THE CARBON SEQUESTRATION NEWSLETTER

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July 2002

Sequestration in the News

Los Alamos High-Temperature Polymer Captures CO_2 from Industrial Processes. A high-temperature composite membrane, combined with a porous metallic support, separates and captures CO_2 from industrial processes. The membrane has high selectivity; a demonstrated operating temperature of 370 degrees Celsius; is chemically resistant; and is easily processed. Collaborators with LANL, through the DOE Carbon Sequestration Program, include Pall Corporation, the University of Colorado, Idaho National Engineering and Environmental Laboratory and Shell Oil Co. Los Alamos National Laboratory, "Hot polymer catches carbon dioxide better," May 29, 2002.

Toshiba develops CO_2 adsorbent. A powdered ceramic, developed by researchers at Toshiba Corp., absorbs CO_2 at room temperature and releases it when heated. The lithium silicate material absorbs 400 to 500 times its volume in CO_2 at temperatures up to about 700 degrees C. When heated above 700 degrees, the reaction is reversed. According to the article, the researchers expect to develop a system for capturing CO_2 generated in industrial processes within 1 to 2 years. In the future, it says, larger systems could capture CO_2 from smokestacks, and cartridges could capture CO_2 from car tailpipes and be exchanged at gas stations. *Global Design News*, "Ceramic captures CO_2," June 1, 2002. Contact Kazuaki Nakagawa, who leads the Toshiba research at kazuaki.nakagawa@toshiba.co.jp.

Canadian clean coal feasibility study. The Government of Saskatchewan is contributing $333,000 of $5 million to the Canadian Clean Power Coalition (CCPC), for the feasibility study phase of a clean coal project. A full-scale demonstration plant with near zero emissions (including CO_2) will be completed by 2007. The CCPC's seven participating companies represent 90 percent of Canada's coal-fired electricity capacity. CCPC founding member SaskPower actively supports carbon capture and zero emissions research organizations. For more information, contact the Canadian Clean Power Coalition, Peter Symons, psymons@telusplanet.net. *Canadian Corporate Newswire*, "Saskatchewan Joins National Clean Coal Effort," June 5, 2002.

China – Canada CBM cooperation. The Chinese Government will use Canadian enhanced coal bed methane recovery technology to tap the country's 33,000 billion cubic meters of CBM resources. CO_2 from nearby energy production and industries will be injected 2,000 meters underground into the coal beds. The project's budget includes Canada's contribution of $ 3.1 million and China's contribution of $ 3 million. In the next three years, the project will perform pilot tests. According to the article, China emits 6 billion cubic meters of methane from mines a year. *China Daily,* "Coal project gets Canadian aid," March 29, 2002.

Enhanced coal seam methane. Rival Resources Inc. and Golder Associates Inc. of Washington State applied for a $500,000 grant from the US Department of Energy to develop sequestration technology on Rival leases in the Bellingham basin. The $700,000 program will develop and demonstrate technologies to permanently store large volumes of CO_2 while simultaneously displacing coal seam methane for power generation. A pilot well would be used for CO_2 injection and methane recovery. *Oil & Gas Journal*, "Area drilling," June 10, 2002.

This newsletter is produced by the National Energy Technology Laboratory and presents summaries of significant events related to carbon sequestration that have taken place over the past month.

Capturing CO_2 from nylon processing. Airgas will build a $10 million liquid CO_2 and dry ice manufacturing plant at Honeywell's caprolactam plant in Virginia, purchasing the gaseous CO_2 as a feedstock source from Honeywell. Airgas operates 16 dry ice plants nationwide. The poultry industry, which is heavily concentrated in North Carolina, Maryland, and Delaware, will be the plant's largest customer. *Chemical Week,* "Airgas to Build CO_2, Dry Ice Unit at Honeywell Site," May 29, 2002.

Sequestration spotlight. A Boston Globe article covered carbon sequestration issues on ocean, terrestrial, geologic, novel systems, and capture technologies. Robert Kane of DOE is quoted emphasizing the supportive role of sequestration activities within a climate change policy . The article divided proposed technologies for capturing and storing carbon into two subcategories - technologies that work right at the smokestack, and technologies that attempt to draw down CO_2 already dispersed throughout the atmosphere. *Boston Globe*, "Cooling the Earth," June 11, 2002.

Direct ocean sequestration to move from Hawaii to Norway. The Pacific International Center for High Technology Research in Honolulu is withdrawing its permit application to conduct a $5 million carbon sequestration experiment off the coast of Hawaii and plans to move the project off the coast of Norway. The timing to obtain a permit for Hawaii was becoming excessive, leading to project delays and budget constraints. The researchers are in the process of applying for permitting in Norway. The project is supported by a consortium of Government organizations from Japan, Canada, the U.S. and Norway. *Nature*, "Ocean carbon study to quit Hawaii," June 27, 2002.

Climate – ozone depletion connection. Industrial products like chlorofluorocarbons are primarily responsible for current ozone depletion, but a NASA study finds that by the 2030s climate change may surpass CFCs as the main driver of overall ozone loss. NASA, "Climate change may become major player in ozone loss," June 4, 2002.

CO_2 and ozone pollution alter northern forest ecology. An international group of researchers working in Wisconsin found that high levels of CO_2 increases the growth of young aspen and birch, high levels of ozone decreases their growth, and the combined effects on growth cancel each other out when both are elevated. Long-term exposure to varying concentrations of the gases may change forest diversity. *Environmental News Service*, "Air pollution affects tree growth," June 13, 2002.

70th Annual U.S. Conference of Mayors. More than 125 local governments have committed to assessing GHG emissions. Among the resolutions adopted by the mayors was a request for state and federal government to provide new resources to local governments to implement GHG reduction measures and foster innovative technologies. Madison WI, June 14-18, 2002.

European Union stabilizes CO_2 emissions. The total CO_2 emissions in 2000 from the 15 member countries were 0.5 percent lower than the total of ten years earlier, according to the latest emissions inventory from the European Environment Agency (EEA). Under the terms of the Protocol, the EU is to cut the combined emissions of the six gases to 8 percent below their 1990 level by 2008-2012. Taking all six gases, the EU greenhouse gas inventory is 3.5 percent below the level in 1990, slightly less than half the reduction required by the Kyoto Protocol in roughly half the time before the first compliance period starts. *Modern Power System,* "Europe stabilizes CO_2 emissions," May 31, 2002.

Climate Policy articles. Several articles in the *Climate Policy* Journal are of interest. An article entitled "Precautionary climate policy and the somewhat flawed protocol: linking sinks to biofuel and the CDM to the convention," reviews and responds to flaws in the Kyoto Protocol. According to the article, carbon capture and sequestration, along with bioenergy, enable a possibly negative carbon emissions system, avoiding premature obsolescence of existing infrastructure. Other relevant articles from this issue: *Magnitude, distribution and causes of terrestrial carbon sinks and some implications for policy; Absolute or relative baselines for JI/CDM projects in the energy sector? Baseline, leakage and measurement issues: how do forestry and energy projects compare? Benchmark-based emission allocation in a cap-and-trade system;* and a book review of *Economics of climate change: the contribution of forestry projects. Climate policy,* May 2002.

Modeling the link between science and policy. The "tolerable windows" approach is an analytical concept developed by researchers at the International Institute for Applied Systems Analysis (IIASA) and others. The ICLIPS (Integrated Assessment of Climate Protection Strategies) model generates a range of suitable climate protection strategies, determining what emission reductions are necessary under different scenarios to avoid unacceptable climate change impacts on ecosystems. *Environment*, "Exploring options for global climate policy: a new analytical framework," May 2002.

Sequestration in the News, Cont'd

German and UK political response to climate change. In April 1999 Germany introduced an environmental tax and the UK announced a tax on energy consumption, beginning in April 2001. This paper investigates both proposals, including similarities and differences between the consultation experiences and resulting policies. *European environment,* "Greenhouse gas emission policies in the UK and Germany: influences and responses" May 2002.

Netherlands to stabilize GHG emissions by 2010. The RIVM Office for Environmental Assessment and the Energy Research Centre of the Netherlands (ECN) have released a report projecting emissions of greenhouse gases in the Netherlands to stabilize at 225 Million metric tons CO_2 equivalent by 2010. The report assesses societal developments and the effects of policy measures implemented as well as policies still in preparation. RIVM, June 2002.

CO_2 Trading picks up. Carbon emissions allowances prices rose to US $10.48 per metric ton in the UK trading market. *Reuters*, "UK carbon prices rise as trade picks up," June 21, 2002.

Emissions trading: constraints and market mechanisms. A paper exploring the distributional consequences of alternative emissions trading schemes simulated their introduction in the Kyoto protocol. The simulation shows that the imposition of emission constraints by country may not significantly change social welfare from the introduction of a market mechanism, and that various market regimes have quite different distributional implications. *Environmental Modeling and Assessment*, "Carbon emissions trading and equity in international agreements," May 2002.

Prototype Carbon Fund's reach grows. The Netherlands Ministry of Economic Affairs plus nine companies, including seven from Japan, Statoil from Norway, and Fortum from Finland jointly contributed US $35 million to the World Bank's Prototype Carbon Fund. This brings the total fund capital to $180 million, almost twice the amount originally projected. World Bank Group, "Prototype carbon fund completes announced increase in capital," June 21, 2002.

Events and Announcements

- **GHG Protocol invites comments for revision.** The World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) are revising and improving the first edition of the GHG Protocol - Corporate Standard, released in October 2001. Comments from all parties on all aspects of the current corporate accounting and reporting standard, including its overall architecture, flow, content, and usability are encouraged. WBCSD/WRI, June 2002.

- **USDA Symposium.** The USDA Symposium on Natural Resource Management to Offset Greenhouse Gas Emissions will be held November 19-21, 2002 in Raleigh, NC. Researchers will present management options for increased carbon storage, innovative technologies and methodologies for monitoring and measuring terrestrial carbon stocks, and economic projections. A panel will discuss policy implications of scientific carbon research findings. Abstracts are due by July 1.

- **The Geological Society of America 2002 Annual Meeting.** A special topic session entitled "Experimental, Field, and Modeling Studies of Geological Carbon Sequestration," will be held at The Geological Society of America 2002 Annual Meeting & Exposition October 27–30, Denver, Colorado. The session intends to bring Earth scientists together from the experimental, field, and modeling perspectives. The deadline for abstract submission is July 16, 2002. For more information, contact Curt White, curt.white@netl.doe.gov.

If you'd like to join the e-mail distribution list, please send a message to majordomo@list-manager.netl.doe.gov with "subscribe sequestration" in the body of the message. We encourage you to pass this along to those whom you believe will be interested.

If you would like to know more about DOE's Carbon Sequestration R&D Program, please contact Scott Klara at NETL, klara@netl.doe.gov, or visit the website at www.netl.doe.gov/coalpower/sequestration/.

Recent Publications

Direct Ocean Sequestration Workshop. The final workshop report gives tactical details on research priorities and timelines for evaluating an effective national capability. Experimental techniques permitting small-scale field observations, evolved only in the last 5 years, address whether it is advisable, feasible, or effective to inject CO_2 directly into the deep ocean and thereby limit the atmospheric disposal/surface ocean uptake. NETL Carbon Sequestration Program, *Direct Ocean Sequestration Experts' Workshop*, June 19, 2002.

NETL accomplishments in FY 2001. A report on NETL accomplishments of last year enumerates carbon sequestration science activities. Accomplishments in this program area include national and regional workshops on carbon sequestration technology, the development of a high-pressure water tunnel for studying deep ocean environments, experimental and theoretical estimates of parameters needed to stabilize drops of CO_2 in sea water, better understanding of monoethanolamine degradation pathways, insights and physics-based models of carbon sequestration flows in porous rock, and basic laboratory information on interactions of CO_2 with coals. NETL also funded three multi-national projects to study CO_2 capture and storage, terrestrial sequestration, and storage of CO_2 in oil reservoirs. *NETL Accomplishments FY 2001*, June 25, 2002.

CSIRO revised GEO SEQ simulation. The revised CSIRO/TNO's SIMED II numerical simulation submitted for the GEO-SEQ CBM simulator comparison study included in the presentation entitled "GEO-SEQ Project, Numerical Model Comparison Study for Greenhouse Gas Sequestration in Coalbeds" by David Law of the Alberta Research Council, is now posted on the website.

U.S. climate change response. The Pew Center on Global Climate Change released a publication summarizing climate change efforts in the U.S. in the past year. Particular focus is placed on efforts in Congress, where twice as many climate change proposals were introduced in the past year as in the previous four years combined; at the state level and in the business community, where a growing number of corporations are setting GHG targets. Pew Center on Global Climate Change*, Climate Change Activities in the United States*, June 11, 2002.

Clean Development Mechanism (CDM) booklet. The International Institute for Environment and Development (IIED), the Edinburgh Centre for Carbon Management (ECCM), and EcoSecurities have published a booklet of information on the CDM and how it affects forestry and land use audience activities, principally in developing countries. *Laying the Foundation for Clean Development: Preparing the Land Use Sector*, June 2002.

Guide for CDM in Canada. The Pembina Institute has released a guide providing Canadian companies with information to develop environmentally sound CDM projects. The guide will help steer them through the approval process. Basic rules governing the CDM, CDM project types, and sustainable development criteria and environmental integrity guidelines are included. Pembina Institute, "A User's Guide to the Clean Development Mechanism," June 2002.

GHG inventory data tables. All of the data tables from EPA's 2002 U.S. Inventory have been posted on the EPA website so that users can view and analyze the entire time series of data developed for the report (1990 to 2000). EPA, June 2002.

3rd Climate Action Report to the UNFCCC. On 28 May 2002, the U.S. Government submitted the *Third Climate Action Report* to the United Nations in fulfillment of its commitment under the Framework Convention on Climate Change (UNFCCC). EPA, "Climate Action Report 2002," June 2002.

Voluntary Reporting of Greenhouse Gases newsletter. The eighth reporting cycle of the Department of Energy's registry system received 52 percent more reports from the industrial sector over last year, rising from 41 for the 1999 data year to 64 for 2000. Twenty-three of these reports were submitted by North Carolina companies participating in EPA's Climate Wise Program. Fifteen of the 23 companies already reported over 223,000 metric tons of CO_2 emission reductions. Collectively, these 15 companies reduced their emissions by 9 percent. EIA, April 2002.

State and local climate action. The 2001 progress report of EPA's State and Local Climate Change Program, "Partnerships and Progress," highlights the accomplishments of states and communities across the country that have taken action to assess and reduce GHG emissions. The 28-page report talks about state GHG inventories and action plans, legislative items, state and local demonstration projects, and education and outreach campaigns. EPA, June 26, 2002, (Click on Partnerships and Progress in the "Guidance Documents" section).

Legislative Activity

- **Comprehensive energy policy update.** Billy Tauzin (R-LA), chairman of the House Committee on Energy and Commerce, will chair the conference negotiations of HR 4. The Senate selected 12 conferees and the House selected 44. Conference negotiations are expected to begin on Thursday, June 27 with introductory remarks by House and Senate leadership. Last week, Senate Majority Leader Tom Daschle (D-SD) suggested that Corporate Average Fuel Economy Standards and drilling in the Arctic National Wildlife Refuge would not be considered by conferees.

- **Senate 4P bill hearing**. On June 12th, 2002, the Environment and Public Works Committee held a hearing on S556, with eight witnesses from government, industry and NGOs. Four witnesses supported S556, and four called it "unworkable," primarily because of CO_2 restrictions. Jeffords added an allocation scheme to S556. A markup of s556 is scheduled for Thursday, June 27th. Senate Majority Leader Tom Daschle (D-S.D.) said he supports the Jeffords bill and would see that it is considered this year on the Senate floor.

- **Senate 4P bill passed by Committee**. On June 27th, S556 narrowly passed the Environment Committee by a vote of 10 to 9. Eight Democrats and Republican Lincoln Chafee (R.I.) supported the bill. Senator Max Baucus (Mont.), who represents a major coal-producing and coal-consuming state, was the only Democrat to oppose the bill. *Washington Post*, "Senate Panel Backs Bill to Curb Power Plant Pollution," June 28, 2002.

- **Clear skies numbers discussion draft: 3P.** A 3 pollutant bill that incorporates the targets set forth by President Bush in the Clear Skies Initiative has been drafted for discussion. The 91-page GOP draft calls for a 2017 deadline to cut SO_2 emissions to 4.5 million tons, NO_X emissions to 2.1 million tons and mercury emissions to 26 tons. For comparison, S. 556 sets a 2008 deadline to cut SO_2 emissions to 1.98 million tons in the eastern U.S. and 275,000 tons in the western U.S., and NO_X emissions to 1.51 million-tons. The S556 caps for CO_2 and mercury would fall at 2.05 billion tons and 5 tons, respectively. The discussion draft also stands apart from S556 by tying the new NO_X and SO_2 trading programs into the existing CAA; allowing for states to call for tighter emission limits, and harmonizing the trading program with state permits. *Greenwire*, "GOP floats Clear Skies numbers," June 25 2002.

- **New Hampshire's multi-pollutant legislation.** In April New Hampshire became the first state to regulate four pollutants from the state's 3 power plants. The new rules have strong support from Republican leadership in both houses of the Legislature, the business community, and the state's major utility. By 2007, Public Service Company of New Hampshire (PSNH) must reduce NO_X and SO_X emissions by roughly 70 percent below federal requirements, and CO_2 emissions by three percent levels by 2010. The bill provides for an additional seven percent cut below 1990 levels. If PSNH cannot meet the standards with actual emissions reductions, it can buy pollution credits from utilities in other states that have already reduced emissions. *Environmental News Service*, "New Hampshire Passes Nation's First CO_2 Cap," April 22, 2002.

- **North Carolina multi-pollutant legislation.** North Carolina is the first southern state to pass multi-pollutant legislation restricting emissions from the state's 14 coal fired power plants. The law mandates NO_X and SO_X emissions reductions and requires the North Carolina Division of Air Quality to conduct a study of mercury and CO_2 emissions. The state joins CT, IL, MA and NH in requiring deeper than Federal emissions cuts. National Caucus of Environmental Legislators, "North Carolina House Passes Bill to Clean Up Old Power Plants," June 13, 2002.

- **Global warming hearing postponed**. The Senate Commerce Committee will postpone a hearing on global warming and the EPA Climate Action Report until July. *Reuters*, "US Senate climate warming hearing delayed until July" June 20, 2002.

- **California GHG bill vote still postponed.** The California Assembly is still stalling on vote on a bill that would regulate GHG emissions from cars and trucks. The State Senate approved the bill in April, directing the California Air Resources Board to reduce GHGs by the 2009 model year. The bill has met with opposition from the auto industry (except Honda), which is concerned that it could be used as a template by other states. *The New York Times*, **"**Curb on Gas Emissions Is Stalled in California" June 12, 2002.