEQUESTRATION IN THE NEWS

Carbon Capture Journal, "Imperial College London CO₂ Storage Labs Opened."

Four recently opened laboratories at Imperial College London will explore methods of storing CO₂ in carbonate rock. The labs offer Imperial researchers an outlet to develop a deeper understanding of what happens to CO₂ emissions at the microscopic level by carrying out experiments observing CO₂ within the rock under reservoir conditions and modeling how it flows through pores in the rock. By linking this to imaging experiments and models on a larger scale, researchers can then predict what happens to CO₂ when it is stored in carbonate rock reservoirs and provide detail on how to effectively and efficiently store CO₂ in carbonate rock. The research is part of the Qatar Carbonates and Carbon Storage Research Center (QCCSRC), which was established in 2008 as part of a 10-year, \$70 million collaboration between Imperial, Qatar Petroleum, Shell, and the Qatar Science and Technology Park. Carbonate Rocks are the predominant reservoir type in the Middle East and store a large portion of the world's oil and gas reserves. September 13, 2012, <http://www.carboncapturejournal.com/displaynews.php?NewSID=1015&PHPSESSID=dth89mab1uh1mptlhea1do0c3>.

Proactive Investors, "Elk Petroleum's Grieve Enhanced Oil Recovery Project on Schedule and Within Budget."

Elk Petroleum is advancing the construction phase of the Grieve oil field enhanced oil recovery (EOR) project in Wyoming on schedule and within budget, according to the company. Operated by Denbury Resources, the Grieve Project is expected to produce up to 1,000 barrels of oil per day net within three years, with the potential to produce up to 5,000 barrels per day by five years. Site preparation work at the Grieve field is nearing completion, and the first of the concrete foundations for the new field facilities has been poured. Denbury has submitted an Application for Permit to Drill to the Wyoming Oil and Gas Conservation Commission for the Grieve #62 well, which will be the first of the wells to be drilled to the Madison formation. The well will be drilled to a target depth of 3,231 meters to source water for the injection and accelerated re-pressuring of the oil-bearing Muddy formation. The project is set to begin CO₂ injection in November 2012. The Elk Petroleum Grieve Project Update is available at:

SEQUESTRATION IN THE NEWS (CONTINUED)

<http://clients2.weblink.com.au/clients/elkpet/article.asp?asx=ELK&view=6604844>. September 21, 2012, <http://www.proactiveinvestors.com.au/companies/news/33677/elk-petroleumsgrieve-enhanced-oil-recovery-project-on-schedule-and-within-budget--33677.html>.

Carbon Capture Journal, “Aquistore Drills Deepest Well in Saskatchewan.”

According to officials, the deepest well in Saskatchewan has been drilled to a total depth of 3,396 meters, becoming the new home of the Petroleum Technology Research Center’s (PTRC) Aquistore project, a saline storage project located outside Estevan in southeastern Saskatchewan. Due to the lack of deep wells in the area, the Aquistore well is expected to become the primary data point for the Deadwood formation, the deepest sedimentary unit in the Williston Basin. In addition to CO₂ storage, the comprehensive suite of well logs will benefit companies interested in oil-bearing formations. The information gathered is expected to provide valuable knowledge for the MVA

program undertaken by the project. A second observation well will also be drilled, at a comparable depth, to further track the CO₂. Together, these two wells can provide valuable information and data to the project and other interested parties. September 25, 2012, <http://www.carboncapturejournal.com/displaynews.php?NewsID=1022&PHPSESSID=18dkjsha7qaa6s815mlrslvtq4>.

Australian Mining, “Geosequestration Research Facility to be Developed,” and Mining Weekly, “[Western Australia] Gets CCS Facility.”

Western Australia will develop a new geosequestration research facility to study advanced carbon storage technologies following a multi-million dollar investment from the Australian government. The new National Geosequestration Laboratory (NGL) will act as a “hub and spoke” model and will be part of the Australian Resources Centre at Technology Park, Kensington, Western Australia, along with nodes at other Australian sites forming part of the overall facility. The first NGL will house a carbon capture and storage geophysics and geochemistry research facility, and its first role will be a detailed analysis of the core and electronic data from the recently completed Harvey 1 Well. September 28, 2012, <http://www.miningaustralia.com.au/news/geosequestration-research-facility-to-be-developed>, and September 27, 2012, <http://www.miningweekly.com/article/wa-gets-ccs-facility-2012-09-27>.

ANNOUNCEMENTS

NETL Releases Accomplishments Document.

DOE/NETL has released a new document, titled, “Carbon Storage Program 2010-2011 Accomplishments,” which highlights the accomplishments of the Carbon Storage Program during the 2010 and 2011 calendar years. The new publication shows that the program has achieved numerous accomplishments through the growth, expansion, and introduction of new concepts and opportunities as a result of an adapting effort that incorporates novel activities to resolve issues uncovered by research and development (R&D) activities and social demands. The document is available on the NETL website at: http://www.netl.doe.gov/technologies/carbon_seq/refshelf/CS-Program-2010-2011-Accomplishments.pdf.

Carbon Storage R&D Project Review Meeting Presentations Available.

NETL has released the conference proceedings from the Carbon Storage R&D Project Review Meeting held on August 21-23, 2012, in Pittsburgh, Pennsylvania. All presentations from the plenary and parallel sessions can be downloaded from: http://www.netl.doe.gov/publications/proceedings/12/carbon_storage/index.html.

New Online Course: CCS Site Exploration: Best Practices.

This Wyoming CCS Technology Institute (WCTI) Course reviews the DOE-published best practice guidelines for characterizing a geological carbon storage site. The online course provides a general overview of geologic storage; identifies key physical, geological, and chemical characteristics of the injection zone, confining system, and CO₂ stream; examines roles of geologic, geochemical, and CO₂ injection and migration modeling in site characterization; and assesses potential impacts of ground and surface waters, atmosphere, and human health and safety. The course syllabus is available at: <http://www.wyomingcarbonstorage.com/?q=courses>.

12th Annual CCUS Conference: Call for Papers Released.

Abstracts are now being accepted for the 12th Annual CCUS Conference, held May 13-16, 2013, at the David L. Lawrence Convention Center in Pittsburgh, Pennsylvania. General topics and subtopic areas include, but are not limited to: post-, pre-, and oxy-combustion technologies; retrofitting coal-fired power plants with CO₂ capture technologies; carbon storage regulations; large-scale CCUS demonstrations; CCUS public outreach; and simulation and risk assessment. For more information, as well as a complete list of accepted topics, visit: http://www.decisionmakersforum.com/carbonsq/pdf/2013/2013Call_for_papers.pdf.



ANNOUNCEMENTS (CONTINUED)

HDS International Announces Grant of U.S. Patent for Carbon Capture and Reutilization.

The U.S. Patent and Trademark Office has granted patent no. 8,197,587, "Method for Eliminating Carbon Dioxide from Waste Gases," according to HDS International, a green technology company. The invention preserves the advantages of prior methods for eliminating CO₂ from waste gases while providing new advantages not found in currently available methods and overcomes many disadvantages of such currently available methods. To view the press release, go to: [http://www.hdsicorp.com/2012%2009%2028%20HDSI%20Announces%20Waste%20Gas%20Patent%20\(a\).pdf](http://www.hdsicorp.com/2012%2009%2028%20HDSI%20Announces%20Waste%20Gas%20Patent%20(a).pdf).

SCIENCE

***ScienceDaily*, "Greenhouse Gas Emissions Mapped to Building, Street Level for U.S. Cities."**

Researchers from Arizona State University have developed a new software system capable of estimating greenhouse gas (GHG) emissions across entire urban landscapes. Scientists previously quantified CO₂ at a much broader level, but the new software system, presented in an October article in "Environment Science and Technology," allows for the estimating of GHG emissions down to the roads and individual building level. The system combines public database "data-mining" with traffic simulation and building-by-building energy-consumption modeling, generating high-resolution maps that identify CO₂ emission sources that can be utilized by policymakers and understood by the public. Data from a wide variety of sources – such as local emission reports, traffic counts, and tax assessor parcel information – was collected by the research team and combined within a modeling system for quantifying CO₂ emissions at the level of individual buildings and street segments. To date, the new system has been applied to Indianapolis, with work ongoing for it also to be applied in Los Angeles and Phoenix; researchers hope to map the CO₂ emissions in all major cities across the United States. Named "Hestia" after the Greek goddess of the hearth and home, the new system is part of larger effort that combines information on emissions with ground- and satellite-based measurements of atmospheric CO₂ concentration. October 9, 2012, <http://www.sciencedaily.com/releases/2012/10/121009121603.htm>.

***The Engineer*, "Material Could Lead to Cheaper Methods of CO₂ Capture."**

Nottingham University researchers have developed an aluminum-based solid material with the potential of leading to cheaper, more efficient, and environmentally friendly methods of capturing CO₂. The material, known as NOTT-300, absorbs CO₂ and sulfur dioxide (SO₂) in a different way to materials used in existing carbon capture and storage technologies. Made with water and simple organic substances, NOTT-300 releases the captured gases while requiring less energy than conventional materials. NOTT-300 will next be tested with actual flue gas, as opposed to controlled laboratory substances, so that it can eventually be scaled-up for potential use in carbon capture and storage technology. The research, which appears in the journal "Nature Chemistry," was funded by the Engineering and Physical Sciences Research Council (EPSRC). September 24, 2012,

<http://www.theengineer.co.uk/sectors/energy-and-environment/news/material-could-lead-to-cheaper-methods-of-co2-capture/1013998>. article.

POLICY

***Reuters*, "California Governor Signs Cap-and-Trade Revenue Bills."**

The Governor of California signed two bills related to the use of revenue raised through the sale of carbon allowances. Although details of how the money will be spent will not be determined until next year, the bills are the first to address the revenue generated during the first year of California's carbon cap-and-trade scheme, which begins in January 2013. A new account for the revenue will be created with the first bill, which also directs the Department of Finance and the California Air Resources Board to develop an investment plan for the funds. That plan will be submitted to the legislature for approval as part of the governor's budget, and will be reviewed and updated on an annual basis; it is expected to be released in the spring of 2013. Under the second bill, 25 percent of the auction revenue is required to go toward economically disadvantaged communities, with the California Environmental Protection Agency tasked with determining which communities qualify. Under California state law, money raised through the sale of carbon allowances must be spent on programs that help reduce the state's GHG emissions. The first carbon allowance auction will offer 61.3 million allowances for sale. October 2, 2012, <http://www.reuters.com/article/2012/10/02/us-california-carbon-idUSBRE89108C20121002?feedType=RSS&feedName=domesticNews>.

"Promoting global CCS RDD&D by stronger U.S.-China collaboration."

The following is the Abstract of this article: "CCS is the only technology available to mitigate GHG emissions from large-scale fossil fuel usage. [The United States] and China are the world's largest GHG emitters. Collaboration between the two nations, therefore, offers the greatest opportunity for achieving meaningful reductions in global GHG emissions. Two countries' current cooperation on CCS through Clean Energy Research Center based on the U.S.-China Strategic Forum on Clean Energy Cooperation mechanism provides an important initial step towards even closer and stronger cooperation in the future. In this paper, [the authors] justify such possibility by

POLICY (CONTINUED)

discourse on the seemingly different but complementary social–political context in two countries including political system, government structure, economic policy, national innovation system, energy strategy, and energy market structure. [The authors] further address the key elements of future cooperation model by carefully considering the principle of equality and mutual beneficiary, the role of two countries in the whole value chain according to their comparative advantages, and the scale and mechanism of the funding. A milestone for the cooperation until 2030 is drafted and priority areas for both countries in the cooperation are identified. Such cooperation will provide the imperative leadership for global climate change and speed up the global CCS deployment.” **Jia-Hai Yuan and Thomas P. Lyon**, *Renewable and Sustainable Energy Reviews*, Available in December 2012 edition, doi:10.1016/j.rser.2012.08.014, <http://www.sciencedirect.com/science/article/pii/S1364032112004832>. (Subscription may be required.)

GEOLOGY

“Ganglion Dynamics and Its Implications to Geologic Carbon Dioxide Storage.”

The following is the Abstract of this article: “Capillary trapping of a nonwetting fluid phase in the subsurface has been considered as an important mechanism for geologic storage of CO₂. This mechanism can potentially relax stringent requirements for the integrity of [caprocks] for CO₂ storage and therefore can significantly enhance storage capacity and security. [The authors] here apply ganglion dynamics to understand the capillary trapping of supercritical CO₂ (scCO₂) under relevant reservoir conditions. [The authors] show that, by breaking the injected scCO₂ into small disconnected ganglia, the efficiency of capillary trapping can be greatly enhanced, because the mobility of a ganglion is inversely dependent on its size. Supercritical CO₂ ganglia can be engineered by promoting CO₂–water interface instability during immiscible displacement, and their size distribution can be controlled by injection mode (e.g., water-alternating-gas) and rate. [The authors] also show that a large mobile ganglion can potentially break into smaller ganglia due to CO₂–brine interface instability during buoyant rise, thus becoming less mobile. The mobility of scCO₂ in the subsurface is therefore self-limited. Vertical structural heterogeneity within a reservoir can inhibit the buoyant rise of scCO₂ ganglia. The dynamics of scCO₂ ganglia described here provides a new perspective for the security and monitoring of subsurface CO₂ storage.” **Yifeng Wang, Charles Bryan, Thomas Dewers, Jason E. Heath, and Carlos Jove-Colon**, *Environ. Sci. Technol.*, Available online July 30, 2012, doi:10.1021/es301208k, <http://pubs.acs.org/doi/abs/10.1021/es301208k>. (Subscription required.)

“Energy recovery opportunities from mineral carbonation process in coal fired power plant.”

The following is the Abstract of this article: “Various CCS technologies are available worldwide to mitigate the effects of global warming. Mineral carbonation technology is one of the types of CCS technology. In this process gaseous CO₂ is converted into

geologically stable carbonates. This process has some potential advantages compared to other available CCS technologies which have attracted the attention of researchers for further development of this technology for [storing] CO₂. One of the potential benefits of this technology is its exothermic reaction process. This exothermic heat energy can be recovered and used in other energy consuming components of carbonation plant. Heat energy from the products of the carbonation process can also be captured. This technology has not fully been developed yet, in particular for implementing it into power plants. In this study a thermodynamic mass and energy balance model is developed using Matlab/Simulink software for investigating energy recovery opportunities. Wollastonite mineral is used as feed stocks. The amount of heat energy which can be recovered at different carbonation temperatures is determined and [analyzed] for a case study power plant with capacity of 1400 MW. It is found from this study that the carbonation process in case study power plant is energy self-sufficient, even only by the exothermic heat produced from the reaction and no heat recovery is needed from the products of carbonation process. It is also found that the energy required to supply to the carbonation plant (i.e. to grinder and compressor) decreases with increase in carbonation temperature. The surplus exothermic heat energy and heat energy from carbonated products can be utilized to reduce the fuel energy required for the existing power plant.” **S. Moazzem, M.G. Rasul, and M.M.K. Khan**, *Applied Thermal Engineering*, Available in March 2013 edition, doi:10.1016/j.applthermaleng.2012.09.021, <http://www.sciencedirect.com/science/article/pii/S1359431112006333> (Subscription may be required.)

TECHNOLOGY

“Evaluation Method of CO₂ [Storage] and Enhanced Oil Recovery in an Oil Reservoir, as Applied to the Changqing Oilfields, China.”

The following is the Abstract of this article: “Injecting CO₂ into oil reservoirs was proven to have a great CO₂ [storage] capacity to reduce [GHG] emission and economic potentials via EOR. This paper proposes a CO₂ [storage] estimation method based on the material balance method, which considered the CO₂ displacement efficiency, CO₂ sweep efficiency, CO₂ dissolution, and some reservoir and fluid properties. The CO₂ EOR estimation method is also proposed and refers to the traditional petroleum engineering method. In the evaluation method of CO₂ [storage] and EOR potential, the [storage] coefficient and recovery factor are two important parameters. In this study, the stream tube simulation method is introduced to determine them. The evaluation method is applied to estimate the CO₂ [storage] capacity and EOR potential in the Changqing oilfield of China. The Changqing oilfield province lies in the Ordos Basin of western China. Published data indicate that the Changqing oilfield includes about 22 oilfields, and the majority of oil reservoirs are low-permeability reservoirs. The estimation results of CO₂ [storage] and EOR potential show that the Changqing oilfield is suitable for CO₂ [storage] and EOR and has great potential. Detailed evaluation of sequestration and EOR is worth further study.” **Xiaoliang Zhao and Xinwei Liao**, *Energy Fuels*, Available online July 9, 2012, doi:10.1021/ef300783c, <http://pubs.acs.org/doi/abs/10.1021/ef300783c> (Subscription required.)

TECHNOLOGY (CONTINUED)

“Predicting Possible Effects of H₂S Impurity on CO₂ Transportation and Geological Storage.”

The following is the Abstract of this article: “For CO₂ geological storage, permitting impurities, such as [hydrogen sulfide (H₂S)], in CO₂ streams can lead to a great potential for capital and energy savings for CO₂ capture and separation, but it also increases costs and risk management for transportation and storage. To evaluate the cost–benefits, using a recently developed model, this study predicts phase equilibria and thermodynamic properties of the system H₂S–CO₂–[water (H₂O)]–[sodium chloride (NaCl)] under transportation and storage conditions and discusses potential effects of H₂S on transportation and storage. The prediction shows that inclusion of H₂S in CO₂ streams may lead to two-phase flow. For H₂S–CO₂ mixtures, at a given temperature, the bubble and dew pressures decrease with increasing H₂S content, while the mass density increases at low pressures and decreases at high pressures. For the CO₂–H₂S–H₂O system, the total gas solubility increases while the mass density of the aqueous solution with dissolved gas decreases. For the CO₂–H₂S–H₂O–NaCl system, at a given temperature, pressure and NaCl concentration, the solubility of the gas mixture in aqueous phase increases with increasing H₂S content and then decreases, while the mass density of aqueous solution decreases and may be lower than the mass density of the solution without gas dissolution.” **Xiaoyan Ji and Chen Zhu**, *Environ. Sci. Technol.*, Available online July 23, 2012, doi:10.1021/es301292n, <http://pubs.acs.org/doi/abs/10.1021/es301292n>. (Subscription required.)

“Evaporite Caprock Integrity: An Experimental Study of Reactive Mineralogy and Pore-Scale Heterogeneity during Brine–CO₂ Exposure.”

The following is the Abstract of this article: “[The authors] present characterization and geochemical data from a core-flooding experiment on a sample from the Three Fingers evaporite unit forming the lower extent of caprock at the Weyburn-Midale reservoir, Canada. This low-permeability sample was characterized in detail using X-ray computed microtomography before and after exposure to CO₂-acidified brine, allowing mineral phase and voidspace distributions to be quantified in three dimensions. Solution chemistry indicated that CO₂-acidified brine preferentially dissolved dolomite until saturation was attained, while anhydrite remained unreactive. Dolomite dissolution contributed to increases in bulk permeability through the formation of a localized channel, guided by microfractures as well as porosity and reactive phase distributions aligned with depositional bedding. An indirect effect of carbonate mineral reactivity with CO₂-acidified solution is voidspace generation through physical transport of anhydrite freed from the rock matrix following dissolution of dolomite. The development of high permeability fast pathways in this experiment highlights the role of carbonate content and potential fracture orientations in evaporite caprock formations considered for both geologic carbon [storage] and CO₂-[EOR] operations.” **Megan M. Smith, Yelena Sholokhova, Yue Hao, and Susan A. Carroll**, *Environ. Sci. Technol.*, Available online July 25, 2012, doi:10/1021.es3012723, <http://pubs.acs.org/doi/abs/10.1021/es3012723>. (Subscription required.)



TERRESTRIAL

“Soil carbon lost from Mollisols of the North Central U.S.A. with 20 years of agricultural best management practices.”

The following is the Abstract of this article: “Soil organic carbon (SOC) is highly sensitive to agricultural land management, so there is a great deal of interest in managing cultivated soils to [store] atmospheric CO₂. In this study [the authors] evaluated the influence of six cropping systems on SOC at the Wisconsin Integrated Cropping System Trial (WICST) over a 20-year period. Analysis of SOC on either a concentration or mass per volume of soil basis indicated a significant decline across all of the systems at WICST. While the rotationally grazed pasture system [stored] carbon (C) in the surface 15 cm these gains were offset by losses at depth. Both no-till (NT) practices and inclusion of perennial crops reduced SOC loss, but neither resulted in C [storage] in the soil profile. Results from this study demonstrate the importance of (i) comparing current and initial soil samples when evaluating SOC [storage] and (ii) evaluating SOC changes throughout the soil profile. The losses of SOC at depths below the plow layer point to either a lack of C input from roots, increased oxidative loss at these depths or both.” **Gregg R. Sanford, Joshua L. Posner, Randall D. Jackson, Christopher J. Kucharik, Janet L. Hedtcke, and Ting-Li Lin**, *Agriculture, Ecosystems & Environment*, Available in November 2012 edition, doi:10.1016/j.agee.2012.08.011, <http://www.sciencedirect.com/science/article/pii/S0167880912003222>. (Subscription may be required.)

TRADING

Clean Technica, “China to Create Emission Trading System, Link to European Union,” and *Reuters*, “Top Emitter China Agrees to Work with EU to Cut Carbon.”

The European Commission announced that China has agreed to work with the European Union (EU) to cut GHGs through a variety of projects, including the development of a Chinese emission trading system that will link with EU’s Emission Trading Scheme (ETS). Announced at an EU-China Summit on September 20, 2012, the agreement also includes \$32 million in financing and technical assistance from the EU over a four-year period for three carbon-reduction projects. As part of the agreement, the EU will also help fund efforts by Chinese cities to improve their resource-use efficiency and implement sustainable waste treatment systems. China recently set targets to reduce CO₂ emissions per unit of gross domestic product 17 percent by 2015 compared to 2005 levels. September 21, 2012, <http://cleantechnica.com/2012/09/21/china-will-create-emission-trading-system-link-to-european-union/>, September 20, 2012, <http://www.reuters.com/article/2012/09/20/uk-eu-china-carbon-idUSLNE88J00P20120920>.

RECENT PUBLICATIONS

“The Global Value of Coal.”

The following is from the Executive Summary of this document: “The Copenhagen Accord (2009) identified two crucial challenges at the global level: first, the need for the nations of the world to meet the growing challenge of climate change and ‘cooperate in achieving the peaking of global and national emissions as soon as possible’; and second, the need to ‘bear in mind that social and economic development and poverty eradication are the first and overriding priorities of developing countries.’ The objective of the current document is to delineate the past, current and potential contributions of coal in meeting both challenges. The discussion focuses on the global value of coal and the opportunities clean coal technologies present to continue and expand [utilization] of this vast energy resource, thereby allowing coal to continue to play a significant role in the world’s socio-economic and environmental goals. Climate objectives and the eradication of poverty are complementary, not conflicting, goals. They are compatible and represent an achievable future for all societies. The challenges are real and substantial. Over 1.4 billion people are totally without electricity and at least another two billion have highly constrained access to power. At the same time, calls to reduce emissions by 80 [percent] by 2050 face the powerful headwind of rising energy demand due to economic growth, increases in population and an ever greater proportion of people living in cities. The world needs much more energy, particularly electricity, yet at the same time must significantly reduce GHG emissions, including those of CO₂. This report is founded on the premise that increased coal-based generation efficiencies, coupled with CCS, can help the world meet the goals of a significant reduction in CO₂ emissions amid sustained economic growth, the eradication of poverty and elimination of energy deprivation.” To read the full document, prepared by the International Energy Agency (IEA) Coal Industry Advisory Board (CIAB), go to: http://www.iea.org/publications/insights/global_value_of_coal-1.pdf.

“The Global Status of CCS: 2012.”

The following is from the Executive Summary of this document: “Addressing climate change requires broad-scale action within the global community. Effective action is needed now to [decarbonize] energy consumption during this century; no single technology, or even class of technologies, can achieve this outcome. To achieve GHG emission reduction targets limiting a global average temperature rise to no more than 2°C, IEA estimates that energy-related emissions must reduce very substantially. Large-scale investments in several technologies are required in order to meet this target, with CCS contributing 7 Gt of the required 42 Gt emission reduction in a least cost scenario. If CCS were to be excluded as a technology option in the electricity sector, IEA states that investment costs over the period to 2050 would increase by 40 [percent]. CCS is a vital component of a portfolio of low-carbon technologies, as it is able to reduce CO₂ emissions substantially from both the energy sector and other industries. The Global CCS Institute’s *Global Status of CCS: 2012* report identifies the status of CCS, the developments that have occurred in the past year, and the challenges that must be addressed in order for climate change to be managed effectively and efficiently.” The full Global CCS Institute document is available at: <http://www.globalccsinstitute.com/publications/global-status-ccs-2012>.

“Central North Sea – CO₂ Storage Hub: Enabling CCS deployment in the UK and Europe.”

The following is from this document: “CCS is widely [recognized] as a vital technology which will play a significant role in the generation of low carbon electricity. CCS has the potential to reduce the carbon emissions of fossil fuelled power stations by as much as 90 [percent] as well as offering the only realistic solution to heavy industrial emitters such as steel mills, petrochemical refineries and cement manufacturing plants. Projects which can combine capture of emissions from power generation as well industrial emitters will enable the development of CO₂ transport infrastructure which can act to safeguard existing employment in carbon-intensive industries within the UK and EU. CCS development zones can also attract new energy intensive industries to locate into an area with an established network of CO₂ pipelines. That means low marginal costs to connect into a guaranteed network for transportation and storage of captured CO₂. Recent studies examining the [levelized] cost of electricity have consistently demonstrated that CCS will be competitive with renewable generation technologies such as offshore wind. CCS provides a low-carbon solution to the issue of intermittency which is inevitable with wind power, thereby helping to address the need for energy security in a future which will see a growth in the percentage of power generation from renewable sources. Fossil fuels will be part of the energy and industry system for many decades to come. CCS is the only viable option for abating those CO₂ emissions. The creation of a CCS industry in the UK will provide opportunities for economic growth through the retention of many thousands of high-value jobs, creation of thousands of new jobs, increased manufacturing activity, as well as retention of the UK’s world leading oil & gas supply chain for home investment and billions of pounds in export services.” The full report is available at: <http://www.scottish-enterprise.presscentre.com/imagelibrary/downloadMedia.ashx?MediaDetailsID=989>.

“Leading By Example: Using Information and Communication Technologies to Achieve Federal Sustainability Goals.”

The following is the Executive Summary of this document: “As the [Nation’s] largest landlord, fleet operator, and purchaser of goods and services, the [Federal] government has the opportunity, if not the responsibility, to lead by example in moving [the United States] in a more sustainable direction. Recent initiatives across the [Federal] government have demonstrated that the expanded use of information and communications technologies (ICT) can spur significant reductions in energy consumption and [GHGs], while at the same time achieve substantial cost savings and improve productivity. Recent technological developments have created new energy saving opportunities in the areas of smart buildings, smart transportation, and travel substitution. Additional opportunities exist

RECENT PUBLICATIONS (CONTINUED)

related to mobility and collaboration tools. Led by the General Services Administration (GSA) and the Department of Defense (DOD), these government-wide efforts are changing the way [Federal] departments and agencies operate. They represent the intersection of two critically important forces driving agency [behavior] today. Increasingly stringent budget constraints are pushing agencies to take a hard look at ways they can reduce costs and enhance efficiencies. At the same time, new Executive Orders and Congressional actions are mandating that agencies alter their practices to become more sustainable. These two forces have come together to create new opportunities for the government to change in important ways that produce multiple benefits for individual agencies and for the public they serve.” To view the entire Center for Climate and Energy Solutions (C2ES) Report, go to: http://www.c2es.org/publications/leading-by-example-federal-sustainability-and-ict?utm_source=Center+for+Climate+and+Energy+Solutions+newsletter+list&utm_campaign=dd4b8608e1-September_2012_Newsletter&utm_medium=email.

“Literature Review of Tracer Partition Coefficients.”

The following is from the Introduction of this document: “Predicting and understanding the [behavior] of CO₂ is challenging due to its complex phase [behavior] (i.e. CO₂ can exist in the subsurface as a liquid, gas, supercritical fluid or a solute in water depending on the physical/chemical conditions) and the wide range of possible trapping mechanisms (i.e. residual, solubility, structural and mineral). Commonly proposed storage scenarios involve pumping CO₂ into reservoir rock formations at depths greater than 800 [meters], where the pressure/temperature typically exceeds the critical point of [CO₂] (7.38 MPa, 31.1°C). Chemical tracers represent a complimentary reservoir [characterization] and monitoring tool to alternative approaches such as geophysical measurements (e.g. time lapse seismic) and have been used extensively worldwide at CCS sites. The majority of tracer applications within CCS are related to either understanding the subsurface movement of [CO₂], quantifying the trapping capacity or determining containment and [release] rates for monitoring and verification programs. Chemical stability, cost effectiveness, ease of detection, toxicity, injection/sampling protocols and subsurface [behavior], together dictate the choice of tracer for a particular application or scenario.” The full Commonwealth Scientific Industrial Research Organization (CSIRO) report is available at: <http://cdn.globalccsinstitute.com/sites/default/files/publications/45416/literaturereviewoftracerpartitioncoefficients.pdf>.

LEGISLATIVE ACTIVITY

Oil & Gas Journal, “Senators Offer Bill to Boost Use of Carbon Dioxide in EOR.”

On September 20, 2012, U.S. Senators Jay Rockefeller, Kent Conrad, and Mike Enzi introduced a bill to expand the use of CO₂ for EOR, modifying a Federal tax incentive that provides a \$10/metric ton credit for CO₂ used in EOR and a \$20/metric ton credit for CO₂ placed directly into secure geologic storage. The bill, S.3581, would adopt recommendations made in February by the National Enhanced Oil Recovery Initiative

(NEORI) to modestly improve the Federal tax code section 45Q sequestration provision, which is authorized to provide credits for up to 75 million metric tons of CO₂. According to NEORI, the change would make modest and functional improvements in the tax code provision at little or no additional cost, and would also help several CO₂-EOR projects secure private financing and operate commercially. To track “S.3581: A bill to amend the Internal Revenue Code of 1986 to modify the credit for carbon dioxide sequestration,” visit: <http://www.govtrack.us/congress/bills/112/s3581>. To view NEORI’s 45Q modifications, go to: <http://neori.org/publications/neori-45q/>. September 21, 2012, <http://www.ogj.com/articles/2012/09/senators-offer-bill-to-boost-use-of-carbon-dioxide-in-eor.html>.



EVENTS

November 2, 2012, **Climate Change Governance Conference**, *Schroders plc (Conference Suite), London, UK*. Convened by Kingston Law School, this conference brings together a range of academics and practitioners to discuss key components of potential climate change governance, focusing on climate change litigation, climate change and forestry, and pensions and climate change. The viability of existing legal mechanisms and the potential of emerging approaches will also be considered. To learn more, click: <http://law.kingston.ac.uk/news-events/events/climate-change-governance-conference>.



EVENTS (CONTINUED)

November 5-6, 2012, **1st International Conference on Urban Sustainability and Resilience**, *University College London, London, UK*. Experts from engineering, science, and social science disciplines will come together at this international conference to discuss the current state of knowledge in the field of urban sustainability and resilience. Among the central themes of the conference will be the development of a low-carbon urban environment. To learn more, go to: <http://www.usar-conference-2012.org/>.

November 5-9, 2012, **CLIMATE 2012**. This online climate conference will focus on the latest scientific findings on the social, economic, and political aspects of potential climate change. New projects and innovative initiatives in both industrialized and developing countries by universities, scientific institutions, government bodies, non-governmental organizations, and other stakeholders will be covered. For more information, visit the conference website at: <http://www.climate2012.de/>.

November 6, 2012, **Mandatory Carbon Reporting 2012**, *Venue TBD*. This conference will cover UK-required GHG reporting regulations, identify key opportunities for companies to save money and avoid financial penalties, and educate investors on the new opportunities and risks facing companies in their portfolios. Among the topics covered are mandatory carbon accounting and the EU ETS. The complete program is available on the conference website at: <http://www.environmental-finance.com/events/view/58>.

November 18-22, 2012, **International Conference on Greenhouse Gas Technologies 11 (GHGT-11)**, *Kyoto International Conference Center, Japan*. This will be the second visit to Kyoto by the GHGT conference series, with more than 1,600 delegates expected to attend. Visit: <http://www.ghgt.info/index.php/Content-GHGT11/ghgt-11-overview.html> for more details.

December 4-5, 2012, **1st International Conference on Global Environmental Changes**, *Government College University, Faisalabad, Pakistan*. This event will bring together researchers, scientists, and policy makers to discuss consequences and mitigation strategies of potential global environmental changes. Topics of interest include, but are not limited to: renewable energy resources; energy policy, planning, and management; potential climate change indicators; and mitigation strategies and adaptation. The conference brochure is available at: <http://gcuf.edu.pk/data/Env%20Conference%20Brochure.pdf>.

February 7-9, 2013, **International Conference on Energy Resources and Technologies for Sustainable Development**, *Howrah (near Kolkata), West Bengal, India*. The theme of the conference is the utilization of energy resources through alternative energy technologies for cleaner environment and sustainable development. Topics to be discussed include, but are not limited to: energy resources; clean coal technology and integrated gasification combined cycle; combustion system modeling and analysis; and energy policy, planning, and economics. To learn more, visit the conference website at: <http://www.icertsd.com/>.

February 28, 2013, **Westminster Energy Environment and Transport Forum**, *Central London, UK*. This forum will cover the options for taking carbon capture and storage technology forward as part of the wider work that is being undertaken to secure future energy supplies and to reduce carbon emissions. Planned sessions include examining the progress and next steps in technology development, deployment costs, the barriers to successful commercialization, and the wider impact and deployment of the technology. To download the latest agenda, visit: <http://www.westminsterforumprojects.co.uk/forums/event.php?eid=487>.

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