

THE CARBON SEQUESTRATION NEWSLETTER

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May 2006

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Sequestration in the News

FutureGen Alliance Press Release, "Widespread Interest Shown in Bid to Host FutureGen Project." The FutureGen Industrial Alliance (Alliance) reported that offerors in nine states, offering a total of 22 sites, have expressed an interest in hosting the FutureGen Project. The Alliance extended the deadline from March 24 to April 7, 2006 for the submission of the Notice of Intent (NOI) to submit a proposal. The Request for Proposals states that the names of offerors submitting notices will not be publicly released. Given the complexity and rigors of the proposal process, the Alliance expects that a smaller number of sites may be offered than originally submitted via the NOI. The Alliance is seeking sites that are consistent with the requirements and objectives of the FutureGen project and have broad applicability domestically and internationally. FutureGen's schedule is aggressive, with plant siting and construction to begin within three years. Proposals to host the site are due May 4, 2006. March 29, 2006, http://www.futuregenalliance.org/news/releases/pr_3-29-06.pdf.

Government of India Press Release, "CSLF Meet Suggests Time Bound Action Plan for Cost Effective Technologies," and *New Karala.com*,

"India, 21 Others Adopt Plan for Carbon Capture, Storage." The Carbon Sequestration Leadership Forum (CSLF) met in New Delhi, India on April 3 - 5. The international CSLF is a voluntary climate initiative of developed and developing nations that account for 75 percent of all manmade carbon dioxide emissions. CSLF was formed to facilitate the development of improved cost-effective technologies for the separation and capture of carbon dioxide for its transport

US and India Sign FutureGen Agreement



and long-term safe storage; to make these technologies broadly available internationally; and to identify and address wider issues relating to carbon capture and storage. During the meeting, a draft Strategic Plan and Action Plan were adopted, and the progress of 17 research projects was reviewed. All member countries will have to approve the plans for the projects to move forward. US Assistant Secretary, Office of Fossil Energy Jeffrey Jarrett served as Chairman of the CSLF Policy Group. See the CSLF website for meeting documents: <http://www.csforum.org/apr032006.htm>. Also, the welcome remarks for the meeting by India's Minister of Power

Shri Sushil Kumar Shinde are found at: <http://pib.nic.in/release/release.asp?relid=16939>. April 4, 2006, <http://pib.nic.in/release/>

HIGHLIGHTS

DOE Press Release, "US and India Sign Historic Agreement on FutureGen Project." The US Department of Energy has announced that India is the first country to join the US on the government steering committee for the FutureGen Initiative. The agreement was signed by Department of Energy Assistant Secretary Jeffrey Jarrett on behalf of the United States, and on behalf of India, by Honorable R. V. Shahi, Secretary, India Ministry of Power. The signing followed President Bush's March 2-4 trip to India, during which Indian Prime Minister Singh first announced the joint agreement on FutureGen. India's participation in the \$1 billion FutureGen project also builds upon the US-India Energy Dialogue that was launched in May 2005. Secretary of Energy Samuel W. Bodman has invited government members of the international Carbon Sequestration Leadership Forum (CSLF), a voluntary climate initiative that includes 20 developed and developing nations plus the European Commission, to become active participants in the FutureGen project. India is the first of the CSLF members to participate in FutureGen. April 3, 2006, <http://www.energy.gov/news/3420.htm>.

[release.asp?reid=16995](#), and April 5, 2006, <http://www.newkerala.com/news2.php?action=fullnews&id=36946>.

Expatica, “German Power Plant Will Store CO₂ Underground.” Germany’s largest utility, RWE, plans to invest \$1.2 billion in a coal-fired power plant that integrates carbon dioxide (CO₂) sequestration with electrical power generation. RWE is aiming to have the 400-450 megawatt plant operational by 2014. Planning for the plant has already begun, and testing will be done with hard coal and gasified lignite. A decision on the plant siting is expected by the latter half of 2007. RWE favors a location close to its opencast lignite mines in the west of Germany but will have to determine a geologically suitable depository for the CO₂. March 30, 2006, <http://www.planetark.com/dailynewsstory.cfm/newsid/35847/story.htm>.



AP, “Iceland Set To Capture Carbon In Its Rocks.” Iceland is planning to test its basalt rock for carbon dioxide (CO₂) storage. If this experiment is successful, it could also be useful in other countries which have basalt formations, such as the United States, India, Brazil and Russia. Wallace Broecker, a professor at Columbia University who is joining Iceland scientists in the project, said that CO₂ capture and storage is going to be needed even with conservation efforts and the use of renewable energy sources. Scientists have

known for more than 50 years that the natural chemical weathering of rocks consumes some atmospheric CO₂. In countries such as Iceland, rain pulls a small amount of CO₂ out of air, and when the rain hits rocks, chemical weathering initiates, dissolving solids such as calcium. The water reacting with rocks then absorbs even more CO₂ from the atmosphere. Rivers capture this water and carry the dissolved CO₂, and other chemical constituents from the weathering process, to the ocean. In the ocean, the calcium and dissolved CO₂ combine to form solid calcium carbonate (similar to the material that makes up sea shells), which sinks to the bottom. The Earth Institute at Columbia University is raising the \$4 to 5 million needed for the pilot project. Scientists, Iceland’s government and local power companies hope to finalize the plan in June 2006, with a launch of the experiment planned for some time next year. April 12, 2006, <http://msnbc.msn.com/id/12034963/>.

DOE Website, “Secretary Bodman Addresses the National Coal Council.” Secretary of Energy Samuel W. Bodman discussed the development of clean coal technologies in remarks to the National Coal Council in Washington, DC, on March 22, 2006. Comments included the FutureGen Initiative. Read his comments here: <http://www.energy.gov/news/3390.htm>.

Science

CBC News, “Venus Express Probe Enters Into Orbit.” The European Space Agency’s robotic space craft, the Venus Express, will orbit Venus for 1 ½ years to help increase our understanding of the greenhouse effect. Venus and the Earth are of similar size and composition, but Venus evolved differently and shows much stronger effects of global warming. Scientist hope that information and measurements gathered on Venus will allow for an increased understanding of how Earth might evolve in the future. The average temperature on Venus is 477 degrees Celsius (891 degrees Fahrenheit), and its toxic atmosphere is mainly composed of carbon dioxide, with clouds of sulfuric acid and 400 kilometers (249 miles) per hour winds. April 11, 2006, <http://www.cbc.ca/story/science/national/2006/04/11/venus-express060411.html>.

Time Magazine, Special Report on Global Warming, Time Magazine has published a special report on Global Warming covering many aspects of the topic including: a cover story overview of the issues and action that can be taken; global warming’s effect on species and possible health effects on humans; and economic, policy, legislative, regulatory, and global aspects of the issue. See the index of April 3, 2006, Volume 167, Number 14, *Time* magazine at: <http://www.time.com/time/magazine/0,9263,7601060403,00.html>. (Subscription required.)

NOAA Press Release, “NOAA/NSF Cruise Reveals Impacts of Ocean Acidification on Chemistry, Biology of North Pacific Ocean.” Preliminary data from a recent field study in the Pacific Ocean shows that the oceans

Announcements

“US Secretary of Energy Samuel W. Bodman to Keynote the Fifth Annual Conference on Carbon Capture & Sequestration.”

Additional featured Department of Energy speakers include:

- Jeffrey Jarrett, Assistant Secretary, Office of Fossil Energy
- Dr. Raymond Orbach, Director, Office of Science
- Carl Bauer, Director, National Energy Technology Laboratory
- Steve Eule, Director, Climate Change Technology Program.

Click here for the latest agenda for the May 8-11 conference: http://www.carbonsq.com/pdf/2006/06ccs_agenda.pdf.

“Novel Technology and Commercially Focused Approaches to CO₂ Capture and Separation for Existing and Future Carbon Based Electric Generation Power Plants.” United States Department of Energy Funding Opportunity Announcement DE-PS26-06NT42829 was released on April 19, 2006. The application due date is June 16, 2006. Questions and comments are welcomed, and should be transmitted through the "Submit Question" feature in IIPS:

<http://e-center.doe.gov/iips/faopor.nsf/3b3cff0a4a1f243485256ec100490e1a/ade34bfa0feeca768525715500668171?OpenDocument>. The contract specialist is Debra Duncan. Applications are sought in three areas of interest ranging from novel breakthrough concepts to field-testing. Please refer to both the general announcement at <http://e-center.doe.gov/iips/faopor.nsf/3b3cff0a4a1f243485256ec100490e1a/ade34bfa0feeca768525715500668171?OpenDocument> and the appropriate areas of interest. Area of Interest 1: “Breakthrough Approaches to Carbon Dioxide and Separation (DE-PS26-06NT42829-1)” at the following link: <https://e-center.doe.gov/iips/faopor.nsf/UNID/EA72CD019D979D8A852571550068E185?OpenDocument>. Area of Interest 2: “Continued Development of Direct CO₂ Capture and Separation Technologies (DE-PS26-06NT42829-2)” at the following link:

<https://e-center.doe.gov/iips/faopor.nsf/UNID/322B7682B616D76E8525715500698C81?OpenDocument>. Area of Interest 3: “Field-testing of CO₂ Capture and Separation Technologies (DE-PS26-06NT42829-3)” at the following link: <https://e-center.doe.gov/iips/faopor.nsf/UNID/F56A52B40ACD63F985257155006A84FC?OpenDocument>.

“1605(b) Greenhouse Gas Registry Guidelines.” On April 17, 2006, the US Department of Energy (DOE) issued revised General and Technical Guidelines for the voluntary reporting of greenhouse gas emissions, sequestration and reductions, known as the 1605(b) Program. The Program will be implemented by DOE during 2007. The new guidelines establish an accurate and transparent national registry where businesses and institutions can submit comprehensive reports on their greenhouse gas emissions, sequestration and reductions. The revised guidelines include “state-of-the-science” guidance and tools for estimating emissions from agricultural, forestry, and conservation activities important for carbon sequestration efforts, as well as from other sources of greenhouse gases. Other provisions encourage participation in the program by small emitters of greenhouse gases, such as farmers and small businesses. A notice containing the General Guidelines, and DOE’s response to the latest round of public comments, is to be published in the Federal Register on April 21, 2006. DOE’s Energy Information Administration (EIA) has initiated the development of the forms and software necessary to implement the revised guidelines. Draft forms are expected to be made available for public review and comment during the summer of 2006. Final forms are expected to be issued before the end of 2006. EIA expects to complete the software necessary for electronic reporting by spring or summer 2007, in time to permit full implementation of the revised program during 2007. See: <http://www.eia.doe.gov/enhancingGHGRegistry/>, and http://www.usda.gov/oce/global_change/gg_reporting.htm for more information.

“The United States Climate Change Science Program Requests Expert Review of the Working Group I Contribution (“Climate Change 2007: The Physical Science Basis”) to the Intergovernmental Panel on Climate Change Fourth Assessment Report.” Comments must be submitted by May 9, 2006; and a password is required for download of the draft report. For details on submitting comments and instructions on how to receive a password, see: <http://www.climatechange.gov/Library/ipcc/wg14ar-review.htm>. See *Federal Register*, April 7, 2006, Volume 71, Number 67, Page 17942 for full announcement: <http://a257.g.akamaitech.net/7/257/2422/01jan20061800/edocket.access.gpo.gov/2006/E6-5131.htm>.

“DOE Appoints Stephen Eule As Director of the Climate Change Technology Program.” On March 31, 2006, US Secretary of Energy Samuel W. Bodman announced the appointment of Stephen D. Eule as the Director of the Climate Change Technology Program (CCTP) in the Office of Policy and International Affairs. As director of the CCTP, Mr. Eule will coordinate the federal government’s technology research and development (R&D) activities. Through a multi-agency structure, Mr. Eule will oversee a comprehensive, sound, multi-year R&D program plan for the development of climate change technology, specifically in regards to climate change goals and objectives. CCTP is organized under the auspices of the Cabinet-level Committee on Climate Change Science and Technology Integration (CCCSTI), established by President Bush on February 14, 2002. CCTP was authorized in the Energy Policy Act of 2005. March 31, 2006, <http://www.energy.gov/news/3417.htm>.

are becoming more acidic. NOAA scientists measured a decrease in pH of approximately 0.025 units and increases in dissolved inorganic carbon of about 15 micromoles per kilogram ($\mu\text{mol/kg}$) in surface waters over a large section of the northeastern Pacific. The findings of an increase in acidity are consistent with data from previous field studies conducted in other oceans. Richard Feely, an oceanographer with the NOAA Pacific Marine Environmental Laboratory and the chief scientist on the study said that the dramatic changes can be attributed, in most part, to the uptake of anthropogenic CO_2 by the ocean over the past 15 years. This verifies earlier model projections that the oceans are becoming more acidic because of the uptake of carbon dioxide released as a result of fossil fuel burning. As levels of dissolved CO_2 in the sea waters rise, the skeletal growth rates of calcium-secreting organisms will be reduced, and the combined effects of other climatic changes in salinity, temperature and upwelled nutrients, could substantially alter the biodiversity and productivity of the ocean. April 5, 2006, <http://www.noaanews.noaa.gov/stories2006/s2606.htm>.



Reuters, “World’s Oldest Ice Could Hold Climate Clues,” and Outside Online, “Oldest Ice Sample Could Offer Clues to Climate Change.” Japanese scientists from the National Institute of Polar Research have obtained a one million year old ice core from the Antarctic. The sample is the oldest ice core sample to be retrieved, with the previously oldest core estimated at 750,000 years old. Researchers at the Dome Fuji base in eastern Antarctic spent more than two years drilling down and obtaining the sample from a depth of 9,936 feet under the ice. The core will be used to examine changes in temperature, levels of carbon dioxide and methane over time. Research published in the journal *Nature* in 2005 states that concentrations of CO_2 and methane are far higher now than at any time in the last 650,000 years. April 18, 2006, <http://msnbc.msn.com/id/12371432/>, and April 19, 2006, http://outside.away.com/outside/news/20060419_1.html.

Policy

Reuters, “EU Executive Gets Tough On Environmental Violations,” and European Commission Press Release,

“EU Climate Change Policies: Commission Asks Member States to Fulfill Their Obligations.” The European Union’s (EU) European Commission is taking legal action against several EU member states for failing to comply with four climate change policies. The aim of these actions is to ensure that EU and its member states meet all of the reporting obligations under the UN Climate Change Convention and the Kyoto Protocol. Cyprus, Greece, Luxembourg, Malta and Poland were sent warning letters for failure to link national registries with the EU-wide registry system. Each member state was to establish a national registry in the form of a standardized database and communications link, which was to occur by December 31, 2004. Austria, Cyprus, Luxembourg, Malta, and Poland were sent second and final written warnings for not communicating their greenhouse gas emissions projections, nor their policies and measures to reduce their emissions level by March 15, 2006. Cyprus, Italy, Malta and Spain received warnings for failing to submit information on greenhouse gas emissions by January 15 each year. Germany, Italy, Luxembourg and Spain have failed to adequately prepare for international emissions trading under the Kyoto protocol, and have been sent their first written warnings. April 6, 2006, http://today.reuters.com/news/articlenews.aspx?type=scienceNews&storyid=2006-04-06T102511Z_01_L06691570_RTRUKOC_0_US-EU-ENVIRONMENT-INFRINGEMENTS.xml and <http://www.europa.eu.int/rapid/pressReleasesAction.do?release=IP/06/469&format=HTML&aged=0&language=EN&guiLanguage=en>.

Greenwire, “US to Host Asia-Pacific Partnership Talks This Week.” The United States will host talks starting April 18 in Berkeley, California. Representatives of the Asia-Pacific Partnership, including Australia, China, Japan, India, South Korea, and the US, will attend closed-door meetings lasting for four days. The US delegation will be led by Undersecretary of State Paula Dobriansky and White House Council on Environmental Quality Chairman Jim Connaughton. Approximately 250 attendees will draft agendas for eight industries with regard to developing and sharing technologies to curb greenhouse gas emissions. The industries include: fossil fuel energy; renewable energy; power generation and transmission; steel; aluminum; cement; coal mining; and buildings and appliances. April 17, 2006, <http://www.eenews.net/Greenwire/2006/04/17/#1>. (Subscription may be required.)

Reuters, “Spain’s CO_2 Emissions Rose 48 Percent From 1990 to 2004.” Spain’s carbon dioxide emissions rose 47.87 percent between 1990 and 2004, two percentage points higher than was previously calculated, said Spain’s Environment Ministry. The rise may be in part due to the impact of a 2004/2005 (hydrogeologic year) drought which reduced power companies’ hydroelectric generating capacity and increased the use of fossil fuels for power generation. The number shows Spain as the worst performer among rich nations with regard to their greenhouse gas emissions. Spain’s Kyoto protocol target is such that it can increase emissions by only 15 percent between the base year 1990 and 2008. The new data are contained in a report from Spain to the European Commission. April

17, 2006, http://today.reuters.co.uk/news/newsArticle.aspx?type=scienceNews&storyID=2006-04-17T113410Z_01_L17632860_RTRIDST_0_SCIENCE-ENVIRONMENT-SPAIN-DC.XML.

Geology

“Gas–water–rock interactions in sedimentary basins: CO₂ sequestration in the Frio Formation, Texas, USA.” To investigate the potential for the geologic storage of carbon dioxide (CO₂) in saline sedimentary aquifers, 1600 tons of CO₂ were injected at approximately 1500 meter (m) depth into a 24-m sandstone section of the Frio Formation — a regional reservoir in the US Gulf Coast. Fluid samples obtained from the injection and observation wells before, during and after CO₂ injection show a Na–Ca–Cl type brine with 93,000 milligrams per liter (mg/L) total dissolved solids (TDS) and near saturation of methane (CH₄) at reservoir conditions. As injected CO₂ gas reached the observation well, results showed sharp drops in pH (6.5 to 5.7), pronounced increases in alkalinity (100 to 3000 mg/L as hydrogen carbonate (HCO₃) and iron (Fe) (30 to 1100 mg/L), and significant shifts in the isotopic compositions of water (H₂O) and dissolved inorganic carbon (DIC). Geochemical modeling indicates that brine pH would have dropped lower, but for buffering by dissolution of calcite and Fe oxyhydroxides. Post-injection results show the brine gradually returning to its pre-injection composition. *Journal of Geochemical Exploration*, Volume 89, Issues 1-3, *GEOFLUIDS V: 5th International Conference on Fluid Evolution, Migration and Interaction in Sedimentary Basins and Orogenic Belts*, April-June 2006, Pages 183-186, [doi:10.1016/j.gexplo.2005.11.077](https://doi.org/10.1016/j.gexplo.2005.11.077), <http://www.sciencedirect.com/science/article/B6VCP-4JGJJ2R-J/2/f0a78dca20716616646af66c2abab5cc>. (Subscription may be required.)

Technology

“Internalization of external cost in the power generation sector: Analysis with Global Multi-regional MARKAL model.” The Global MARKAL-Model (GMM), a multi-regional "bottom-up" partial equilibrium model of the global energy system with endogenous technological learning, is used to address impacts of internalization of external costs from power production. This modeling approach imposes additional charges on electricity generation, which reflect the costs of environmental and health damages from local pollutants (SO₂, NO_x) and climate change, wastes, occupational health, risk of accidents, noise and other burdens. Technologies allowing abatement of pollutants emitted from power plants are rapidly introduced into the energy system, for example, desulphurization, NO_x removal, and CO₂ scrubbers. The modeling results indicate substantial changes in the electricity production system in favor of natural gas combined cycle, nuclear power and renewables induced by internalization of external costs and also efficiency loss due to the use of scrubbers. Structural changes and fuel switching in the electricity sector result in significant reduction of emissions of both local pollution and CO₂ over the modeled time period. Strong decarbonization impact of internalizing local externalities suggests that ancillary benefits can be expected from policies directly addressing other issues than CO₂ mitigation.

Finally, the detailed analysis of the total generation cost of different technologies points out that inclusion of external cost in the price of electricity increases competitiveness of non-fossil generation sources and fossil power plants with emission control. *Energy Policy*, Available online April 17, 2006. [doi:10.1016/j.enpol.2006.03.003](https://doi.org/10.1016/j.enpol.2006.03.003), <http://www.sciencedirect.com/science/article/B6V2W-4JRM0JS-2/2/94617fc5ec770200db1a981fa94b3511>. (Subscription may be required.)

“Hydrogen production from methane hydrate with sequestering of carbon dioxide.” Methane hydrate exists in large amounts in certain locations, in sea sediments and the geological structures below them and below arctic regions' permafrost, at low temperature and high pressure. It has recently been shown that there are suitable methods for producing methane, perhaps on a floating platform. There it could be reformed via an endothermic process to produce hydrogen and carbon dioxide. Some of the methane could be used to provide heat energy for a power plant on the platform to produce all needed power and support for the methane and CO₂ reforming process. After separation, hydrogen is the valuable and transportable product. All carbon dioxide produced on the platform could be separated from other gases and then sequestered, in one of several possible forms. In this way, hydrogen could be made available without the release of carbon dioxide to the atmosphere and the hydrogen could be an enabling step toward a world hydrogen economy, free of particles and carbon dioxide pollution. *International Journal of Hydrogen Energy*, Available online April 4, 2006, [doi:10.1016/j.ijhydene.2006.01.017](https://doi.org/10.1016/j.ijhydene.2006.01.017), <http://www.sciencedirect.com/science/article/B6V3F-4JMVHKC-1/2/ffcae5d815b1b21fa182743a0e22a6e>. (Subscription may be required.)

Terrestrial/Ocean

“Nitrogen limitation constrains sustainability of ecosystem response to CO₂.” Enhanced plant biomass accumulation in response to elevated atmospheric CO₂ concentration could dampen the future rate of increase in CO₂ levels and associated climate warming. However, it is unknown whether CO₂-induced stimulation of plant growth and biomass accumulation will be sustained or whether limited nitrogen (N) availability constrains greater plant growth in a CO₂-enriched world. Here the authors show, after a six-year field study of perennial grassland species grown under ambient and elevated levels of CO₂ and N, that low availability of N progressively suppresses the positive response of plant biomass to elevated CO₂. Initially, the stimulation of total plant biomass by elevated CO₂ was no greater at enriched than at ambient N supply. After four to six years, however, elevated CO₂ stimulated plant biomass much less under ambient than enriched N supply. This response was consistent with the temporally divergent effects of elevated CO₂ on soil and plant N dynamics at differing levels of N supply. The authors results indicate that variability in availability of soil N and deposi-

tion of atmospheric N are both likely to influence the response of plant biomass accumulation to elevated atmospheric CO₂. Given that limitations to productivity resulting from the insufficient availability of N are widespread in both unmanaged and managed vegetation, soil N supply is probably an important constraint on global terrestrial responses to elevated CO₂. doi:10.1038/nature04486. *Nature*, Volume 440, April 13, 2006, <http://www.nature.com/nature/journal/v440/n7086/full/nature04486.html>. (Subscription may be required.)



“Effect of sugarcane residue management (mulching versus burning) on organic matter in a clayey Oxisol from southern Brazil.” Changes in residue management may help sustain land productivity, and may have noticeable consequences in the global carbon budget when large areas are involved. The effects of sugarcane residue management on topsoil carbon were assessed in a clayey Oxisol of Brazil, largest world’s producer of sugarcane. The carbon concentration of the whole soil and particle-size fractions were determined in a long-duration sugarcane plantation (50 years), with either a pre-harvest residue burning (BUR) or a 6-year green trash management (MUL, residue mulching). Soil carbon concentrations were greater in MUL than in BUR. The difference was significant at a 0–5 centimeters (cm) depth (25.2 versus 21.0 grams of carbon per kilogram (g C kg⁻¹)) but not at 5–10 cm (22.3 versus 20.5 g C kg⁻¹); nevertheless it was significant at 0–10 cm (23.7 versus 20.7 g C kg⁻¹). This difference resulted in carbon sequestration in MUL, which amounted to 0.65 megagrams of carbon per hectare per year (Mg C ha⁻¹ year⁻¹) at 0–10 cm depth and corresponded to 14 percent of aboveground residue carbon returned to the soil. Differences in soil carbon between MUL and BUR mainly affected the fraction <2 micrometers (µm). It was hypothesized that the preferential enrichment in fine fractions resulted in a long-term carbon storage. *Ecosystems & Environment*, Volume 115, Issues 1-4, July 2006, Pages 285-289, doi:10.1016/j.agee.2005.12.014, <http://www.sciencedirect.com/science/article/B6T3Y-4J8D8SX-2/2/9d55b66f54da3eacdf4a96c0e259cc9>. (Subscription may be required.)

“Maximizing the profitability of forestry projects under the Clean Development Mechanism using a forest man-

agement optimization model.” Forestry projects under the Clean Development Mechanism (CDM) may provide several benefits for developing countries. Under the current rules, these projects can participate in both timber and carbon markets. Thus, project developers need to know what the optimal forest management design would be to maximize their revenues according to timber and carbon market expectations while at the same time complying with international rules adopted for carbon sequestration projects under the CDM. The authors developed Carbomax, a management optimization model that simulates forest growth under different forest management regimes (intensity and frequency of thinnings and rotation lengths). A genetic algorithm was used to find the management regime that maximizes the Annual Equivalent Value (AEV) of projects under different market scenarios. The authors tested their model under a wide variety of possible scenarios for forestry projects. Five tropical plantation species (*Alnus jorullensis*, *Cordia alliodora*, *Pinus patula*, *Cupressus lusitanica* and *Eucalyptus grandis*) were evaluated, at discount rates of 4, 7 and 10 percent, and certified emissions reduction (CER) prices of \$3, 7, 10 and 13. Temporary CERs (tCERs) and long-term CERs (ICERs) prices were considered in the evaluation and were calculated as a variable proportion of CER price. Results showed that optimal forest management is sensible to carbon and timber market conditions. Under each discount rate, as CER price increased, frequency and intensity of thinnings tended to decrease and optimal thinnings and rotation lengths tended to be reached at older ages. The largest AEV were obtained with discount rates of 10 percent, CER prices of 13 and rotation lengths of 40 years for all species. For those species with higher timber prices, thinnings tended to be more frequent and at early ages of the plantation. For all species optimal thinnings were found at 35 years of plantation age. tCERs was selected by the model as the best choice to maximize the profitability of the projects. *Forest Ecology and Management*, Volume 226, Issues 1-3, May 1, 2006, Pages 341-350. <http://www.sciencedirect.com/science/article/B6T6X-4JKRTP3-1/2/f43ae5203c557c774a943c6329dfa9d1>. (Subscription may be required.)

Trading

Carbon Market Update, April 18, 2006	
CCX-CFI 2006 (\$/tCO ₂) \$4.55	EU ETS-EUA DEC 2006 (\$/tCO ₂) \$ 37.29
(Converted from € to US\$)	

Reuters, “Chicago Climate Mart To Try CO₂ Link With EU.” The Chicago Climate Exchange (CCX) has announced that it is opening its voluntary carbon dioxide (CO₂) market to European Union (EU) traders that have Emissions Trading Scheme allowances. The CCX will allow EU CO₂ emission allowances to be used in compliance with CCX commitments for calendar year 2005, cre-

ating a linkage between North America's only reduction and trading system and the European Union Emissions Trading Scheme. CCX has set up "demonstration transfers," through which trade can be carried out between markets. "Batches of 100 tons of EU allowances would be transferred by a CCX member from its EU allowance account into an account CCX has established in an EU registry," CCX said in a statement. "The EU allowances would then be retired, and CCX would issue 100 metric tons of CO₂ into that member's CCX registry account." April 5, 2006, http://today.reuters.co.uk/news/newsArticle.aspx?type=scienceNews&storyID=2006-04-05T004141Z_01_N04191089_RTRIDST_0_SCIENCE-ENERGY-EMISSIONS-CHICAGOCLIMATE-DC.XML.

Reuters, "EU CO₂ Emission Prices Hit New Record High."

European carbon dioxide emissions prices jumped to a new record high of 31 euros (\$38.28) per tonne (December 2007 carbon quotas) on April 12, although they closed at 30.25 euros (\$37.35) per tonne. The boost was caused by surging oil prices and strong German power markets. CO₂ prices have risen five fold since the launch of the European Union trading scheme last year. Dry weather in Europe is prompting generators, especially in Spain, to burn fossil fuel due to lack of hydropower. Deutsche Bank is forecasting that CO₂ emission prices could rise toward 40 euros (\$49.39) over the coming year. April 12, 2006, <http://today.reuters.com/business/newsarticle.aspx?type=tnBusinessNews&storyID=nL12586863>.

Reuters "CO₂ Market on Brink as Price Continues to Slide,"

Carbon credits for December 2006 delivery fell as low as 14 euros (\$17) in early Thursday trading on the European Climate Exchange. The price recovered to around 17 euros (\$21) by 10:00 Greenwich Mean Time. Carbon credits had hit a high of 31 euros (\$39) on April 12. "From a market perspective it's terrible news," said James Emanuel, Head of Carbon Trading at brokers CO₂e.com. "If there's a (net carbon credit) surplus there's no incentive to reduce emissions and the (carbon) price collapses. It won't go to 0, it would effectively go down to the administrative cost of the scheme... it could be 1 euro, who knows?" Power prices in Europe have declined due to the falling CO₂ prices. British Energy was down 1.8 percent, International Power 1.2 percent, RWE 2 percent, EON 2.1 percent and EDF 3.1 percent. April 26, 2006, <http://www.planetark.com/dailynewsstory.cfm/newsid/36175/story.htm>.

Globe and Mail, "Legal Teams Clean Up On Emissions Trading."

Emissions trading can require legal expertise in securities, the environment and tax law. Large law firms are being drawn into corporate legal work to assist business in preparing for compliance as each country sets emissions targets for their industries. Law firms working in this area include: Chicago-based Baker & McKenzie, London-based Clifford Chance LLP, Amsterdam-based De Brauw Blackstone Westbroek, Canadian Based Fasken Martineau DuMoulin LLP, McCarthy Tétrault LLP, and Calgary-based Bennett Jones, Macleod Dixon LLP and Thackray Burgess. Boston-based Brown Rudnick Berlack Israels LLP announced on March 20 the formation of a Climate & Energy Group to work on renewable energy project development, emissions reduction schemes and alternative energy sources for clients. March 29, 2006, <http://www.theglobeandmail.com/servlet/story/LAC.20060329.RLAWYERS29/TPStory/Business>.

Recent Publications

"Coal: America's Energy Future, Volume I, The National Coal Council, March 2006." US Secretary of Energy Samuel W. Bodman requested the National Coal Council to conduct a study and assemble a report identifying the challenges and opportunities of more fully exploring US coal resources to meet the national's future energy needs. Included in the report are information and overviews of near-zero emissions power generation technology, FutureGen, carbon capture and storage, enhanced oil and gas recovery, carbon dioxide pipelines, the Carbon Sequestration Regional Partnerships, and global carbon sequestration programs. March 2006, <http://nationalcoalcouncil.org/report/NCCReportVol1.pdf>.

"Voluntary Reporting of Greenhouse Gases 2004."

The Voluntary Reporting of Greenhouse Gases Program, required by Section 1605(b) of the Energy Policy Act of 1992, records the results of voluntary measures to reduce, avoid, or sequester greenhouse gas emissions. For the 2004 reporting year, 226 US companies and other organizations reported to the Energy Information Administration (EIA) that they had undertaken 2,154 projects to reduce or sequester greenhouse gases in 2004. The reported greenhouse gas emission reductions for the projects reported included 277 million metric tons carbon dioxide equivalent (million MTCO₂e) of direct reductions, 92 million MTCO₂e of indirect reductions, 7 million MTCO₂e of reductions from carbon sequestration, and 14 million MTCO₂e of unspecified reductions. Total U.S. greenhouse gas emissions in 2004 are estimated at 7,122 million MTCO₂e. [http://www.eia.doe.gov/oiaf/1605/vrrpt/pdf/0608\(04\).pdf](http://www.eia.doe.gov/oiaf/1605/vrrpt/pdf/0608(04).pdf).

"Seismic Imaging for Site Selection and Monitoring of Carbon Dioxide Sequestration Part 2—Laboratory Studies."

This is the second in a two part series from *GasTips*, a publication of Gas Technology Institute, the US Department of Energy and Hart Energy Publishing which covers technology developments in natural gas exploration, production and processing. The Gas Technology Institute, with support from the Illinois Clean Coal Institute and cooperation of the Illinois State Geological Survey, designed and implemented a comprehensive research project aimed at determining the viability of seismic techniques for site selection and monitoring of carbon dioxide sequestration in Illinois coal seams. Read details of the studies starting on page 2 of the pdf file of the Winter 2006 *GasTips*, which is available at: <http://www.netl.doe.gov/technologies/oil-gas/publications/GasTIPS/GasTIPS-Winter2006.pdf>.

"Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2004. April 2006."

After gathering comments from a broad range of stakeholders around the country, the US Environmental Protection Agency has published the "Inventory of US Greenhouse Gas Emissions and Sinks: 1990-2004." The report analyzes the sources of greenhouse gas emissions. It shows that both methane and nitrous oxide emissions have decreased from 1990

levels by 10 percent and two percent, respectively. Overall, greenhouse gas emissions during 2004 increased by 1.7 percent from the previous year. This increase, which occurred during a period of economic expansion, was due primarily to an increase in carbon dioxide emissions associated with fuel and electricity consumption. Fossil fuel combustion was the largest source of emissions, accounting for 80 percent of the total. While the US economy expanded by 51 percent from 1990 to 2004, emissions have grown by only 15.8 percent over the same period. This report is the latest in an annual set of reports that the US submits to the Secretariat of the United Nations Framework Convention on Climate Change, which sets an overall framework for intergovernmental efforts to tackle the challenge posed by climate change. Read a press release at: <http://yosemite.epa.gov/oia/admpress.nsf/68b5f2d54f3eefd28525701500517fbf/7510b703526bc37b85257153006e5add!OpenDocument>. April 2006. Download a pdf file of the complete report, or sections of the report at: <http://yosemite.epa.gov/oar/globalwarming.nsf/content/ResourceCenterPublicationsGHGEmissionsUSEmissionsInventory2006.html>.

“The Climate Action Team Report to Governor Schwarzenegger and the Legislature.” The California Climate Action Team (CAT) has released a report that recommends a wide range of measures to reduce greenhouse gas emissions in California by approximately 30% by 2020. The final report was released on April 3. The CAT Report recommends 46 specific strategies to reduce greenhouse gas emissions in California, including implementation of the California Solar Initiative, development of alternative fuels, forest conservation measures, and intelligent transportation systems. Combined with emission reduction efforts already underway, these new strategies would help the state meet the Governor’s targets in 2010 (approximately 60 million tons CO₂ equivalent in emission reductions) and 2020 (approximately 175 million tons CO₂ equivalent in emission reductions). To view the final 2006 Climate Action Team Report to Governor Schwarzenegger and the Legislature, and other supporting documents, see: http://www.climatechange.ca.gov/climate_action_team/reports/index.html.

Greenwire, “Draft World Bank Report Emphasizes Technology to Curb Emissions.” The World Bank has released their draft report “Clean Energy and Development: Towards an Investment Framework,” intended to assist developing nations in accessing sustainable energy sources to fuel economic growth and reduce poverty. The report, which was requested by G8 leaders at their meeting in Scotland in 2005, will be discussed at the development committee forum of the World Bank and International Monetary Fund meeting on April 23 in Washington, DC. The report says that the development and use of new energy technologies are key to mitigating global warming. The draft recommends integrated gasification combined cycle (IGCC) with carbon capture and storage (CCS), afforestation, and a decrease in deforestation, among other measures. The draft also states that research, development and demonstration are needed to further improve technologies in certain areas including IGCC with CCS. The draft also calls for detailed financing plans on clean energy projects and climate mitigation, and to be prepared quickly for the World Bank’s September 2006 annual meeting. Some experts say



that the draft does not go far enough in recommending new ways to address climate change, and that the report recommends technologies that are too expensive for developing nations. The World Bank spokesperson declined to comment on the draft, saying only that the final version will be available the week of April 17. Download the draft April 5, 2006 report as a pdf file here: [http://siteresources.worldbank.org/DEVCOMMINT/Documentation/20890696/DC2006-0002\(E\)-CleanEnergy.pdf](http://siteresources.worldbank.org/DEVCOMMINT/Documentation/20890696/DC2006-0002(E)-CleanEnergy.pdf). April 14, 2006, <http://www.eenews.net/Greenwire/2006/04/14/#10>. (Subscription may be required to access news story.)

“Benchmarking Air Emissions of the 100 Largest Electric Power Producers in the United States – 2004. April 2006.” The 2006 Benchmarking report is the fifth collaborative effort among Ceres, the Natural Resources Defense Council (NRDC) and Public Service Enterprise Group (PSEG) highlighting environmental performance and progress in the nation’s electric power sector. The Benchmarking series began in 1997 and uses publicly reported data to compare the emissions performance of the 100 largest power producers (producers) in the United States. The current report is based on 2004 generation and emissions data. These producers include public and private entities that own nearly 2,000 power plants and account for 88 percent of reported electric generation and 89 percent of the industry’s reported emissions. The report focuses on four power plant pollutants for which public emissions data are available: sulfur dioxide (SO₂), oxides of nitrogen (NO_x), mercury (Hg), and carbon dioxide (CO₂). Since 1990, power plant emissions of SO₂ and NO_x have decreased and CO₂ emissions have increased. CO₂ emissions are not regulated at the federal level. In 2004, power plant CO₂ emissions were 27 percent higher than they were in 1990. The report predicts a bigger increase in the years ahead due to an unprecedented surge of new US coal-plant proposals that would emit substantially more CO₂ than other sources generating the same amount of power. There are currently more than 130 new coal plants proposed across the US, and the Energy Information Administration (EIA) projects a 66 percent increase in coal-based power production and a 43 percent increase in CO₂ emissions by 2030. The EIA projection assumes no controls on CO₂

emissions at the power plants. To download the report, see: http://www.ceres.org/pub/docs/Ceres_bchmrkng_electric_2004_0406_full.pdf. Also see <http://www.nrdc.org/air/pollution/benchmarking/default.asp> to download supporting data tables.

“Carbon Capture and Storage: A Consultation on Barriers to Commercial Deployment.” The United Kingdom HM Treasury has released a consultation report on carbon capture and storage (CCS) that invites answers to questions that aim to establish the extent to which there are barriers to commercial deployment and whether and how these could be addressed. Specifically, the consultation aims to build understanding on: the current state and future development of CCS technologies and the likely costs attached to deploying them commercially; the potential carbon savings available from CCS; the barriers which currently exist to further development and commercial deployment; and whether there is a case for government intervention and, if called for, the forms this might take. Responses to the document are accepted until May 11, 2006. March 2006, http://www.hm-treasury.gov.uk/budget/budget_06/other_documents/bud_bud06_odcarbob.cfm.

Legislative Activity

Reuters, “California Aims to Limit Emissions of Gases.” April 3, 2006, California state assembly members drafted a bill that could make California the first state to set a limit on emissions of greenhouse gases. The bill was drafted by Democrat Speaker Fabian Núñez and Democrat Assemblywoman Fran Pavley, and would cut emission levels by 25% or 145 million tons, to 1990 levels by 2020. Also, on April 3, a report was released by California’s “Climate Action Team”

April 3, 2006, California state assembly members drafted a bill that could make California the first state to set a limit on emissions of greenhouse gases.

-Reuters

that presented emissions cutting strategies to the Governor and the legislature. (See **Recent Publications** section of this newsletter for a link to the final 2006 “Climate Action Team Report to Governor Schwarzenegger and the Legislature.”) The report recommends that the emissions reduction target for 2020 (approximately 175 million tons CO₂ equivalent in emission reductions) be the basis for an emissions cap that was recommended to be extended beyond California’s borders to other Western states. Mandatory reporting of emission levels by oil and gas exploration and production, oil refining, electric power, cement manufacturing, and solid waste landfills were also recommended. The environmental advisors who contributed to the report also said that a market-based program should be developed for California to include trading, emissions credits, auction and offsets, and that such a program should be presented to the governor by January 1, 2008. April 3, 2006, <http://go.reuters.com/newsArticle.jhtml?type=scienceNews&storyID=11737539>.

Greenwire, “Governor Schwarzenegger Vows ‘Sensible and Deliberate’ Effort On Emissions.” At the first “Climate Action Summit” held by California, Governor Arnold Schwarzenegger stated that California should establish a carbon emissions inventory and then proceed in a “sensible and deliberate way” to meet goals established a year ago to reduce total carbon output to 1990 levels by 2020, and 80 percent below that by 2050. His comments were in response to the Climate Action Team Report issued by the Climate Action Team on April 3. (See Recent Publications section of this newsletter for a link to the final 2006 “Climate Action Team Report to Governor Schwarzenegger and the Legislature.”) The Governor also stated that California should work toward the goals without caps, since caps could impact the business community. A debate followed with comments made by the invited panelists regarding aspects of the Climate Action Team Report. Much of the discussion centered on California’s historic leadership in pioneering regulations that are eventually accepted by other states or the federal government; for example, its early efforts to reduce vehicle pollution led to development of the catalytic converter technology. April 12, 2006, <http://www.eenews.net/Greenwire/2006/04/12/#1>. (Subscription may be required.)

Yahoo News, “Maryland joins states breaking with Bush on CO₂.” On April 6, 2006, Governor Robert Ehrlich, a Republican, signed an act requiring Maryland to join the Regional Greenhouse Gas Initiative (RGGI) agreement. Maryland joins seven states in the RGGI agreement, New York, Connecticut, New Jersey, Vermont, Maine, New Hampshire, and Delaware, whose aim is to cap carbon dioxide (CO₂) emissions from power plants at 1990 levels starting in 2009, and cut emissions by 10 percent below 2018 levels. Of the eight states, Maryland’s “CO₂ emissions per person” in 2000 ranked second, as did their CO₂ emissions, according to Environment Northeast. April 7, 2005, http://news.yahoo.com/s/nm/20060407/pl_nm/energy_rggi_maryland_dc_1.

Energy and Environment Daily, “Bipartisan House Plan Aims to Cap GHG Emissions.”

Representatives Tom Udall (D-NM), and Tom Petri (R-WI) have sponsored the “Keep America Competitive Global Warming Policy Act of 2006” aimed at capping emissions through a market-based trading system. The legislation does not include emissions limits but requires the US EPA to set up a pollution cap three years after the bill becomes law. The bill would establish a system of allowances for the cap-and-trade program, and allocate 25 percent of those allowances to a new Department of Energy research program, 10 percent to the State Department for investment in developing countries’ low-carbon and no-carbon projects/policies, and 35 percent to the US EPA for those who may be adversely impacted due to the legislation. An unlimited number of “safety value” allowances will be available at \$25 per metric ton of carbon. This bill would regulate emissions from “upstream” sources, including oil im-

porters; natural gas processors and pipelines; oil refineries; and coal producers and importers. To view the bill go to: <http://www.govtrack.us/data/us/bills.text/109/h5049.pdf>, or <http://thomas.loc.gov/cgi-bin/query/z?c109:h5049>. March 29, 2006, http://www.eenews.net/EEDaily/sr_climate_change/2006/03/29/6/. (Subscription may be required.)

Forbes, “US Industries Plead for Cleaner Air.” The Senate Committee on Energy & Natural Resources Climate Conference was held April 4 at which business, government and non-profit groups and “think-tank” organizations responded to the questions raised in the white paper entitled “Design Elements of a Mandatory Market-Based Greenhouse Gas Regulatory System” released in February 2006 by Senator Pete V. Domenici, (R-NM) and Senator Jeff Bingaman (D-NM). The white paper outlines the key questions and design elements of a national greenhouse gas program assuming a “mandatory market-based system,” and serves to help formulate a bill to be presented to Congress by Senator Bingaman. A consensus is growing in business to set up a cap-and-trade emissions system modeled after Europe’s system. Businesses long opposed to mandatory emissions caps are seeing the laws that are being created in the US to cap emissions on a statewide or regional basis, and are giving input towards a nationwide system, which many companies see as inevitable. To read the responses by the various participants in the conference see: http://energy.senate.gov/public/index.cfm?FuseAction=Conferences.Detail&Event_id=4&Month=4&Year=2006. April 5, 2006, http://www.forbes.com/business/2006/04/04/greenhouse-emissions-environment-cx_jh_0405green.html.



Events

May 10-12, 2006, **Climate Change Technology Conference “Engineering Challenges and Solutions in the 21st Century,”** *Ottawa Congress Center, Ottawa, Ontario, Canada.* This conference is sponsored by the Engineering Institute of Canada, its Member Societies and other Collaborators. Its purpose is to deal with the need to mitigate against and adapt to the negative effects of climate change, recognizing that such is the role of engineering. A preliminary program is available. Register online at: <http://www.ccc2006.ca/eng/register.html>.

May 10-12, 2006, **Third Annual CARBON EXPO,** *Congress Centre East, Cologne, Germany.* CARBON EXPO is the global carbon market event that combines the up-to-date content of a high-level conference with the advantages of a trade fair. For additional information visit: <http://www.carbonexpo.com/>.

May 21-26, 2006, **The Clearwater Coal Conference, 31st International Technical Conference on Coal Utilization & Fuel Systems.** *Sheraton Sand Key Hotel, Clearwater, FL.* Sponsored by: US Department of Energy, National Energy Technology Laboratory, Coal Technology Association & American Society of Mechanical Engineers - Power Division. The program presents an extensive overview of emerging, evolving, and innovative technologies, fuels and/or equipment in the power generation industry. The presentations will deal with technical solutions to problems; specific strategies; projects; innovations; industry trends; and/or regulatory compliance. Contact Barbara Sakkestad, Coal Technology Association, Phone: 301/294-6080. E-mail: Barbarasak@aol.com; or the website: www.coaltechnologies.com

June 14-15, 2006, **Carbon Markets Asia,** *Excelsior Hotel, Hong Kong.* As the amount of carbon mitigation activity builds rapidly across the region with both the Clean Development Mechanism and domestic emissions trading, this 2nd annual event brings together the region's key experts to discuss methodologies, best practice project development, linking and carbon trading. For general enquiries, please contact Matthew Probyn at matthew.probyn@greenpowerconferences.com, or see : <http://www.greenpowerconferences.com/events/CarbonMarketsAsia.htm>.

June 25-30, 2006, **SPE CO₂ Capture and Storage Forum,** *Omni Interlocken Resort, Broomfield (Denver), CO.* Opportunities exist in the oil and gas industry to use enhanced oil recovery (EOR) with CO₂ captured from anthropogenic sources. This forum will discuss the requirements for CO₂ capture and storage to become a way of contributing to the reduction of emissions as well as enhancing the production of oil and gas fields. It aims at bringing together the practitioners who are currently using CO₂ in their EOR projects, the brownfield asset managers, and geoscience experts, along with the technology developers and suppliers. The forum would also benefit from the participation of representatives from the power and downstream sectors. For additional information, visit: http://www.spe.org/spe/jsp/meeting/0,2460,1104_1535_4242542,00.html.

June 19-22, 2006, **GHGT-8,** *Norwegian University of Science and Technology (NTNU), Trondheim, Norway.* The aim of this conference is to provide a forum for the discussion of the latest advances in the field of greenhouse gas control technologies. The conference program can now be found on the website: <http://www.ghgt-8.no>.

June 28, 2006, **Kyoto - At What Price?: How GHG Markets Are Impacting The Power Industry,** *The IEE, Savoy Place, London, UK.* Greenhouse gas reduction targets are set in the Kyoto Accord that formally came into effect on February 16, 2005. Climate change is high on the agenda for Tony Blair's term as leader of the G8 group of industrialized nations and he has identified that science and technology must play a major role in addressing this issue. This seminar will bring together stakeholders in the electricity industry ranging from generation (renewables, combined heat and power (CHP), gas, coal, nuclear), transmission system and electricity supply (demand side management/metering) plus customer representatives (energy watch, large users, etc.). See: <http://www.iee.org/Events/kyoto.cfm>.

September 25-28, 2006, **The 23rd International Pittsburgh Coal Conference,** *David L. Lawrence Convention Center, Pittsburgh, PA.* The Twenty-Third Annual International Pittsburgh Coal Conference will focus on environmental emissions issues and technologies surrounding the continued use of coal and the development of future coal-based energy plants to achieve near-zero emissions of pollutants, reduced costs, and high thermal efficiency while producing a suite of products to meet future energy market requirements. A proposed topic area of “Global Climate Change: Science, Sequestration, and Utilization” includes possible subtopics of: Kyoto protocol and policy issues; CO₂ capture technologies; sequestration in geological sinks; Enhancing natural sinks; modeling and assessments; non-CO₂ greenhouse gas capture and storage; multi-pollutant capture and storage; and CO₂ utilization. For more information, see: <http://www.engr.pitt.edu/pcc/2006%20Conference.htm>.

Events (continued...)

May 8-11, 2006, **The Fifth Annual Conference on Carbon Capture & Sequestration "Taking Steps Toward Deployment,"** *Hilton Alexandria Mark Center, Alexandria, VA.* The conference will bring together experts directly involved in developing, demonstrating and deploying carbon capture, separation and sequestration technologies as part of the Administration's Climate Change Technology Program. The Conference is sponsored by EM Publications & Forums, in partnership with the US Department of Energy, National Energy Technology Laboratory, and other federal agencies. (**"US Secretary of Energy Samuel W. Bodman to Keynote the Conference."** Additional featured Department of Energy speakers include: Jeffrey Jarrett, Assistant Secretary, Office of Fossil Energy; Dr. Raymond Orbach, Director, Office of Science; Carl Bauer, Director, National Energy Technology Laboratory; and Steve Eule, Director, Climate Change Technology Program.) Full details are available at: <http://www.carbonsq.com/>. Click here for the latest agenda as a pdf file: http://www.carbonsq.com/pdf/2006/06ccs_agenda.pdf

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