

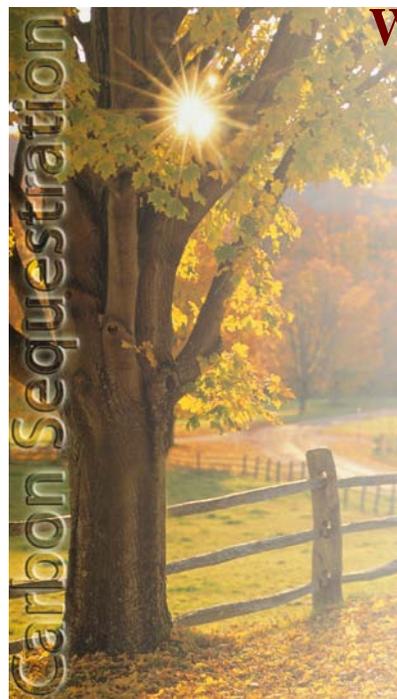


Carbon Sequestration Newsletter

OCTOBER 2007

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HIGHLIGHTS

NETL News Release, "Regional Partner Launches Drilling Test in DOE's Carbon Sequestration Program."

The Plains CO₂ Reduction Partnership (PCOR), one of the seven Department of Energy (DOE) Regional Carbon Sequestration Partnerships, has begun a small-scale geologic field test as part of their validation phase efforts which will focus on carbon dioxide (CO₂) storage in a lignite seam in Burke County, North Dakota. The PCOR Partnership, managed by the University of North Dakota's Energy and Environmental Research Center, will partner with Eagle Operating Inc. of Kenmare, North Dakota to conduct the two-year, two-phased test. During phase one, data about the coal seam will be collected in order to evaluate the seam's potential to produce coalbed methane. PCOR researchers will drill five test wells in order to complete a geologic characterization of the lignite coal seam. Phase two will involve the injection of CO₂ into the coal seam, as well as the potential recovery of valuable coalbed methane. PCOR's validation phase test will inject at least 400 tons of CO₂ at a depth of approximately 1,200 feet. Results from the field test will be used to conduct similar geologic sequestration and coalbed methane recovery tests in the PCOR region. August 30, 2007,

http://www.netl.doe.gov/publications/press/2007/070830-Regional_Partner_Launches_Drilling.html.

SEQUESTRATION IN THE NEWS

ZeroGen Media Release, "Clean Coal Project Achieves Significant Milestone," and The Age (Australia), "Queensland ZeroGen Project Passes First Test."

A significant milestone was reached with ZeroGen, Australia's zero-emissions, clean coal power demonstration project, located in central Queensland. The Australian project combines Integrated Gasification Combined Cycle (IGCC) technology with CO₂ capture and storage in efforts to greatly reduce atmospheric CO₂ emissions. The first phase of testing, known as Drilling Program One (DP1), was completed successfully and involved drilling two test wells, both more than one kilometer deep. Results of the test have established the safe injection and storage of CO₂ into saline formations in the Northern Denison Trough. Knowledge gained about the geology of the formation will assist ZeroGen researchers in locating suitable geologic formations for long-term storage of CO₂. It will also allow them to move into the next phase of testing, Drilling Program 2 (DP2), which will involve locating a formation with sufficient storage capacity, analyzing project costs, performing risk assessment, and conducting monitoring and verification studies. More information about Australia's ZeroGen project can be found at: www.zerogen.com.au. August 30, 2007, <http://www.zerogen.com.au/files/Media%20Release%2030%20August%202007%20Clean%20Coal%20project%20achieves%20significant%20milestone.pdf>, and August 30, 2007, <http://www.theage.com.au/news/National/Qld-ZeroGen-project-passes-first-test/2007/08/30/1188067237414.html#>.

Greenwire, "Blue Source Will Capture Kansas CO₂, Use for Oil Recovery Elsewhere."

Blue Source LLC will partner with Coffeyville Resources Nitrogen Fertilizers LLC on a carbon sequestration project that will capture and transport CO₂ for enhanced oil recovery (EOR) efforts. Once the CO₂ is sequestered, CO₂ emission levels are expected to be reduced by 650,000 metric tons per year. The project involves capturing CO₂ from Coffeyville Resources' fertilizer plant in Kansas and transporting it via pipeline to depleted oil fields 120 miles away. Blue Source intends to market the emissions credits created by this project to fund other EOR or geologic sequestration projects. The project will cost between \$50



SEQUESTRATION IN THE NEWS (CONTINUED)

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This newsletter is produced by the National Energy Technology Laboratory to provide information on recent activities and publications related to carbon sequestration. It covers domestic, international, public sector, and private sector news.

million and \$80 million. Blue Source has collaborated on many similar projects in the past and has about thirteen more in the planning stages. August 23, 2007, <http://www.eenews.net/Greenwire/print/2007/08/23/14>.



The Age (Australia), “Big Firms Set for Carbon Opportunities.”

While no firm emissions targets were established at the Asia-Pacific Economic Cooperation (APEC) summit held in Sydney, many large Australian companies are recognizing investment opportunities in carbon-related business ventures, such as geosequestration and other clean coal technologies. At the same time, businesses including Chevron in Western Australia, BP Australia, Rio Tinto, Santos Limited, and Worley Parsons are reluctant and uncertain to move forward with emissions reduction investments in the absence of a clear regulatory framework and a structured carbon trading market. Carbon-related opportunities for Australian businesses include involvement of BP Australia and Rio Tinto in geosequestration, Santos' large-scale carbon sequestration project in the Cooper Basin in Victoria, and General Electric's clean coal technology development. September 11, 2007, <http://www.theage.com.au/news/Business/Big-firms-set-for-carbon-opportunities/2007/09/11/1189276710149.html#>.

ANNOUNCEMENTS

DOE's National Energy Technology Laboratory (NETL) Launches New Carbon Capture and Sequestration FAQ Portal.

A profusion of information about carbon capture and storage (CCS) can be found at the recently launched NETL web portal. The website provides answers to a wide range of questions about the technology, the status of ongoing projects, and potential safety concerns, among other CCS topics. The website is useful to experts in the field of CCS and to those wanting to learn about the topic for the first time. To visit the website, click on: http://www.netl.doe.gov/technologies/carbon_seq/faqs.html.

Carbon Sequestration Technology Roadmap and Program Plan 2006 Wins Award for Excellence.

DOE's National Energy Technology Laboratory has been awarded a 2007 APEX Award for the 2006 Carbon Sequestration Technology Roadmap and Program Plan. The "Roadmap" was recognized for its superior quality in graphic design, editorial content, and the ability to achieve overall communications excellence. The 2006 roadmap described the status of CO₂ capture and sequestration technology, identified research pathways, and described DOE efforts to pursue priority pathways. The 2007 Carbon Sequestration Roadmap and Program Plan can be downloaded at: http://www.netl.doe.gov/publications/carbon_seq/project%20portfolio/2007/2007Roadmap.pdf.

Video Interview with National Resource Defense Council on Cost Implications of Cap-and-Trade Policy.

This video interview with Dan Lashof, Deputy Director and Science Director of the National Resource Defense Council's Climate Center, analyzes the economic implication of key legislative proposals and why he favors a cap-and-trade policy over a carbon tax. To watch the video, click on: http://www.eenews.net/tv/video_guide/655.

Listen to a Podcast, "Carbon Storage: How It Works, What It Means."

Earth & Sky's Lindsay Patterson spoke with two experts on the subject in order to understand how carbon capture and storage works and what it means. This 5-minute Earth and Sky Podcast is available for download at: <http://www.earthsky.org/clear-voices/51562/lynn-orrr-and-elizabeth-wilson>.

Intergovernmental Panel on Climate Change (IPCC) Meeting Scheduled.

The 27th Session of the Intergovernmental Panel on Climate Change is scheduled to take place in Valencia, Spain on November 12-17, 2007. The focus of this meeting will be on the adoption and approval of the draft Synthesis Report of the IPCC Fourth Assessment Report (AR4). The Chairman will also introduce a discussion paper about the future of the IPCC and take up other items that require consideration and decision by the Panel. Information for invited participants can be found by going to: <http://www.ipcc.ch/meet/27session.htm>.

SCIENCE

SciDev.Net (London), "Soil Degradation Issues 'Swept Aside', Say Experts."

Scientists in attendance at the International Forum of Soils, Society and Global Change, held in Selfoss, Ireland, claim that the connection between soil and land degradation and climate change is significant. Global emissions from deforestation and degradation of lands are contributing as much as 25 percent of the excess CO₂ in the atmosphere. Without the cover of vegetation, land becomes more reflective and heats the air above it, causing temperatures to increase. Attendees at the forum are calling for the Intergovernmental Panel on Climate Change to draft a special report on this subject. They are also demanding more attention be given to the potential for carbon sequestration in soils, noting that land and forest restoration have the capacity to replace one to two billion tons of carbon by restoring degraded ecosystems. September 7, 2007,

<http://www.scidev.net/News/index.cfm?fuseaction=readNews&itemid=3879&language=1>.

Reuters, "Islands Emerge as Arctic Ice Shrinks to Record Low."

Significant decreases in ice and snow amounts are occurring on the Norwegian archipelago of Svalbard, and unmapped islands are appearing out of the water. Data from the US National Snow and Ice Data Center show that the 2007 level of Arctic sea ice is currently below the all-time recorded low, which was registered back in 2005. Norwegian Environment Minister Helen Bjoernoy spoke to scientists and politicians at a seminar in Ny Alesund, a settlement and base for Arctic research that is located 750 miles from the North Pole. Bjoernoy and others believe that the acceleration of melting ice may be occurring at a faster rate than that predicted by the United Nation's Intergovernmental Panel on Climate Change. The reduction of snow and ice is already having adverse effects on polar bears, seals, and other species. August 21, 2007, <http://www.planetark.com/avantgo/dailynewsstory.cfm?newsid=43813>.

POLICY

Greenwire, “Asia-Pacific Business Leaders Want Carbon Pricing.”

During the Asia Pacific Economic Cooperation (APEC) summit in Australia, business leaders pledged that they will make urgent appeals to their governments to implement CO₂ emissions trading schemes. Attendees also requested that their leaders provide incentives to invest in energy saving technologies to control greenhouse gas emissions. Australia has placed significant importance on climate change at the summit. The government has expressed interest in a new treaty after the 2012 expiration of the Kyoto Protocol that would require more effort on the part of developing nations to reduce emissions. While the United States backs Australia’s sentiments, developing nations such as India and China do not support agreements that duplicate or replace the United Nations framework on climate change. Other APEC leaders have expressed their exclusive support to the United Nations emissions framework. According to research conducted in Australia, the country’s failure to ratify the Kyoto Protocol is costing the country billions of dollars in lost investment opportunities by hindering investment in low-emissions technologies that could be funded through carbon credits. September 5, 2007, <http://www.eenews.net/Greenwire/print/2007/09/05/13>. (Subscription may be required.)

“Research for Deployment: Incorporating Risk, Regulation, and Liability for Carbon Capture and Sequestration.”

Carbon capture and sequestration (CCS) has the potential to enable deep reductions in global carbon dioxide (CO₂) emissions, however this promise can only be fulfilled with large-scale deployment. For this to happen, CCS must be successfully embedded into a larger legal and regulatory context, and any potential risks must be effectively managed. [The authors] developed a list of outstanding research and technical questions driven by the demands of the regulatory and legal systems for the geologic sequestration (GS) component of CCS. [The authors] then looked at case studies that bound uncertainty within two of the research themes that emerge. These case studies, on surface leakage from abandoned wells and groundwater quality impacts from metals mobilization, illustrate how research can inform decision makers on issues of policy, regulatory need, and legal considerations. A central challenge is to ensure that the research program supports development of general regulatory and legal frameworks, and also the development of geological, geophysical, geochemical, and modeling methods necessary for effective GS site monitoring and verification (M&V) protocols, as well as mitigation and remediation plans. If large-scale deployment of GS is to occur in a manner that adequately protects human and ecological health and does not discourage private investment, strengthening the scientific underpinnings of regulatory and legal decision-making is crucial. **Elizabeth J. Wilson, S. Julio Friedmann, and Melisa F. Pollak**, *Environmental Science Technology*, Published online July 25, 2007, DOI: 10.1021/es062272t, <http://pubs.acs.org/cgi-bin/abstract.cgi/esthag/2007/41/i17/abs/es062272t.html>. (Subscription required.)

GEOLOGY

“Effects of in-situ conditions on relative permeability characteristics of CO₂-brine systems.”

Carbon dioxide capture and geological storage (CCGS) is an emerging technology that is increasingly being considered for reducing greenhouse gas emissions to the atmosphere. Deep saline aquifers provide a very large capacity for CO₂ storage and, unlike hydrocarbon reservoirs and coal beds, are immediately accessible and are found in all sedimentary basins. Proper understanding of the displacement character of CO₂-brine systems at in-situ conditions is essential in ascertaining CO₂ injectivity, migration and trapping in the pore space as a residual gas or supercritical fluid, and in assessing the suitability and safety of prospective CO₂ storage sites. Because of lack of published data, the authors conducted a program of measuring the relative permeability and other displacement characteristics of CO₂-brine systems for sandstone, carbonate and shale formations in central Alberta in western Canada. The tested formations are representative of the in-situ characteristics of deep saline aquifers in compacted on-shore North American sedimentary basins. The results show that the capillary pressure, interfacial tension, relative permeability and other displacements characteristics of CO₂-brine systems depend on the in-situ conditions of pressure, temperature and water salinity, and on the pore size distribution of the sedimentary rock. This paper presents a synthesis and interpretation of the results. **Stefan Bachu and Brant Bennion**, *Environmental Geology*, Published online July 24, 2007, DOI: 10.1007/s00254-007-0946-9, <http://springerlink.metapress.com/content/k05245331h864771/?p=70070aac2be64638acdb2f7b3cce2f51&pi=0>. (Subscription required.)

“Site characterization of a basin-scale CO₂ geological storage system: Gippsland Basin, southeast Australia.”

Geological storage of CO₂ in the offshore Gippsland Basin, Australia, is being investigated by the Cooperative Research Centre for Greenhouse Gas Technologies (CO₂CRC) as a possible method for storing the very large volumes of CO₂ emissions from the nearby Latrobe Valley area. A storage capacity of about 50 million tonnes of CO₂ per annum for a 40-year injection period is required, which will necessitate several individual storage sites to be used both sequentially and simultaneously,



GEOLOGY (CONTINUED)

but timed such that existing hydrocarbon assets will not be compromised. Detailed characterization focused on the Kingfish Field area as the first site to be potentially used, in the anticipation that this oil field will be depleted within the period 2015–2025. The potential injection targets are the interbedded sandstones of the Paleocene-Eocene upper Latrobe Group, regionally sealed by the Lakes Entrance Formation. The research identified several features to the offshore Gippsland Basin that make it particularly favorable for CO₂ storage. These include: a complex stratigraphic architecture that provides baffles which slow vertical migration and increase residual gas trapping and dissolution; non-reactive reservoir units that have high injectivity; a thin, suitably reactive, lower permeability marginal reservoir just below the regional seal providing mineral trapping; several depleted oil fields that provide storage capacity coupled with a transient production-induced flow regime that enhances containment; and long migration pathways beneath a competent regional seal. This study has shown that the Gippsland Basin has sufficient capacity to store very large volumes of CO₂. It may provide a solution to the problem of substantially reducing greenhouse gas emissions from future coal developments in the Latrobe Valley. **C. M. Gibson-Poole, L. Svendsen, J. Underschultz, M. N. Watson, J. Ennis-King, P. J. van Ruth, E. J. Nelson, R. F. Daniel and Y. Cinar**, *Environmental Geology*, Published online August 3, 2007, DOI: 10.1007/s00254-007-0941-1, <http://www.springerlink.com/content/0r4v814j846t5308>. (Subscription required.)

TECHNOLOGY

“Performance of immobilized tertiary amine solid sorbents for the capture of carbon dioxide.”

The capture of carbon dioxide (CO₂) from a simulated flue gas stream was achieved by utilizing immobilized tertiary amine solid sorbents. The tertiary amine immobilized in these solid substrates was 1, 8 Diazabicyclo-[5.4.0]-undec-7-ene (DBU) and it has the stoichiometric capability of capturing carbon dioxide at a 1:1 R-NH₂:CO₂ molar ratio. This is a unique feature compared to other primary and secondary amines which capture CO₂ at a 2:1 molar ratio, thus making the immobilized DBU solid sorbents competitive with existing commercially available sorbents and liquid amine-based capture systems. The immobilized DBU solid sorbents prepared in this study exhibit acceptable CO₂ capture capacities of 3.0 mol CO₂/kg sorbent at 25 [degrees Celsius]; however, at the critical operational temperature of 65 [degrees Celsius], the capacity was reduced to 2.3 mol/kg sorbent. The DBU sorbents did exhibit acceptable stability over the adsorption/desorption temperature range of 25–90 [degrees Celsius] based on XPS [X-ray photoelectron spectroscopy] and TGA [Thermogravimetric analysis] analyses. **M.L. Gray, K.J. Champagne, D. Fauth, J.P. Baltrus and Henry Pennline**, *International Journal of Greenhouse Gas Control*, Available online August 22, 2007, doi:10.1016/S1750-5836(07)00088-6, <http://www.sciencedirect.com/science/article/B83WP-4PGH839-1/2/fcbae8bbe7648c2ef8f54b433dd903ec>. (Subscription may be required.)

“A model for the CO₂ capture potential.”

Global warming is a result of increasing anthropogenic CO₂ emissions, and the consequences will be dramatic climate changes if no action is taken. One of the main global challenges in the years to come is therefore to reduce the CO₂ emissions. Increasing energy efficiency and a transition to renewable energy as the major energy source can reduce CO₂ emissions, but such measures can only lead to significant emission reductions in the long-term. Carbon capture and storage (CCS) is a promising technological option for reducing CO₂ emissions on a shorter time scale. A model to calculate the CO₂ capture potential has been developed, and it is estimated that 25 billion tonnes CO₂ can be captured and stored within the EU by 2050. Globally, 236 billion tonnes CO₂ can be captured and stored



by 2050. The calculations indicate that wide implementation of CCS can reduce CO₂ emissions by 54 [percent] in the EU and 33 [percent] globally in 2050 compared to emission levels today. Such a reduction in emissions is not sufficient to stabilize the climate. Therefore, the strategy to achieve the necessary CO₂ emissions reductions must be a combination of (1) increasing energy efficiency, (2) switching from fossil fuel to renewable energy sources, and (3) wide implementation of CCS. **Aage Stangeland**, *International Journal of Greenhouse Gas Control*, Available online August 9, 2007, doi:10.1016/S1750-5836(07)00087-4, <http://www.sciencedirect.com/science/article/B83WP-4PCR1YB-1/2/d9089a5c4fce446272a34780a6426660#sec8>. (Subscription may be required.)





TERRESTRIAL/OCEAN

“Projected increase in continental runoff due to plant responses to increasing carbon dioxide.”

In addition to influencing climatic conditions directly through radiative forcing, increasing carbon dioxide concentration influences the climate system through its effects on plant physiology. Plant stomata generally open less widely under increased [CO₂] concentration, which reduces transpiration and thus leaves more water at the land surface. This driver of change in the climate system, which [the authors] term ‘physiological forcing’, has been detected in observational records of increasing average continental runoff over the twentieth century. Here [the authors] use an ensemble of experiments with a global climate model that includes a vegetation component to assess the contribution of physiological forcing to future changes in continental runoff, in the context of uncertainties in future precipitation. [The authors] find that the physiological effect of doubled [CO₂] concentrations on plant transpiration increases simulated global mean runoff by 6 percent relative to pre-industrial levels; an increase that is comparable to that simulated in response to radiatively forced climate change (11 ± 6 percent). Assessments of the effect of increasing [CO₂] concentrations on the hydrological cycle that only consider radiative forcing will therefore tend to underestimate future increases in runoff and overestimate decreases. This suggests that freshwater resources may be less limited than previously assumed under scenarios of future global warming, although there is still an increased risk of drought. Moreover, [the authors’] results highlight that the practice of assessing the climate-forcing potential of all greenhouse gases in terms of their radiative forcing potential relative to [CO₂] does not accurately reflect the relative effects of different greenhouse gases on freshwater resources. **Richard A. Betts, Olivier Boucher, Matthew Collins, Peter M. Cox, Peter D. Falloon, Nicola Gedney, Deborah L. Hemming, Chris Huntingford, Chris D. Jones, David M. H. Sexton & Mark J. Webb.** *Nature*, Volume 448, Pages 1037-1041, DOI: 10.1038/nature06045, Published online August 30, 2007, <http://www.nature.com/nature/journal/v448/n7157/abs/nature06045.html>. (Subscription required.)



Chicago Climate Exchange Press Release, “Chicago Climate Futures Exchange to Launch Certified Emission Reduction (CER) Futures Contracts on August 24.”

On August 23, the Chicago Climate Futures Exchange (CCFE) announced that it will begin the CCFE Certified Emission Reduction (CERs) futures contracts on August 24, 2007. CERs, which are considered the global currency in carbon trading, are issued under the United Nations Clean Development Mechanism, an arrangement under the Kyoto Protocol that allows national and corporate GHG reduction goals to be met through the use of CERs. The arrangement allows industrialized countries to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. This CCFE CER futures contracts will be the first time that hedging tools for CERs are offered on a North American exchange. The CCFE is a wholly-owned subsidiary of the Chicago Climate Exchange. To learn more about the CCFE, visit: www.ccfex.com. August 23, 2007, http://www.chicagoclimateexchange.com/news/press/release_20070823_CER.pdf.

Reuters, “U.S., Canadian West Set Joint Carbon-Cutting Target,” and All American Patriots, “Western Climate Initiative Members Set Regional Target to Reduce Greenhouse Gas Emissions.”

On August 22, the six western states and two Canadian provinces that make up the Western Climate Initiative (WCI) announced a regional goal to reduce greenhouse gas (GHG) emissions to 15 percent below 2005 levels by 2020. As part of the agreement, state officials have until August 2008 to design a multi-sector market-based policy to meet emissions targets, which will most likely be a load-based cap-and-trade program. Each participating state and Canadian province will also participate in a multi-state GHG emissions registry. The WCI pact, along with the eastern US equivalent, the Regional Greenhouse Gas Initiative pact, may add pressure on Congress to pass legislation that will regulate GHG emissions at the federal level. The WCI was formed in February 2007 by the governors of Arizona, New Mexico, Oregon, Washington, and California. The state of Utah and the Canadian provinces of British Columbia and Manitoba subsequently joined the group, which is led by California Governor Arnold Schwarzenegger. Other states and provinces are participating as observers to the WCI. Details about the recently announced regional goal can be found at: www.westernclimateinitiative.org. August 22, 2007, <http://www.reuters.com/article/environmentNews/idUSN2244930020070822?sp=true>, and August 23, 2007, http://www.allamericanpatriots.com/48729669_new_mexico_western_climate_initiative_members_set_regional_target_reduce_greenhouse_gas_emi.

TRADING

Carbon Market Update, Sept. 14, 2007	
CCX-CFI 2007 (\$/tCO ₂) \$3.00 (Vintage 2007)	EU ETS-EUA DEC 2008 (\$/tCO ₂) \$28.72
(Converted from € to US\$)	

RECENT PUBLICATIONS

“The Power to Reduce CO₂ Emissions, The Full Portfolio.”

The large-scale CO₂ reductions envisioned to stabilize, and ultimately reverse, global atmospheric CO₂ concentrations present major technical, economic, regulatory and policy challenges. Reconciling these challenges with the continued growth in energy demand highlights the need for a diverse, economy-wide approach. This Discussion Paper provides stakeholders with a framework for developing a research, development, and demonstration (RD&D) Action Plan that will enable sustainable and substantial electricity sector CO₂ emissions reductions over the coming decades. The technology development pathways and specific research activities discussed in this paper provide a basis for a detailed Action Plan to be published later this year incorporating input from participants in the 2007 EPRI [Electric Power Research Institute] Summer Seminar. The analyses summarized in this paper address the technical feasibility for the sector to achieve large-scale CO₂ emissions reductions, the technology development pathways and associated RD&D funding needed to achieve this potential, and the economic impact of realizing emissions reduction targets. Given the 20- to 30-year lead-time needed to fully research, develop, and commercially deploy technologies, it is critical for the industry to define priorities and initiate RD&D activities. The assessment involves three related EPRI studies: [1] The PRISM analysis, which determined the US electricity sector's potential for reducing CO₂ emissions from a purely technical perspective, based on deployment of a portfolio of advanced technologies; [2] A technology development pathways analysis, which identified the sequence of research, development, and demonstration (RD&D) steps needed to achieve the necessary technology performance and deployment levels, and developed preliminary estimates of the RD&D investment required; [3] The MERGE analysis, which assessed the economic value of deploying the full technology portfolio analyzed in the PRISM analysis, and projected the least-cost combination of technologies needed to meet a specified CO₂ emission reduction requirement. To download the complete EPRI discussion paper prepared for the EPRI 2007 Summer Seminar, go to: <http://epri-reports.org/DiscussionPaper2007.pdf>.

“State of the Voluntary Carbon Markets 2007: Picking Up Steam.”

In the course of 2006 and 2007, interest in climate change, carbon offsets and the voluntary carbon markets accelerated dramatically. And yet despite this interest, and the fact that voluntary carbon markets have effectively been operating since 1989, quantitative data surrounding this market has been sorely lacking. Because of this situation, Ecosystem Marketplace and New Carbon Finance teamed up to undertake the most comprehensive analysis to date of the voluntary carbon market. The research has involved a wide ranging survey with responses from over 70 organizations and involved all stages of the supply chain including developers, aggregators, brokers and retailers, covering five continents. The results show that, like the early stages of the regulated carbon markets of the European Union's Emissions Trading Scheme (EU ETS) and the Kyoto Protocol, the voluntary markets are evolving rapidly. They also show that 2006 was a year of significant growth with many new retailers, brokers, and other actors entering the market. Since 2002 the number of organizations supplying carbon credits into the market has grown by 200 [percent], with online retailers being the fastest growing sector of the marketplace. Between 2005 and 2006, the Over the Counter (OTC) voluntary offset market also grew 200 [percent]. In 2006, 23.7 million tonnes of carbon dioxide equivalent (MtCO₂e) were transacted in the voluntary carbon markets. Of this, 10.3 MtCO₂e were transacted on the Chicago Climate Exchange (CCX), and [the authors'] survey revealed that some 13.4MtCO₂e were transacted in the OTC market. Because it is impossible to capture all OTC transactions in a survey such as this, the actual volume traded may be considerably larger than this amount. While these numbers are small relative to volumes of transacted in the regulated carbon markets like the EU ETS, the combined voluntary markets (CCX+OTC) are larger in volume than both the Kyoto Protocol's Joint Implementation mechanism and the New South Wales Greenhouse Gas Abatement Scheme. Just as importantly, the voluntary markets are significant in that they represent an active demand by businesses and individuals for some form of action on climate change in the absence of direct regulation. To read this comprehensive report on the state of the voluntary carbon markets in its entirety, go to: http://ecosystemmarketplace.com/documents/acrobat/StateoftheVoluntaryCarbonMarket18July_Final.pdf.

“Stepping Up: Accelerating the Deployment of Low Emission Technology in Australia.”

Addressing the serious consequences of climate change is arguably the biggest challenge facing current and future generations globally. Effective management of climate change requires an integrated, national response to both mitigation and adaptation challenges. The Australian Business & Climate Group strongly supports the adoption of an integrated National Climate Change Response. It will be essential to integrate the component elements of the response as they are intrinsically interlinked. It is also critical that [Australians] seek solutions on a national basis, rather than state by state. A National Climate Change Response will also benefit by linking with international efforts to maximize learning, share costs and expertise while minimizing unnecessary duplication of effort. Transforming the way Australia produces and uses energy must be a cornerstone of a national response aimed at significantly reducing greenhouse gas emissions. While bipartisan acceptance for the establishment of an emissions trading scheme is now established, Australia must also explore complementary policies to accelerate the uptake of breakthrough low emission technologies. The rate of technology improvement and subsequent adoption must be faster than the usual commercial timeframes if these technologies are to be available at scale,

RECENT PUBLICATIONS - CONTINUED

performance and at an acceptable cost when required to meet challenging emission trajectories. The Australian Business & Climate Group believes that a National Low Emission Technology Strategy is an essential element of a National Climate Change Response. The challenge is complex and the response must be comprehensive. Business is ready to play its part in delivering the solutions and has prepared this paper as a catalyst for discussion between all stakeholders. To read the complete report, which includes consideration of carbon capture and storage, go to: http://www.businessandclimate.com/downloads/ABCG_Report_2007.pdf.

LEGISLATIVE ACTIVITY

E&E Daily, “International Carbon Traders Pick Apart Lieberman-Warner Proposal.”

Participants in the European carbon market are voicing their concern over Senators Joe Lieberman (I-Conn.) and John Warner’s (R-Va.) draft climate bill, and specifically their approach on how to manage a US cap-and-trade program. In a letter to the senators, International Emissions Trading Association (IETA) president and CEO, Andrei Marcu, praised them for taking a market-based approach to climate change with the establishment of a cap-and-trade based system, but offered detailed suggestions on certain issues of concern contained within it. The Lieberman-Warner bill proposes the formation of a Carbon Market Efficiency Board, whose responsibility it would be to monitor the pricing of the carbon market. The IETA, however, discouraged this type of intervention. Other areas of concern to the IETA include the provision in the senators’ proposal to set up a 15 percent limit on the use of carbon sequestration, forestry, methane capture, and other projects. An initial auction of up to 42 percent of the allowances in the cap-and-trade program was also opposed by Marcu and other IETA members.



The Lieberman-Warner plan is expected to be formally introduced in the Senate by the end of September. To read the IETA’s letter to the senators, go to: http://www.eenews.net/features/documents/2007/09/10/document_pm_05.pdf. September 11, 2007, <http://www.eenews.net/EEDaily/print/2007/09/11/1>.

E&E Daily, “Global Warming Panel Takes on CO₂-Capture for Coal.”



On September 6, the House Select Committee on Global Warming will hear testimony from industry and government representatives on ways to reduce CO₂ emissions in the US, including the option of carbon capture and storage. With emissions expected to increase at an average rate of 1.2 percent per year through 2030, the prospect of adopting legislation aimed at reducing the country’s carbon footprint is being considered. NETL Director Carl Bauer provided testimony at the hearing, along with American Electric Power CEO, Michael Morris and Natural Resources Defense Council Climate Center Director, David Hawkins. The hearing follows a study released by Latham and Watkins partner Bob Sussman, which recommends mandatory carbon capture and storage for new coal-fired power plants by 2016. To read Carl Bauer’s testimony “Future of Coal: Carbon Capture and Storage,” go to: http://www.netl.doe.gov/newsroom/testimony/September%206_NETL_Bauer.pdf. September 4, 2007, <http://www.eenews.net/EEDaily/print/2007/09/04/9>.



EVENTS

October 2-5, 2007, **Greenhouse 2007**, *The Hilton, Sydney, Australia*. The conference will focus on projections for the future, the use of probabilities for risk management, the impact climate change will have on human activity, and changing perceptions of climate change. There will be many examples of industry and government approaches to tackling climate change, as well as presentations on the latest Australian and international science findings. This high-profile, prestigious international event is designed for representatives from industry, research organizations, government and the community. Links to the conference program, registration and accommodation information, and other useful links can be found at: <http://www.greenhouse2007.com/>.

October 3, 2007, **CO₂GeoNet – Training and Dialogue Workshop on CO₂ Geological Storage**, *Paris, France*. This workshop aims to provide participants with pertinent information and to encourage dialogue on essential questions concerning the technical aspects of CO₂ geological storage. For more information and to download a conference brochure, see the link on CO₂GeoNet website at: <http://www.co2geonet.com/NewsData.aspx?IdNews=21>.

October 4-5, 2007, **2nd International Symposium on Capture and Geological Storage of CO₂**, *Hôtel Le Méridien Étoile, Paris, France*. In order to reconcile the use of fossil fuels with the need to control the emissions responsible for global warming, CO₂ capture and storage represents a highly promising avenue, with much at stake, in both economic and industrial terms. This event follows the success of the first international symposium on emission reduction and CO₂ capture and geological storage held in Paris in 2005. In particular, the event will be an opportunity to present feedback from a number of pilot projects being conducted around the world. To view complete conference information, click on: http://www.co2symposium.com/IFP/en/CO2site/colloque_va.htm.

October 16-17, 2007, **The 4th Trondheim Conference on CO₂ Capture, Transport and Storage**, *Nova Conference Center, Trondheim, Norway*. This international event focuses on research and development regarding CO₂ capture, transport and storage. The conference series has grown to become the key scientific CO₂ technologies conference in Norway, with all the major R&D institutions, oil and gas industry, Gassnova and the Research Council of Norway involved. To access the event website, go to: http://www.energy.sintef.no/arr/CO2_2007/index.asp.

October 16-17, 2007, **Investors' Summit on Climate Change Investment Opportunities**, *New York Helmsley Hotel, New York City*. This conference is designed to help investors explore new investment opportunities and risk strategies related to climate-related business trends, and identify and evaluate the impact of climate risk on their portfolios. For additional information, see: <http://www.frallc.com/conference.aspx?ccode=B507>.

October 16-19, 2007, **Clean Coal Asia 2007**, *Meritus Mandarin, Singapore*. This event is part of Clean Energy Asia 2007, which brings together 6 conferences focusing on different aspects of Asia's growing clean energy market. Clean Coal Asia will explore the key clean coal solutions including gasification, sequestration, coal preparation and emission controls. The conference will feature case studies on the world's most effective clean coal projects, including both pilot projects and retrofits to bring aging plants up to new emission control standards. To find out more about this event, go to: <http://www.terrapinn.com/2007/coal/>.

October 18, 2007, **CO₂ Introductory Training Course**, *Geneva, Switzerland*. This one-day course will provide attendees with an introduction into all aspects of the global carbon markets. The training is designed for traders, analysts and risk managers who need a thorough understanding of how carbon markets work. The course will provide insight into policy, legislation and regulation, as related to the carbon markets. For more information and a link to the course registration form, click on: <http://www.pointcarbon.com/Events/Training%20courses/CO2%20Geneva/category1437.html>.



EVENTS (CONTINUED)

November 11-15, 2007, **20th World Energy Congress and Exhibition**, *Nuova Fiera, Rome, Italy*. With member committees in over 90 countries, the World Energy Congress aims to monitor the status of the energy sector and to find solutions to promote the economic development of the most industrialized and developing countries and, at the same time, a sustainable supply and use of energy for the greatest benefit to all people. The Congress is held every three years and is considered the most important energy forum. For complete information, see: <http://www.rome2007.it/Congress/Congress.asp>.

November 14-16, 2007, **Carbon Reduction Project Development and Finance**, *Omni Houston Westside Hotel, Houston, Texas*. This event brings together experienced carbon market players, developers, and financiers from throughout the world to share their insights into developing, certifying, and financing profitable GHG emission reduction projects. Participants will explore how to take advantage of carbon revenue flows in geologic capture and other carbon reduction projects in overseas and US markets. To learn more about this event, go to: <http://www.infocastinc.com/carbonred/conference.html>.

December 3-5, 2007, **Carbon Capture Status and Outlook**, *Almas Temple Club, Washington DC*. This conference will provide attendees with a global update on key technical, economic, financial, and policy developments in implementing carbon capture for power plants and other major industrial applications. To download the conference agenda and obtain registration information, go to: <http://www.infocastinc.com/capture.html>.

December 10-14, 2007, **AGU Fall Meeting**, *Moscone Center, San Francisco, California*. The AGU Fall Meeting provides an opportunity for researchers, teachers, students, and consultants to present and review the latest issues affecting the Earth, the planets, and their environments in space. This meeting will cover topics in all areas of Earth and space sciences. A session entitled “Carbon Sequestration: Reservoirs, Techniques, Policy” will cover novel and current work in geologic, terrestrial, and oceanic carbon sequestration, as well as Monitoring, Mitigation and Verification (MMV) development as it relates to sequestration. For complete information, visit: <http://www.agu.org/meetings/fm07/>.

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

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