THE CARBON SEQUESTRATION NEWSLETTER

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November 2006

HIGHLIGHTS

Workers Thread Monitoring Lines Through An Injection Well-Head at the Frio Site (Photo: SD Horvorka, BEG USG UT)

***DOE Techline,* "DOE Project Injects 700 Tons of Carbon Dioxide Into Texas Sandstone Formation; Researchers to Determine the Ability of Brine Formations to Sequester Greenhouse Gas," and *United Press International,* "US Tests CO_2 Underground Storage Options."** As part of the Carbon Sequestration program, the US Department of Energy's National Energy Technology Laboratory is following up on its 2004 effort to determine the feasibility of storing carbon dioxide in brine formations though the Frio Brine Project. The Frio Brine test site is located 40 miles northeast of Houston, Texas near Dayton, Texas. The latest stage in the research consists of pumping more than 700 tons of carbon dioxide (CO_2) underground to determine how the CO_2 moves though brine-filled highly porous sandstone. This sandstone is representative of formations found worldwide. The Frio Brine project is a carbon sequestration project funded by the US Department of Energy and managed by the DOE's National Energy Technology Laboratory. The lead project partner is the University of Texas at Austin's Bureau of Economic Geology, and the research team includes: Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, the US Geological Survey, and Sandia Technologies LLC. The Frio Brine Pilot project falls within the Gulf Coast Carbon Center area, a participant in DOE's Southeast Regional Carbon Sequestration Partnership. In 2004, the researchers used computer models to predict that the CO_2 would stop quickly after traveling a short distance through the formation, and that the researchers were able to accurately measure the pattern of movement and the final distribution of the CO_2. For the current year-long monitoring project, researchers have begun to collect chemistry, pressure and temperature data, and by the end of the project, will have collected information to better assess and monitor larger-scale, longer-duration injections of CO_2. "This current project will ... help to advance our injection and monitoring technology to the point where we know what formations can safely and effectively store greenhouse gases in each region of the country to address global climate change," said Assistant Secretary for Fossil Energy Jeffrey Jarrett. October 12, 2006, http://www.netl.doe.gov/publications/press/2006/06057-Frio_CO2_Injection.html, and October 12, 2006, http://www.upi.com/NewsTrack/view.php?StoryID=20061012-011940-4991r.

HIGHLIGHTS (continued)

***China Daily,* "Nation Ready To Join US FutureGen Power Project."** At the 12th US-China Joint Commission Meeting on Scientific and Technological Co-operation, China announced that it plans to join the FutureGen International Partnership. The US Department of Energy's plans to collect about $950 million in international funds to help to build FutureGen, a zero-emission, coal-fired electric and hydrogen production plant. As a member of the International Partnership, China would need to contribute $10 million to the FutureGen program. India and South Korea are already members of the International Partnership. China's Huaneng Group, the country's leading power corporation, is one of the corporate members that are part of the FutureGen Industrial Alliance. Final talks between the US and China regarding the International Partnership will be held once the draft of the general agreement for the FutureGen partners is finalized by the US Department of State. November 19, 2006, http://www.chinadaily.com.cn/china/2006-10/19/content_711519.htm.

Sequestration in the News

***E&E News,* "Idaho Considers Carbon Sequestering Projects."** Idaho is exploring the possibility of sequestering carbon dioxide (CO_2) in lava flow formations and using the projects to offset carbon emissions in the state. In 2002, the Idaho Soil Conservation Commission created an advisory committee at the request of the state. Two pilot project areas have been proposed by the committee. The Idaho National Laboratories are trying to inject CO_2 into lava formation in east-central Idaho. The Soil Conservation Commission met with a group of carbon emitters in January, and also with members of the National Carbon Offset Coalition, a Montana-based group that helps landowners plan sequestration activities. September 27, 2006, http://www.eenews.net/Greenwire/print/2006/09/27/17. (Subscription may be required.)

***Reuters,* "Norway To Build World's Biggest CO_2 Capture Facility."** The Norwegian government will help finance carbon capture and storage for the Statoil project in Mongstad, Norway. Statoil is building the world's largest facility for carbon dioxide (CO_2) capture and storage, near where Statoil plans to build a gas-fired power plant to feed one of its refineries. A technology company will be created of which the government will own 80 percent. Norway will spend $594 million on the facility, which will capture 100,000 tons of CO_2 in 2010, and 1.3 million tons in 2014. October 13, 2006, http://www.planetark.org/dailynewsstory.cfm/newsid/38487/story.htm.

***Energy Central,* "ALSTOM, EPRI and We Energies To Build Pilot Plant In the US To Demonstrate Its Unique CO2 Capture Process,"** A five megawatt pilot plant will be built in order to demonstrate a carbon dioxide (CO_2) capture process, capturing CO_2 from a portion of boiler flue gas at the We Energies power plant in Pleasant Prairie, WI. This capture process was developed by the engineering firm ALSTOM, and uses chilled ammonia to capture the CO_2. This specific process has not yet been demonstrated in the US. The process reduces the required energy for capture and isolation of the CO_2 in a highly concentrated, highly pressurized form. In previous laboratory testing, the process was shown to be 90 percent efficient at removing CO_2, at a much lower cost than other methods. The pilot project will be commissioned in mid-2007 at the We Energies Pleasant Prairie Power Plant and operated for approximately one year. An engineering/environmental performance and cost analysis will be conducted by Electric Power Research Institute (EPRI) during the operation. October 3, 2006, http://www.energycentral.com/centers/news/daily/article.cfm?aid=7226310. (Registration may be required.)

***Central Valley Business Times (California),* "Central Valley May Be Site for 'Carbon Repository' In Global Warming Battle," and *San Mateo County Times,* "Delta Explored As Place To Stash Carbon Dioxide: Global Warming Solution Could Be To Put Gases In Underground Caverns."** The West Coast Regional Sequestration Partnership (WestCarb)—comprised of industry and government from California, Nevada, Arizona, Oregon, Washington and British Columbia—is planning a sequestration project at a site near Thorton, California. Westcarb is part of the National Energy Technology Laboratory's Regional Carbon Sequestration Partnerships program. The project site consists of a saline deposit (salt water and sand 3,500 feet underground) which is capped by a thick layer of shale, above which is a depleted natural gas deposit also topped by a layer of shale. Plans are to inject CO_2 into both formations. The site will be the first tested, among other potential sites in the northern Central Valley of California, for its potential to store carbon dioxide (CO_2) from 20 power plants from the Bay area. Before pumping the CO_2 underground, public hearings will be held and permits obtained from the US Environmental Protection Agency, state oil and gas regulators, or both. The volume of carbon dioxide injected will be small, roughly amounting to what a coal-fired power plant would release in a day. The scientists will then monitor the CO_2 in the formations. The injection

Announcements

2006 Gasification Technologies Council Annual Conference Papers and Presentations. The papers and presentations from the 2006 Gasification Technologies Conference, which was held from October 1-4 in Washington, DC, are available to download. Visit http://www.gasification.org/Presentations/2006.htm to view the papers, with several papers under the heading of "**Carbon Management with Gasification Technologies**." Also available is a presentation given by Mike Mudd of the FutureGen Alliance on the Status and Schedule of the FutureGen Plant at: http://www.gasification.org/Docs/2006_Papers/39MUDD.pdf.

Federal Loan Guarantees for Projects that Employ Innovative Technologies in Support of the Advanced Energy Initiative. (Funding Opportunity Number: DE-PS01-06LG00001) This Solicitation Announcement invites the submission of Pre-Applications seeking Loan Guarantees from the United States Department of Energy in support of debt financing on projects that promote the President's Advanced Energy Initiative and are eligible to receive loan guarantees under Title XVII of the Energy Policy Act of 2005. One of the categories of projects eligible for a loan guarantee includes those that employ carbon capture and sequestration practices and technologies. Pre-Applications are due at 5:00 PM Eastern Time on November 06, 2006. Successful pre-applicants will be contacted with an invitation to submit a full application. For more information please see: https://e-center.doe.gov/iips/faopor.nsf/UNID/D230E80D10F4AAD4852571C5004A1749?OpenDocument.

Solicitation for Natural Gas & Petroleum Exploration & Production, Emissions Reduction, and Carbon Sequestration Soon To Be Released. The New York State Energy Research and Development Authority (NYSERDA) announces its Program Opportunity Notice (PON) 1111: Natural Gas & Petroleum Exploration & Production, Emissions Reduction, and Carbon Sequestration. NYSERDA anticipates making multiple awards in the following categories: Type 1: Resource Characterization ($100,000 maximum NYSERDA funding per project); Type 2: Resource Development ($150,000 maximum NYSERDA funding per project); Type 3: Efficiency Increases and Emissions Reduction in Resource Extraction, Transportation, and Distribution ($150,000 maximum NYSERDA funding per project); and Type 4: CO_2 Sequestration ($400,000 maximum NYSERDA funding per project). Proposals can be submitted by individual companies, research institutions, or teams. Teaming arrangements are encouraged, including the use of outside technical expertise or joint ventures between companies/organizations. The submission deadlines will be December 28, 2006, and August 8, 2007. Check for the full solicitation soon to be found under Funding Opportunities on NYSERDA's website: http://www.nyserda.org/Funding/funding.asp?i=2.

"The Great Warming," a new documentary film, to be released November 3. The film examines world-wide issues of climate change and offers many real-world solutions. Filmed on four continents and narrated by Keanu Reeves and Alanis Morissette, the film will be released nationwide through the Regal Cinema chain in the top 50 U.S. markets. http://www.prweb.com/releases/2006/10/prweb445785.htm.

Television show "The Climate Code with Dr. Heidi Cullen" to be launched on the Weather Channel. The Weather Channel is launching a new show called "The Climate Code" that will focus on global warming and environmental issues. The host is Heidi Cullen, who holds a Ph.D. from Columbia University. The show will air at 5 p.m. every Sunday with reruns on Saturdays at 5 p.m., 7 p.m. and 11 p.m. http://climate.weather.com/onair.html.

Point Carbon's Carbon Market North America free e-newsletter. View and/or register for Point Carbon's newsletter covering North America's carbon market news and commentary. Also included is a summary of global carbon politics and markets. http://www.pointcarbon.com/Home/Carbon%20Market%20North%20America/category1325.html.

could begin as early as spring 2007. October 12, 2006, http://www.centralvalleybusinesstimes.com/stories/001/?ID=3265, and October 1, 2006, http://www.insidebayarea.com/sanmateocountytimes/localnews/ci_4426718.

Science

***Reuters,* "US Northeast Could Warm Drastically by 2100 – Study."** In a two-year study by the Northeast Climate Impacts Assessment group, the US Northeast could see a rise in average summer temperatures of more than 12 degrees Fahrenheit (F) by 2100 if emissions go unchecked. The Northeast region is comprised of nine states and ranks just behind Germany for quantity of emissions, and ahead of all of Canada. If 3 percent of the emissions are cut, then the temperatures may only rise to between 3.5 degrees and 6.5 degrees F by 2100. With the higher emissions projections, cities would see 60 or more summer days over 90 degrees, and 14 to 28 days with temperatures over 100 degrees F by 2100. With lower emissions projections, cities may see 30 or more days over 90 degrees F and 9 days with over 100 degrees F by 2100. Currently, Northeast cities have one or two days each year with temperatures over 100 degrees F. October 5, 2006, http://www.planetark.com/dailynewsstory.cfm/newsid/38380/story.htm.

Policy

***Reuters,* "Branson Commits US$3 Billion to Fight Global Warming."** British billionaire Richard Branson has committed to spending all the profits from his airline and rail businesses on combating global warming, approximately $3 billion over the next 10 years. One venture already in existence, Virgin Fuels, will invest $400 million over three years in renewable energy initiatives. Profits from the transport business which comprises one half of the company, will be invested in biofuels research, development, production and distribution, and also used to fund projects to combat emissions though a planned Environmental Trust. September 22, 2006, http://www.planetark.com/dailynewsstory.cfm?newsid=38212&newsdate=22-Sep-2006.

***EPA Press Release,* "Companies Set Aggressive Greenhouse Gas Emissions Reduction Goals."** Through the US Environmental Protection Agency's (EPA) Climate Leaders program, 13 companies are setting new emission reduction targets and 21 new companies are joining the program. The greenhouse gas emissions reduction targets for the 13 companies range from 9 percent to net zero emissions. The Climate Leaders represent a broad range of industry sectors and more than $1 trillion in revenue. Over 100 companies take part, and represent more than 8 percent of the total annual US greenhouse gas emissions. Reduction efforts by the group are estimated to prevent greenhouse gas emissions equivalent to those from 7 million cars. See the news link at the end of this paragraph to view a list of the companies and their reduction goals. For more information on the EPA's Climate Leaders program, see: http://epa.gov/climateleaders/. October 12, 2006, http://yosemite.epa.gov/opa/admpress.nsf/4d84d5d9a719de8c85257018005467c2/abaf76a31c93d2e685257205006305cb!OpenDocument

"Geographically explicit global modeling of land-use change, carbon sequestration, and biomass supply." This study aims to determine whether carbon sequestration policies could present a significant contribution to the global portfolio of climate change mitigation options. The objective is to model the effects of policies designed to induce landowners to change land use and management patterns with a view to sequester carbon or to reduce deforestation. The approach uses the spatially explicit Dynamic Integrated Model of Forestry and Alternative Land Use (DIMA) to quantify the economic potential of global forests. The model chooses which of the land-use processes (afforestation, reforestation, deforestation, or conservation and management options) would be applied in a specific location, based on land prices, cost of forest production and harvesting, site productivity, population density, and estimates of economic growth. The approach is relevant in that it (1) couples a revised and updated version of the Special Report on Emissions Scenarios with the dynamic development of climate policy implications through integration with the Model for Energy Supply Strategy Alter-

natives and their General Environmental Impact (MESSAGE); (2) is spatially explicit on a 0.5 degree grid; and (3) is constrained by guaranteeing food security and land for urban development. As outputs, DIMA produces 100-year forecasts of land-use change, carbon sequestration, impacts of carbon incentives (e.g., avoided deforestation), biomass for bioenergy, and climate policy impacts. The modeling results indicate that carbon sequestration policies could contribute to a significant part of the global portfolio of efficient climate mitigation policies, dependent upon carbon prices. **Dmitry Rokityanskiy, Pablo C. Benítez, Florian Kraxner, Ian McCallum, Michael Obersteiner, Ewald Rametsteiner and Yoshiki Yamagata,** Technological *Forecasting and Social Change,* Available online October 4, 2006. http://www.sciencedirect.com/science/article/B6V71-4M1TSSW-1/2/47317f4790cb9904c5823656b6af0d6e. (Subscription may be required.)

Geology

"Enhanced geothermal systems (EGS) using CO_2 as working fluid—A novel approach for generating renewable energy with simultaneous sequestration of carbon." Responding to the need to reduce atmospheric emissions of carbon dioxide, Brown [Brown, D., 2000. A Hot Dry Rock geothermal energy concept utilizing supercritical CO_2 instead of water. In: Proceedings of the Twenty-Fifth Workshop on Geothermal Reservoir Engineering, Stanford University, pp. 233–238] proposed a novel enhanced geothermal systems (EGS) concept that would use carbon dioxide (CO_2) instead of water as heat transmission fluid, and would achieve geologic sequestration of CO_2 as an ancillary benefit. Following up on his suggestion, the authors have evaluated thermophysical properties and performed numerical simulations to explore the fluid dynamics and heat transfer issues in an engineered geothermal reservoir that would be operated with CO_2. The authors find that CO_2 is superior to water in its ability to mine heat from hot fractured rock. Carbon dioxide also offers certain advantages with respect to wellbore hydraulics, in that its larger compressibility and expansivity as compared to water would increase buoyancy forces and would reduce the parasitic power consumption of the fluid circulation system. While the thermal and hydraulic aspects of a CO_2-EGS system look promising, major uncertainties remain with regard to chemical interactions between fluids and rocks. An EGS system running on CO_2 has sufficiently attractive features to warrant further investigation. **Karsten Pruess**, *Geothermics*, Volume 35, Issue 4, August 2006, Pages 351-367. Available online September 27, 2006. http://www.sciencedirect.com/science/article/B6VCN-4M0BHBT-1/2/37fce8fddfd341ff8190583b6c62e25c. (Subscription may be required.)

Technology

"Characterization and selectivity for methane and carbon dioxide adsorption on the all-silica DD3R zeolite." Clathrasil Deca-dodecasil 3R (DD3R) zeolite was synthesized in this study. Then, adsorption properties of carbon dioxide and methane were examined on the all-silica DD3R zeolite. Pure component adsorption isotherms are reported at temperatures of 273–348 Kelvin (K) and pressures as high as 3 megapascals (MPa). The isotherms follow a typical Type-I shape according to the Brunauer classification. They are well described using Langmuir and multi-site Langmuir models. Isosteric heats of adsorption and Henry's Law constants of all adsorbates were determined. High selectivity of adsorption for carbon dioxide over methane suggests that the all-silica DD3R is an effective adsorbent or zeolite membrane material that can separate carbon dioxide and methane gaseous mixtures. **Shuji Himeno, Toshihiro Tomita, Kenji Suzuki and Shuichi Yoshida,** *Microporous and Mesoporous Materials,* Available online October 2, 2006, http://www.sciencedirect.com/science/article/B6TH4-4M1D0HR-3/2/1333505f2fe51b588a8072b3fa0d2fb5. (Subscription may be required.)

"Production of hydrogen through the carbonation-calcination reaction applied to CH_4/CO_2 mixtures." The production of hydrogen combined with carbon capture represents a possible option for reducing carbon dioxide (CO_2) emissions in atmosphere and anthropogenic greenhouse effect. Nowadays the worldwide hydrogen production is based mainly on natural gas reforming, but the attention of the scientific community is focused also on other gas mixtures with significant methane (CH_4) content. In particular mixtures constituted mainly by methane and carbon dioxide are extensively used in energy conversion applications, as they include land-fill gas, digester gas and natural gas. The present paper addresses the development of an innovative system for hydrogen production and CO_2 capture starting from these mixtures. The plant is based on steam methane reforming, coupled with the carbonation and calcination reactions for CO_2 absorption and desorption, respectively. A thermodynamic approach is proposed to investigate the plant performance in relation to the methane content in the feeding gas. The results suggest that, in order to optimize the hydrogen purity and the efficiency, two different methodologies can be adopted involving both the system layout and operating parameters. In particular such methodologies are suitable for a methane content, respectively, higher and lower than 65 percent. **L. Barelli, G. Bidini, A. Corradetti and U. Desideri,** *Energy,* Available online September 12, 2006. http://www.sciencedirect.com/science/article/B6V2S-4KW5W8H-1/2/73d3abb827e7617976c93284610c69ea. (Subscription may be required.)

Terrestrial/Ocean

"Management Practice Effects on Surface Total Carbon, Differences in Spatial Variability Patterns." Lack of information about the spatial variability of soil carbon in different management systems limits accurate extrapolation of carbon sequestration findings to large scales. The objectives of this study were to: (i) describe and quantify variability of total carbon in three management systems, chisel-plow (CT) and no-till (NT) with conventional chemical inputs and a chisel-plow organic management practice with cover crops (CT-cover) 15 years after conversion from conventional management; (ii) assess the strengths of spatial correlation in the three studied systems; and (iii) evaluate contributions of topography and texture to the overall total carbon variability and its spatial components. The data were collected at 12 60 by 60 meter plots at the Long Term Ecological Research site, Kellogg Biological Station, MI. The data consisted of elevation measurements taken on a 2 by 5 meter grid and a total of 1160 measurements of total carbon, sand, silt, and clay contents taken from the 0- to 5-centimeter depth. Overall variability of total carbon in NT was more than four times greater than in CT, and in CT-cover the variability was more than two times greater than CT. Spatial correlation of total carbon was the strongest in NT, followed by CT-cover, and then by CT. Stronger spatial structures in NT and CT-cover were found to form in response to topographical and texture gradients. Effects of texture were largely associated with topographical effects; however, even when topography was controlled for, texture still substantially contributed to explaining total carbon variability. **A. N. Kravchenko, G. P. Robertson, X. Hao and D. G. Bullock,** *Agronomy Journal,* 98:1559-1568 (2006), Published online October 3, 2006. http://agron.scijournals.org/cgi/content/abstract/98/6/1559. (Subscription required.)

Trading

Carbon Market Update, October 13, 2006	
CCX-CFI 2006 ($/tCO2) **$3.90 (Vintage 2006)**	EU ETS-EUA DEC 2006 ($/tCO2) **$ 15.69** **(Converted from € to US$)**

***Reuters,* "EU Warns 8 States Over Late CO_2 Emissions Plans."** On October 12, the European Commission began legal action against eight of European Union states, sending warning letters to Austria, the Czech Republic, Denmark, Hungary, Italy, Portugal, Slovenia, and Spain for failing to submit their 2008-2012 national allocation plans, required under the Kyoto Protocol. The plans, which were due in June, are to outline the carbon dioxide (CO_2) emissions limits that large factories can release and enable the states to buy and sell emissions permits. The Commission is also taking Luxembourg to the European Court of Justice "for not providing sufficient information on its policies and measures to reduce greenhouse gas emissions and on its projected future emissions." Also the Commission is sending seven other warning letters to states "for not communicating important technical information relating to their emission targets." October 13, 2006, http://www.planetark.com/dailynewsstory.cfm?newsid=38492&newsdate=13-Oct-2006.

***Reuters*, "California seeks CO_2 market with EU, US Northeast."** California Governor Arnold Schwarzenegger met with New York Governor George

Pataki to discuss a plan for California and the Regional Greenhouse Gas Initiative (RGGI) to work to create a market-based carbon trading program with the European Union. Last month, Schwarzenegger signed into law the Global Warming Solutions Act of 2006, which caps greenhouse gas emissions by 25 percent by 2020. Pataki was responsible for spearheading RGGI once President George H.W. Bush withdrew from the Kyoto Protocol in 2001. RGGI is an alliance of seven Northeastern and Mid-Atlantic states working to reduce carbon dioxide emissions starting in 2009. On Oct 17, Schwarzenegger will sign an executive order to "develop a comprehensive market-based compliance program with the goal of creating a program that permits trading with the European Union, the Regional Greenhouse Gas Initiative and other jurisdictions," according to document obtained by Reuters. October 16, 2006, http://today.reuters.com/news/articlenews.aspx?type=domesticNews&storyID=2006-10-16T171015Z_01_N16459595_RTRUKOC_0_US-ENVIRONMENT-SCHWARZENEGGER-EMISSIONS.xml&WTmodLoc=USNewsHome_C2_domesticNews-6.

***Reuters,* "Rhodia, SOCGEN Form Carbon Trading Joint Venture."** French companies Rhodia and Societe Generale will form a joint venture company ORBEO to handle all of their carbon trading interests. ORBEO will start by marketing pollution reductions at Rhodia's chemical plants in Brazil and South Korea for 11 to 13 million ton of carbon credits per year from 2007-12. These credits are trading at approximately $17.50 per ton, making Rhodia's sales of credits worth $114.2 million annually. ORBEO will be one of the largest holders of emissions credits worldwide. Rhodia generates carbon credits by destroying the potent greenhouse gas nitrous oxide, a by-product of nylon manufacture. Two of Rhodia's plants in Brazil and South Korea are among the world's 10 biggest such Kyoto projects worldwide. ORBEO is pursuing carbon trading deals in China, Brazil and Eastern Europe. October 10, 2006, http://www.planetark.com/dailynewsstory.cfm/newsid/38442/story.htm.

***Reuters,* "UK Sees EU-Wide Carbon Capture Incentive from 2008."** European power plants which use carbon capture and storage will receive some exemptions from pollution caps under the European carbon trading scheme, beginning in the second phase of the scheme, from 2008-2012. Currently under the scheme, carbon sequestration is treated as if the CO_2 were emitted. The United Kingdom's Department for Environment Food and Rural Affairs plans to work with the European Commission to gain recognition of the storage element of sequestration in the second phase of the trading scheme. The European Commission has not made any definite plans yet in incorporating carbon capture and storage into the scheme, but is looking into the matter. Some energy analysts see carbon sequestration as a technology that can cut the greatest amount of emissions before 2050, to help avert climate change. October 6, 2006, http://www.planetark.com/dailynewsstory.cfm?newsid=38397&newsdate=06-Oct-2006.

Recent Publications

"International Carbon Capture and Storage Projects Overcoming Legal Barriers." To assist in the development of a regulatory framework for carbon capture and storage (CCS) projects, an understanding of current practices is important. This paper therefore examines regulatory developments of major CCS projects to determine actual progress in regulating such projects. In particular, we look at five case studies of CCS projects that range from enhanced resource recovery to direct storage and which have been developed for a mix of purposes, such as commercial, research and development, and pilot demonstrations. These case studies indicate that regulatory progress varies greatly among projects, and differs depending on the size, scope, and the location of the projects. The focus of this report is the legal and regulatory context for international projects, but it should be recognized that CCS field projects in the United States are also addressing many of the regulatory issues related to CCS. **NETL contact: Sarah Forbes; Authors: Kate Robertson, Jette Findsen, Steve Messner.** DOE/NETL-2006/1236. http://www.netl.doe.gov/energy-analyses/pubs/CCSregulatorypaperFinalReport.pdf.

"Agricultural & Forestlands: U.S. Carbon Policy Strategies." This report examines the wide array of ways in which forest and agricultural lands can be managed to store or "sequester" carbon and reduce net emissions (hereafter the authors use the term "sequestration" for the process by which carbon is removed from the atmosphere by plants and stored in soils and trees). It discusses a range of policies and programs that would promote this objective and evaluates them in terms of their cost, environmental effectiveness, and other considerations. The results of this analysis suggest that, by carefully designing and implementing a large-scale forest and agricultural carbon sequestration strategy, the United States could substantially reduce its net carbon dioxide emissions. A successful strategy is likely to encompass a variety of initiatives at the national, state, and local levels, and to involve both government and private parties. **Kenneth R. Richards*, R. Neil Sampson, Sandra Brown.*** Prepared for the Pew Center on Global Climate Change, September 2006. September 21, 2006, http://www.pewclimate.org/global-warming-in-depth/all_reports/ag_forestlands/index.cfm,

"Agriculture's Role in Greenhouse Gas Mitigation." In this report, the authors make the case for "suitable payments" to encourage farmers to adopt new management practices to store carbon in agricultural soils and reduce agricultural emissions of methane and nitrous oxide. Policy incentives also are needed, the authors say, to reduce costs of producing biofuels and accelerate key technologies. The report notes that climate mitigation could potentially become a source of new income and cost reductions for farmers. However, access to financing, changes in economic conditions and technologies, and policies will be key factors that will affect farmers' willingness to play a part in climate solutions. **Keith Paustian, John M. Antle, John Sheehan, Eldor A. Paul.** Prepared for the Pew Center on Global Climate Change, September 2006, September 21, 2006, http://www.pewclimate.org/global-warming-in-depth/all_reports/agriculture_s_role_mitigation/index.cfm.

"The World in 2050: Implications of global growth for carbon emissions and climate change policy." PricewaterhouseCoopers (PwC) released a report which considers six possible carbon emissions and climate change policy scenarios but focuses most attention on two key possibilities: 1.) A baseline scenario in which energy efficiency improves in line with trends of the past 25 years, with no change in fuel mix by country; this 'business as usual' scenario acts as a benchmark against which to assess the need for change, rather than as a forecast of the most likely outcome; and 2.) A scenario called 'Green Growth + CCS,' which incorporates possible emission reductions due to a greener fuel mix, annual energy efficiency gains over and above the historic trend, and widespread use of carbon capture and storage (CCS) technologies. Of the scenarios considered in the report, only this 'Green Growth Plus' strategy stabilizes atmospheric carbon dioxide concentrations by 2050 at what the current scientific consensus suggests would be broadly acceptable levels. The G7 economies — the US, Japan, Germany, UK, France, Italy and Canada — may need to take the lead in reducing their carbon emissions, given that emissions from the faster-growing emerging economies, such as China and India, will almost certainly continue to rise over the next few decades. **John Hawksworth, Head of Macroeconomics,** September 2006, http://www.pwcglobal.com/extweb/pwcpublications.nsf/docid/DFB54C8AAD6742DB852571F5006DD532

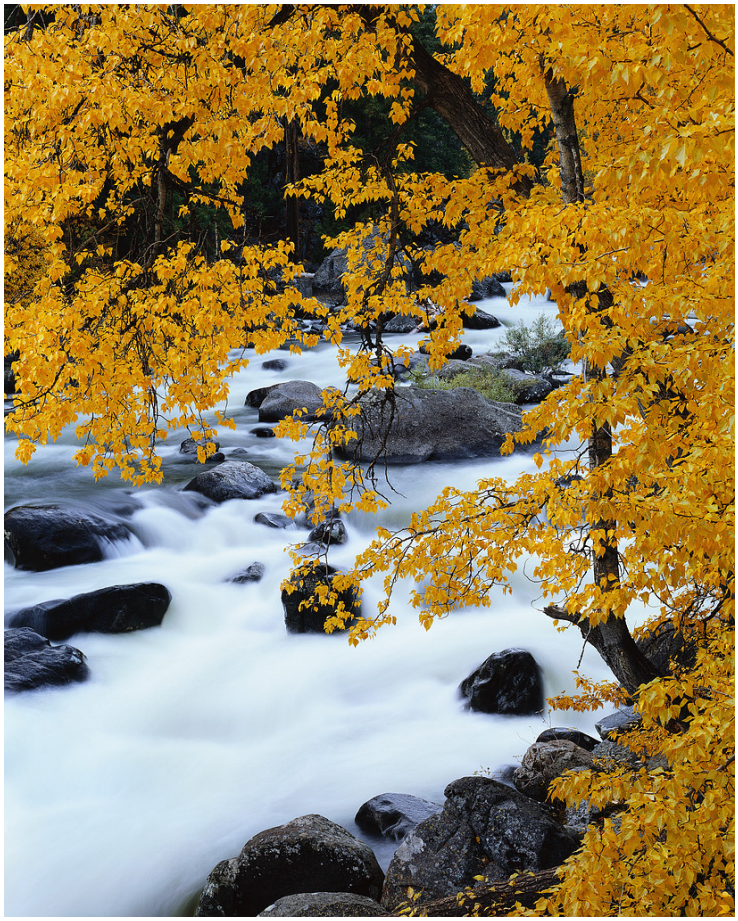
"Global Framework for Climate Risk Disclosure," and "Guide to Using the Global Framework for Climate Risk Disclosure." A unique global partnership of 14 leading institutional investors and other organizations representing trillions in assets released the Global Framework for Climate Risk Disclosure to provide specific guidance to companies regarding the information they provide to investors on the financial risks posed by climate change. Also included is a companion tool for using the Framework. For each of the four elements of the Framework, the Guide provides specific guidance for companies about how to disclose using the most

common reporting mechanisms for climate risk: securities filings, the Global Reporting Initiative, and the Carbon Disclosure Project. The Guide also contains examples of disclosure from leading companies using these disclosure mechanisms. See the website to download both pdf files of the reports and to see the list of organizations that comprise the partnership. October 2006, http://www.ceres.org/pub/publication.php?pid=225.

Legislative Activity

***Greenwire,* "Oral Arguments Set For November 29 In Supreme Court Emissions Case."** The US Supreme Court will hear arguments in its first global warming case, *Massachusetts v. U.S. EPA*, beginning on November 29. The case revolves around whether or not the federal government will regulate greenhouse gasses from new vehicles. The plaintiffs in the case argue that the EPA violated the law when in 2003 when it did not designate carbon dioxide as a pollutant under the Clean Air Act. Plantiffs include Massachusetts Attorney General Tom Reilly (Democrat) and a coalition of a dozen states, New York City, Baltimore and environmental groups. The case was decided against them in two prior decisions by the U.S. Circuit Court of Appeals for the District of Columbia. October 2, 2006, http://www.eenews.net/Greenwire/print/2006/10/02/9.

***Greenwire,* "California Businesses Fear A.B. 32 Will Spur 'Tax-Like' Carbon Fees."** As California takes steps to implement its latest climate change legislation, A.B. 32 also known as the "Global Warming Solutions Act of 2006," business leaders are warning the law could lead to a tax on carbon and curbs on the state's economic growth. The California Chamber of Commerce Vice President Dominic Dimare stated, "A cap on carbon is a cap on growth." The law sets reduction levels for greenhouse gas emissions to the 1990 levels by 2020. There is also a provision through which the California Air Resources Board may adopt by regulation a fee schedule under which emitters would have to pay into an Air Pollution Control Fund. In California, these charges are known as "Sinclair fees" after a 1997 California Supreme Court decision, Sinclair Paint Co. v. State of California, which allowed regulators to charge mitigating pollution to the source, upholding the "polluter pays" principle. Dimare is also concerned that there is no budget allocation for economic analysis of any carbon reduction efforts. A lead agency also has yet to be determined for the law. October 12, 2006, http://www.eenews.net/Greenwire/2006/10/12/#2



***Marin Independent Journal,* "Marin Launches Attack On Global Warming."** On October 10, Marin Country California, pledged to reduce their greenhouse gas emissions by 15 percent by 2020, using alternative energy projects. The county is one of 30 local governments in California and 134 across the nation that is participating in an international greenhouse gas reduction program. The total percent of the world's greenhouse gases produced by those municipalities is 17 percent. http://www.marinij.com/marin/ci_4479920.

Events

November 8-9, 2006, **Coal-Seq V Forum,** *Hilton Houston NASA Clear Lake, Houston, TX.* Experts from around the world will present the latest results from field projects and other technology development efforts, and discuss the unique technical and non-technical issues associated with carbon dioxide, Enhanced Coalbed Methane (CO_2 ECBM)/sequestration in coal seams. Go to www.coal-seq.com under "Upcoming Events" for a registration form. For further information about participating in or attending this event, please contact Susan Pershall at (713) 780-0815 or spershall@adv-res-hou.com.

November 13-15, 2006, **Coal Gasification: The Path Forward,** *Sheraton Denver West, Denver, CO*. Get the comprehensive update not only on the state of coal gasification technologies and the status of current gasification project developments, but also on the latest information regarding the technologies for and economics of carbon sequestration. For more information, call (818) 888-4444 or see the website: http://www.infocastinc.com/advcoal.html**.**

November 15-16, 2006, **International Power Generation '06 Conference: Implementing the European Commission (EC) Directives,** *Renaissance Leipzig Hotel, Leipzig, Germany.* Following on from the success of last year's conference, IPG'06 will dissect the terms and conditions of the EC Directives, (Large Combustion Plant Directive (LCPD) and Integrated Pollution Prevention and Control (IPPC)) including case study examples of a compliant plant. Best available technology to bring plants in line with the regulations will also be discussed, as will carbon capture and storage. For registration and program information, see: http://www.ipg.antfx.com/index.php?option=com_content&task=view&id=65&Itemid=91.

November 20-21, 2006, **6th Emissions Trading & the Carbon Markets Conference,** *The Jumeirah Carlton Tower, London, England.* This conference will provide an analysis of the most critical developments in European and International carbon regulation, and address the strategic business implications for carbon market players. Taking place right after the close of UN's 12th Conference of the Parties and 2nd Meeting of the Parties (coP/MOP) in Nairobi, this conference will be a good platform to analyze and debate issues raised and conclusions achieved at the meeting. For details, see: http://www.pointcarbon.com/Events/Upcoming%20conferences/article17372-141.html.

November 21, 2006, **From Vision to Value: CO_2 Capture, Transportation, and Injection for Enhanced Hydrocarbon Recovery,** *Hyatt Regency Calgary, Calgary, Alberta, Canada.* This forum will explore carbon dioxide (CO_2) capture, transportation, and injection for enhanced hydrocarbon recovery (EHR). The event will focus on combining government policy and industry vision to guide the initiation of new technology projects to address current barriers to commercial CO_2 EHR implementation. Register online at: http://www.ptac.org/co2/co2f0602.html.

November 27-29, 2006, **Australian Institute of Energy National Conference 2006: Energy at the Crossroads,** *University of Melbourne, Melbourne, Australia.* Discussion at the conference will focus on Australia and include climate change, renewable energy, sequestration technologies, and nuclear energy. A preliminary program is also posted. http://www.conferences.unimelb.edu.au/aie2006/home.htm.

Events (continued)

December 11-15, 2006, **2006 American Geophysical Union (AGU) Fall Meeting,** *Moscone Center West, San Francisco, CA.* The Fall meeting of the American Geophysical Union will include several presentations regarding carbon geosequestration. Registration deadline is December 6, 2006. See: http://www.agu.org/meetings/fm06/.

January 21-24, 2007, **Electric Utilities Environmental Conference (EUEC), 10th Annual EPA, DOE, EPRI, EEI Conference on Clean Air, Mercury, Global Warming & Renewable Energy,** *Westin La Paloma Resort, Tucson, AZ*. EUEC is one of the best recognized annual technical meetings in the US where over 1000 professionals network in a 150+ exhibit area with 250 presentations in 5 tracks, including a Climate Policy Track. The Climate Policy Track includes topics of Carbon Capture and Storage, and Carbon Markets and Trading. For information, see: http://www.euec.com/default.html.

January 17-18, 2007, **North America and the Carbon Markets,** *Ronald Regan Building and International Trade Center, Washington, DC.* This event is designed to introduce North American stakeholders to lessons and opportunities in the global carbon markets and will include public and private sector delegates from across the United States and Canada for an innovative forum of speakers, panel discussions and workshops. Register online at: http://www.pointcarbon.com/Events/Workshops%20%20Seminars/North%20America%20and%20the%20carbon%20markets/category1307.html

For subscription details regarding the Carbon Sequestration Newsletter, please visit http://listserv.netl.doe.gov/mailman/listinfo/sequestration, enter your email address, and create a password to receive the newsletter at no cost, both as text and in pdf format. (If you prefer not to receive the pdf file in your email, choose "yes" for the daily digest option. Otherwise leave the default value at "no.") To view the archive of newsletters, see: http://www.netl.doe.gov/publications/carbon_seq/subscribe.html.

To learn more about DOE's Carbon Sequestration Program, please contact Sean Plasynski sean.plasynski@netl.doe.gov, or Dawn Deel at dawn.deel@netl.doe.gov.