



# THE CARBON SEQUESTRATION NEWSLETTER

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September 2002

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## Sequestration in the News

**DOE R&D Solicitation.** 50 to 75 winning cost-shared projects will be selected from three rounds of competition and run 1 to 3 years, covering a total of 13 areas of interest. \$23.8 million will be made available through the Office of Fossil Energy and National Energy Technology Laboratory, with \$1.5 million for Carbon Sequestration. Carbon sequestration topics include: "direct capture" technologies, "indirect capture" technologies for reforestation and enhanced carbon uptake in soils of previously disturbed lands, technologies for mitigating non-CO<sub>2</sub> greenhouse gas emissions, and novel systems/ approaches for monitoring, verification and risk assessment. "[Development of Technologies & Capabilities for Developing Coal, Oil and Gas Energy Resources](#)," IIPS, August 21, 2002. For more information, contact: William F. Haslebacher, NETL, [william.haslebacher@netl.doe.gov](mailto:william.haslebacher@netl.doe.gov).

**Second Phase of Sleipner CO<sub>2</sub> Storage Project.** Building on the success of a Statoil-led project in the Sleipner field in the North Sea, the second phase of the European Union project will study and simulate onshore CO<sub>2</sub> geologic storage possibilities in Denmark, Germany, South Wales in the UK, and an area on the mid-Norwegian coast. Partners are: Statoil, BP, ExxonMobil, Norsk Hydro, TotalFinaElf and Sweden's Vattenfall, as well as scientific bodies in Denmark, France, the Netherlands, Norway and the UK. "[Studying Carbon Storage on Land](#)," Statoil, August 16, 2002.

**Statoil Receives Technology Prize.** The World Petroleum Congress awarded an annual technology prize to Statoil for its CO<sub>2</sub> gas re-injection and monitoring program in the Sleipner West field 3,300 ft below the seabed. Roughly 1 million metric tons of CO<sub>2</sub> emissions per year have been avoided since the project began in 1996. "[Statoil Wins WPC 2002 Technology Prize](#)," *Oil and Gas International*, August 8, 2002.

**Utilities Challenged to Meet President's Goal.** An analysis conducted by six utilities finds that half of the fossil-fired generation fleet would have to cap their CO<sub>2</sub> emissions at roughly 2000 levels by 2012 to meet the President's carbon intensity goal. Although the analysis is not publicly available, an article in the *White House Weekly* summarizes results. The study finds that the President's goal is more rigorous than previously thought. An 18 percent reduction from the power sector would require all fossil-fired generators to cut GHG intensity from the current 1.94 pounds of CO<sub>2</sub> per kilowatt-hour to 1.59 lbs. per kWh. The analysis recommends that U.S. companies be allowed to use credits for projects that reduce, avoid or sequester GHG emissions. "[Coal Utilities Find Cold Comfort in Bush Climate Goals](#)," *White House Weekly*, August 20, 2002.

**Clean Coal Editorial.** An article in *Mechanical Engineering* surveys the state of clean coal technology in the U.S. The article discusses gasification and fluidized bed technologies, costs of repowering systems, and commercial utilization of available technology, and calls attention to The National Energy Technology Laboratory's R&D in the area. "[Old King Coal](#)," *Mechanical Engineering*, August 2002.

**Zero Emissions Coal.** Scientists at Los Alamos National Laboratory say they have reconfigured well-known chemical reactions and energy technologies in a way that could soon produce the world's first coal-fueled energy plant that would be completely free of emissions. The proposed system is centered on a hydrogasification process that would combine coal with hydrogen to form a synthetic gas that would then pass through a bed of hot lime (CaO) with steam, producing more hydrogen and a pure stream of CO<sub>2</sub>. "Researchers begin developing emission-free coal plant," *Civil Engineering*, July 2002.

**Hybrid CO<sub>2</sub> Natural Gas Separation Technologies.** Removal of CO<sub>2</sub> can be accomplished via absorption using amines or hot potassium carbonate, or by adsorption using membranes. Classic separation technologies, such as distillation, extraction, catalytic reaction and membrane filtration can often be combined in a single unit operation to create a hybrid separation scheme. An article in *Chemical Engineering* concludes that hybrid separation schemes, consisting of membranes and downstream solvent processes, provide higher selectivity and flexibility. "Hybrid Separation Schemes for CO<sub>2</sub> Removal: Conditioning Natural Gas," *Chemical Engineering*, August 2002.

**Uncertainty in Sinks and Modeling Projections.** An article by Sarmiento and Gruber provides a summary of the carbon cycle, carbon sequestration, and climate modeling projections. Assumptions regarding the response of natural sinks (e.g. oceans and forests) to increasing atmospheric CO<sub>2</sub> concentration affects modeling results markedly. "Sinks for Anthropogenic Carbon," *Physics Today*, August 2002.

**Norway Rejects Ocean Direct-Injection Research.** The Norwegian government denied permission for an international research experiment to inject 5.4 tons of liquid CO<sub>2</sub> into the deep ocean. "Norway Scraps Experiment to Dump CO<sub>2</sub> at Sea," *Reuters*, August 23, 2002.

**Depth of Direct Ocean Sequestration Critical.** Results from a modeling simulation study at Lawrence Livermore National Laboratory suggest that the depth of the CO<sub>2</sub> injection into the ocean, rather than radiocarbon dating, is a good predictor of how effective that location is at long-term carbon sequestration. "Ocean Depths Critical to Sequestering CO<sub>2</sub>," *Space Daily*, August 25, 2002.

**Private Interest in Indirect Ocean Sequestration.** Three areas in the world's oceans -- the North Pacific off the coast of Canada, the equatorial Pacific around the Galapagos Islands, and the area around Antarctica -- contain relatively little phytoplankton, possibly due to low iron content. Private companies are now starting to think of ways to make money off iron-fertilized plankton blooms. For example, the California-based Planktos Foundation is selling "green tags" for \$4 each, representing the removal of one metric ton of CO<sub>2</sub> from the atmosphere. "Entrepreneurs see profit in pollution-fighting plankton," *The Ottawa Citizen*, August 5, 2002.

**Compilation of Global Terrestrial Sequestration Projects.** WRI has compiled a list of forest and land-use change carbon sequestration projects. There are 21 projects in 14 countries, representing over 130 million tons of carbon. Total cost is roughly 40 million dollars. WRI, August 22, 2002.

**Bioenergy Technology and Carbon Storage.** The hydrogen research team from Clark Atlanta University, Georgia Institute of Technology, DOE National Renewable Energy Laboratory, Scientific Carbons, Inc. and Envirotech, Inc., produced hydrogen from biomass while sequestering 25% of the material by weight. The resulting carbon is highly adsorbent and can be combined with co-products of the process to form a slow-release nitrogen fertilizer. "High Volume Carbon Sequestration and a Nitrogen Fertilizer Offer a Sustainable Future," *PR Newswire*, August 27, 2002.

**No-till Soil Solution.** The total carbon content of the country's soil has been reduced by about 50 % since the advent of plowing, but practices by U.S. farmers could restore the original level of carbon within 40 years, potentially reducing the expected increase in CO<sub>2</sub> emissions by 20 % per year, according to CASMGS (Consortium for Agricultural Soils Mitigation of Greenhouse Gases). "On Farms, a No-Till Tactic on Global Warming," *The Washington Post*, August 26, 2002.

**Carbon Sequestration Through Riparian Restoration.** The Deschutes Resources Conservancy (DRC) and The Climate Trust have signed an innovative CO<sub>2</sub> Offset Purchase Agreement, under which the Climate Trust will provide the DRC with \$780,000 in CO<sub>2</sub> offset funds to help landowners in the Deschutes Basin restore riparian areas. "The Climate Trust Awards Contract to the Deschutes Resources Conservancy," Climate Trust, August 15, 2002.

**Brazil's Agro-Forestry Carbon.** A pilot forestry project, which could earn Brazil tradeable pollution credits under the Kyoto Protocol, is one of the main innovations in the country's 2002/03 agriculture and livestock investment plan. "Brazil May Earn Pollution Credits from Forestry," *Reuters*, August 6, 2002.

**Entergy Donates Land to U.S. Government.** Entergy Corp. is donating 600 acres of land along Louisiana's Red River to the U.S. Department of the Interior as a voluntary GHG emissions offset. The new federal wildlife refuge will store an estimated 275,000 tons of CO<sub>2</sub> over 70 years. The public-private partnership was facilitated by the Conservation Fund, which arranged the \$500,000 land purchase from farmers. "U.S. Utility Donates Land for Refuge --- Entergy Corp. Will Receive Credit if Government Later Regulates CO<sub>2</sub> Emissions," *The Wall Street Journal Europe*, August 27, 2002.

**Chicago Climate Exchange.** Early next year a voluntary carbon trading forum, CCX, will be launched, becoming the first U.S. marketplace for GHG emissions. Major U.S. companies, five Mexican and Canadian firms, along with Chicago and Mexico City, will agree to reduce their overall GHG emissions by 2% below 1999 levels, plus an additional 1% cut per year. Firms will be monitored for compliance. The exchange is modeled after the CAA Acid Rain Program. "His market is a gas," *Time*, August 26, 2002.

## Sequestration in the News, Cont'd

**U.S. and Korea Cooperate on Climate.** A joint statement released by the United States and the Republic of Korea expressed agreement to enhance bilateral cooperation on global climate change policy issues, science and technology, and institution building. The Republic of Korea reiterated its commitment to the Kyoto Protocol and suggested areas where bilateral collaboration may be strengthened, such as: R&D in clean, efficient and renewable sources of energy, carbon sequestration, and landfill methane utilization. "[U.S.-Republic of Korea joint statement on enhanced bilateral climate change cooperation](#)," U.S. Department of State, August 27, 2002.

## Events and Announcements

**The Nineteenth Annual International Pittsburgh Coal Conference** will be held in Pittsburgh, PA, from September 23-27, 2002. [Topics](#) will include gasification and greenhouse gas control and CO<sub>2</sub> sequestration.

**GHGT-6.** The sixth international conference on Greenhouse Gas Control Technologies will be held October 1-4, in Kyoto, Japan at the Kyoto International Conference Hall. The conference will provide a forum for discussing the latest in GHG Control Technologies, including capture, storage and utilization of CO<sub>2</sub>. The conference is organized by Research Institute of Innovative Technology for the Earth (RITE), the IEA Greenhouse Gas R&D Programme, and the Japan Society of Energy and Resources (JSER). NETL will be presenting two papers on the Carbon Sequestration Program. For more information or to register, visit <http://www.ieagreen.org.uk/ghgt6.htm>.

**IBC's Carbon Sequestration Conference.** [The Carbon Reducing Technology and Management Conference](#) will be held October 24th and 25th in Houston, Texas. The conference will address regulatory and policy issues, commercialization, profitability, public acceptance, and industrial perspectives related to carbon sequestration. Scott Klara, NETL's Sequestration Product manager, will be among the featured speakers.

**The Geological Society of America 2002 Annual Meeting.** A special topic session on geological carbon sequestration will be included at [The Geological Society of America 2002 Annual Meeting & Exposition](#) October 27-30, Denver, Colorado. For more information, contact Curt White, [curt.white@netl.doe.gov](mailto:curt.white@netl.doe.gov).

**Future Energy Systems and Technology for CO<sub>2</sub> Abatement.** Organized by The Technological Institute, this symposium will cover the potential impact of chemistry, catalysis and process engineering in CO<sub>2</sub> abatement from industry, transport and other areas. CO<sub>2</sub> capture and sequestration will also be covered. The symposium will be held in Antwerpen, Belgium from November 17-20, 2002. For more information, visit <http://www.ti.kviv.be/conf/>.

**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.

**Electric Utilities Environmental Conference.** The 6th Annual [Conference on Air Quality & Global Climate Change](#) will be held January 27-30, 2003 in Tucson, Arizona. The conference will cover policy, trading, voluntary programs, science and technology options, including carbon sequestration. DOE is one of the conference sponsors.

**NETL at the February AAAS Meetings.** The American Association for the Advancement of Science [annual meeting](#) will be February 13-18, 2003 in Denver, CO. NETL has organized two symposia on Carbon Sequestration which will be included in the Dealing with Global Change track on Monday, February 17, 2003. For more information, please contact Sarah Forbes, [sarah.forbes@netl.doe.gov](mailto:sarah.forbes@netl.doe.gov).

**The American Association of Petroleum Geologist Annual Convention**, entitled "[Energy: Our Monumental Task](#)," will be held in Salt Lake City, UT May 11-14, 2003. A special session on "Geological Sequestration of CO<sub>2</sub>" has been arranged. Abstracts are due September 18, 2002, and can be submitted electronically. Click on session O-22.

**NETL's Second National Conference on Carbon Sequestration will be held late May or early June 2003.** More details will be provided soon. The First National Conference was held May 2001 in Washington DC, and was attended by over 400 national and international experts from government, academia and industry. Conference proceedings from that event are available on the [NETL website](#).

## Recent Publications

**NETL Factsheets.** The following Fact Sheets are now available on the NETL Reference Shelf:

- [Coal-Seam Sequestration](#). "Physics and Chemistry of Coal-Seam CO<sub>2</sub> Sequestration & Coalbed Methane Production": One of the primary project goals is to provide guidelines for drilling new, more efficient, CBM production wells.
- [Geologic Chemistry](#). "An Investigation of Gas/Water/Rock Interactions & Chemistry": The work is being performed by NETL and the U.S.G.S. Their primary goal is to assess the role of formation water chemistry in CO<sub>2</sub> solubility.
- [Monitoring Geologically Stored CO<sub>2</sub>](#). "Development of Comprehensive Monitoring Techniques to Verify the Integrity of Geologically Sequestered CO<sub>2</sub>": The goal of the project is to develop and demonstrate advanced monitoring techniques that can assess the capacity, stability, leakage, and permanence of CO<sub>2</sub> stored in geologic formations.
- [Ocean Sequestration Feasibility](#). "Oceanic Sequestration": The goal of the work is to obtain information that will help to both assess the technical feasibility of ocean sequestration and develop optimal methods of introducing CO<sub>2</sub> into the ocean.

**Carbon Storage in Woody Ecosystems.** Researchers at Duke, UT Austin, Colorado State, and UNM found that the invasion of woody vegetation into deserts, grasslands and savannas does not always increase overall ecosystem carbon storage. Previous to this study, shrub and forest expansion was suggested to be a substantial component of the terrestrial carbon sink. The study found that a loss in soil carbon in woody communities more than offset the gain in aboveground carbon, at least in relatively wet sites. ["Ecosystem carbon loss with woody plant invasion of grasslands,"](#) *Nature*, August 8, 2002.

**CSIRO Forest Sequestration Kit.** *The Greenhouse Resource Kit for Private Forest Growers*, developed by CSIRO on behalf of the Australia Department of Agriculture, Fisheries and Forestry, provides information on all aspects of forest carbon sequestration, including methods of carbon accounting in forests, possible emissions trading systems, the economics of forest-based carbon sequestration projects, and methods for independent verification and accountability. The kit is available from the [AFFA web site](#), August 26, 2002.

**Rhode Island GHG Action Plan.** *The Rhode Island Greenhouse Gas Action Plan* identifies 52 ways in which Rhode Island can reduce GHG emissions, including land-use change initiatives, energy production tax credits, and a carbon cap and trade system. In September 2002 the Rhode Island Action Plan GHG stakeholders will begin further research to analyze and design ways to implement some or all of the recommended actions. The RI action plan was completed July 15, 2002, and [posted on the website](#) August 26, 2002.

**GHG Market Development.** An analysis of the future of the emerging GHG market found that industry representatives expect GHG credits to range from slightly more than \$5 per metric ton of CO<sub>2</sub> equivalent in 2005 (pre-Kyoto Protocol) to \$11 per ton of CO<sub>2</sub> equivalent in 2010 (mid-Kyoto Protocol). The report is the result of interviews with representatives of 35 companies with operations in the European Union, the U.S., Canada, Japan and Russia. [Assessment of Private Sector Anticipatory Response to Greenhouse Gas Market Development](#), by Natsource LLC at the request of Environment Canada; July 17, 2002.

**RIIA Analysis of European GHG Control in the Electricity Sector.** This publication examines possible economic mechanisms for controlling GHG emissions in the electricity industry, including trading, taxes, and voluntary agreements. [Climate Change and Power](#), Royal Institute of International Affairs, August 2002.

## Legislative Activity

Congress has been on recess during the month of August and will return to session September 3rd.

*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.*

If you'd like to join the e-mail distribution list, please send a message to [majordomo@list-manager.netl.doe.gov](mailto: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](mailto:klara@netl.doe.gov), or visit the website at [www.netl.doe.gov/coalpower/sequestration/](http://www.netl.doe.gov/coalpower/sequestration/).