THE CARBON SEQUESTRATION NEWSLETTER

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Sequestration in the News

***Anchorage Daily News,* DOE Report: Carbon dioxide injection can boost Alaska oil production by 12 billion barrels.** A new U.S. Department of Energy report considered Alaska's oil fields on the North Slope and in Cook Inlet and determined that carbon dioxide flooding could dislodge 12 billion barrels of oil that otherwise would remain stuck in the ground. Nationwide, the technique could add 43 billion barrels to U.S. supply, according to the report. Carbon dioxide flooding isn't done now on the North Slope, but Congress already has laid the groundwork for encouraging it. In a law passed last fall that provides incentives for an Alaskan natural gas pipeline, lawmakers included a tax break for a massive plant on the North Slope to purify raw natural gas. Part of its job would be to strip carbon dioxide out of the gas. "Use of natural gas could yield more oil: Carbon dioxide injection can boost production," April 23, 2005, http://www.adn.com/front/story/6411546p-6290064c.html (registration required)

***New York Times,* "Coal in a nice shade of green."** This op-ed discusses the negative attributes associated with burning of fossil fuels, but recognizes that current renewable technology is not sufficient to satisfy America's energy needs economically. Authors pitch gasification as a bridge technology saying, "The combination of gasified coal plants and geologic storage can be our bridge to the clean energy of the 22nd century and beyond." March 26, 2005, http://www.iht.com/articles/2005/03/25/opinion/edhomer.html

***The Observer,* "Seabed supplies a cure for global warming crisis."** British scientists say they have found the solution to the global warming crisis. They want to bury millions of tonnes of carbon dioxide under the bed of the North Sea at BP's Miller oilfield. "Production at the Miller is coming to an end, so we have a wonderful opportunity to develop techniques that could control global warming," said Professor Stuart Haszeldine, a geologist at Edinburgh University. "This is a once-in-a-decade opportunity," said Haszeldine. "We have the right gear in the right place at the right time. If we don't take advantage of it and allow the Miller to be closed down, we will have lost a wonderful chance to conquer global warming." To make it feasible BP is asking the government to reduce its oil taxes from £7 from every £10 worth of North Sea oil to £3. April 24, 2005, http://www.guardian.co.uk/climatechange/story/0,12374,1469049,00.html

***The Star Ledger,* "As CO_2 market expands, company steps on the gas."** Article highlights BOC's new plant in west Texas that supplies liquid CO_2 to boost production of natural gas wells. The gas is piped from a natural reservoir in Colorado and pumped underground at high pressure; the CO_2 fractures rock formations to increase gas flow. "It dramatically increases the amount of natural gas you get from the life of the well," says John Miller, BOC's national manager for oil field services. The article says, "In a few places, CO_2 is being entombed inside oil and gas wells – a process called "sequestration" that may offer a solution to global warming." April 12, 2005, http://www.nj.com/business/ledger/index.ssf?/base/business-9/1113285567113060.xml (archived)

***The Australian,* "Shell deal fires up Gorgon gas hopes."** The $11 billion Gorgon gas project, off the West Australia coast, moved a step closer with project partner Shell saying it had finalized the sale of 2.5 million tonnes of Gorgon LNG a year to the US west coast. Shell will supply up to 2.5 million tonnes of Gorgon LNG a year to the Energia Costa Azul terminal in Baja California, with first deliveries expected in 2010. In addition to gas production, the project scope includes the capture and sequestration of 5 million tonnes CO_2 per year in a saline reservoir located 2300m below Barrow Island. April 12, 2005, http://www.theaustralian.news.com.au/common/story_page/0,5744,12825264%255E643,00.html

***Rigzone*, Production Cost of Crude Oil from CO_2 EOR on Norwegian Shelf Estimated to be 30 $/bbl.** The Norwegian Petroleum Directorate (NPD) studied 20 Norwegian oil platforms and estimates that CO_2 EOR could help extract an additional 150 to 300 million cubic meters of oil in total. "However, the threshold costs for establishing a delivery chain for injection of CO_2 are so high that other methods of improving recovery emerge as being more attractive for the licensees at this time," the authors said. "Norway CO_2 Study: Too Expensive & Risky," April 26, 2005 http://www.npd.no/English/Emner/Ytre+miljo/co2rapport_pm_260405.htm. Also see, "Injecting CO_2 into oil fields to boost production is too pricey: report," *Agence France Presse*, April 26, 2005, http://www.wbcsd.org/includes/getTarget.asp?type=DocDet&id=14475. Statoil's senior vice president for the environment, Tor Fjaeran, was at the meeting where the NPD report was announced and reaffirmed his company's commitment to carbon storage. "Statoil Continues Commitment to Carbon Storage," *Rigzone*, April 26, 2005, http://www.rigzone.com/news/article.asp?a_id=22075

***Energy Bulletin*, "Carbon sequestration - the hottest topic on the planet."** Article offers an in-depth discussion of the proposed Gorgon LNG project in Western Australia, and calls it "the template for proving up a regulatory framework for geologic sequestration." The article says, "outside of the economy and events in the Middle East, global warming or more importantly, prospective action to inhibit its progress is just about the hottest inter-governmental topic on the planet. At the top of the list of mitigation strategies is carbon sequestration." Article addresses the need for monitoring and a regulatory framework and attempts to rouse public debate with numerous parallels to nuclear waste disposal. A published overview of how the International Energy Agency categorizes the Gorgon project is shown at the end of the article. April 12, 2005, http://www.energybulletin.net/newswire.php?id=5220.
This issue also included **"Australia: Gorgon Gas Project – Ugly by name,"** which takes the opposite viewpoint and states that there are many boundaries being tested with the Gorgon Gas project (technical, geoscientific, economic, legal, political, and geographic) and there are just as many questions that need to be addressed before the project commences. The article says that the introduction of a regulatory framework for the project will "inadvertently also create the necessary legal framework for the subterranean disposal/storage of other more noxious substances, ones that have been rejected in the past, at least in the public eye." April 12, 2005, http://www.energybulletin.net/newswire.php?id=5219

***Australian Broadcasting Corporation*, "Coal-21 group debates clean power options."** This transcript of an Australian radio broadcast discusses the Coal-21 program, which is exploring the possibilities of geo-sequestration. According to Coal-21's Tim Besley, costs are falling and he's optimistic they'll be able to trial the new technology by the end of the year. Coal-21 is currently assessing sites for a project. Says Besley, "Some of those geologically good sites are not economically viable because they're too far away from a major source, like a big power station." April 6, 2005, http://www.abc.net.au/pm/content/2005/s1339741.htm

***The Philadelphia Inquirer*, "Burlco's Recycling Project is Garbage In, Gas Out."** At the Burlington County landfill in Pennsylvania, some entrepreneurs have discovered a way to cut the costs of garbage collection, lessen reliance on foreign oil, reduce global warming, and make money all at the same time. One man's trash, they say, is another man's gas. The pilot project uses methane produced from decaying trash to fuel garbage trucks that use the landfill. The $1 million project was funded mostly by Allentown-based Mack Trucks and the U.S. Department of Energy. April 20, 2005, http://www.enn.com/biz.html?id=490

***CNN*, "Seeking solutions to a cooler planet."** Article mentions carbon sequestration as one of many current technologies that could dramatically turn down the heat of global warming over the next 50 years. Highlights the Mountaineer project in West Virginia and BP's In Salah project in Algeria and states, "These carbon sequestration projects send millions of tons of carbon dioxide gas into underground geologic formations such as aquifers or gas beds now filled with water, natural gas or oil. The risks of such techniques include leakage of carbon dioxide from underground reservoirs that may endanger human life and the environment. Scientists are studying techniques to find which rock formations permanently store gases such as carbon dioxide." April 15, 2005, http://www.cnn.com/2005/TECH/science/04/15/earth.solutions/

Announcements

Now Available on NETL/Sequestration Website. Two documents, the "Technology Roadmap and Program Plan 2005" and "Regional Carbon Sequestration Partnerships Phase I Accomplishments" have been posted to the Sequestration website at http://www.netl.doe.gov/sequestration

Funding Opportunity Announcement for capture technologies. On April 28, 2005 DOE/NETL announced funding opportunity DE-PS26-05NT42464 entitled "Oxycombustion and Other CO_2 Capture Technologies Available for Application to the Existing Coal Fired Power Generation Fleet." Application Due Date is June 30, 2005. For additional information visit http://www.fedgrants.gov/Applicants/DOE/PAM/HQ/DE-PS26-05NT42464/Grant.html

NETL Systems Analysis Guidelines for Pre- and Post-combustion CO_2 Capture and Separation Technologies. Now available online, these guidelines will be used by all new capture projects funded through the Sequestration program. The guidelines are consistent with the Quality Guidelines for Energy Systems Studies, which was issued by NETL in February 2004. The guidelines are available at http://www.netl.doe.gov/coal/Carbon%20Sequestration/pubs/CO2CaptureGuidelines.pdf
Several results tables have been developed in Microsoft Excel® format and can be used as templates for your analysis. To download, visit http://www.netl.doe.gov/coal/Carbon%20Sequestration/pubs/NETL_Carbon_Capture_and_Sequestration_Systems_Analysis_Guidelines_Economic_Templates_April_2005.xls

Request for Proposals. The International Utility Efficiency Partnerships, Inc. (IUEP) announced the release of its 2005 Request for Proposals (RFP) for developing and implementing international energy efficiency projects and methane reduction projects that will result in the reduction, avoidance, or sequestration of greenhouse gases. The RFP will provide funding for approximately six to eight GHG reduction projects with a total value of $2,000,000 including a 50/50 cost share requirement. The RFP is open from March 31, 2005 thru May 31, 2005. Grant winners are expected to be announced in July, 2005. For more information, please visit the IUEP website at http://www.iuep.org/RFP2005/

"Nicholls opens Navy's databank for small businesses." A program to open the U.S. Navy's databank of technologies to small businesses in south Louisiana is under way at Nicholls State University. The program will provide online access to more than 600 unclassified patents. The databank will include technologies for hydrogen extraction from seawater, methane hydrate processing, carbon sequestration, extremely high pressure valves and seals, sensors and monitoring systems and advanced power sources such as fuel cells for marine applications. Additional information is available at http://www.nicholls.edu/sttp and http://www.sciaonline.net

Science

"Carbon dioxide continues its rise." The atmospheric concentration of the greenhouse gas carbon dioxide has reached a new high, say US researchers at the Climate Monitoring Diagnostics Laboratory, part of the National Oceanic and Atmospheric Administration. The figures - 378 parts per million - were gathered by a Hawaiian lab regarded by experts as one of the most reliable in climate research. The rise in the past year is smaller than it was in the previous two years. *BBC News*, March 31, 2005, http://news.bbc.co.uk/1/hi/sci/tech/4395817.stm

"Researchers: Data validates global warming projections." Climate scientists, with the aid of diving robots probing the world's warming seas, have found the heat exchange between Earth and space is seriously out of balance – what the researchers called a "smoking gun" discovery that validates forecasts of global warming. They said the findings confirm that computer models of climate change are on target and that global temperatures will rise 1 degree Fahrenheit (0.56 degree Celsius) this century, even if greenhouse gases are capped tomorrow. *CNN,* April 28, 2005, http://edition.cnn.com/2005/TECH/science/04/28/global.warming.ap

"Impact of Humans on the Flux of Terrestrial Sediment to the Global Coastal Ocean." Study provides global estimates of the seasonal flux of sediment, on a river-by- river basis, under modern and pre-human conditions. According to the article, humans have simultaneously increased the sediment transport by global rivers through soil erosion yet reduced the flux of sediment reaching the world's coasts because of retention within reservoirs. Over 100 billion metric tons of sediment and 1 to 3 billion metric tons of carbon are now sequestered in reservoirs constructed largely within the past 50 years. *Science,* April 15, 2005, http://www.sciencemag.org/content/vol308/issue5720/index.shtml (subscription required)

"Global Iron Connections Between Desert Dust, Ocean Biogeochemistry, and Climate." The iron cycle, in which iron-containing soil dust is transported from land through the atmosphere to the oceans - affecting ocean biogeochemistry and hence having feedback effects on climate and dust production – is an important part of the "Earth system." In this study the authors review the key components of this cycle, identifying critical uncertainties and priorities for future research. *Science,* April 1, 2005, http://www.sciencemag.org/content/vol308/issue5718/index.shtml (subscription required)

Policy

EIA study finds that GHG emission caps safe for economy. Senator Jeff Bingaman (D-NM) asked the EIA to study the possible effects of a proposal by the National Commission on Energy Policy. Under the proposal, beginning in 2010, businesses that pollute more than their allotment would have to pay up to $7 a ton to those that pollute less. EIA estimates the commission's plan would cut greenhouse gases by 7 percent, or 622 million tons, from what is forecast for 2025. EIA found coal use would increase 22 percent over that time, while total electricity prices would rise less than 5 percent and gasoline prices would go up by a few pennies a gallon. "Emission limits safe for economy, agency says," *Star Tribune*, April 16, 2005, http://www.startribune.com/stories/484/5351522.html. The April 2005 study, "Impacts of Modeled Recommendations of the National Commission on Energy Policy," can be downloaded at http://www.eia.doe.gov/oiaf/servicerpt/bingaman/pdf/sroiaf(2005)02.pdf

"Duke Push For Carbon Tax May Signal Shift Toward Nuclear Power." Duke Energy chief Paul Anderson's surprising call on Congress to enact a carbon tax is being viewed as evidence of a company, and possibly an industry shift to nuclear power over coal, according to observers, who say such a tax would give emission-free nuclear power a significant competitive edge over coal. *Energy Washington*, April 12, 2005, http://www.energywashington.com (subscription required)

"States Seek Regulation Of Greenhouse Gases." A coalition of 12 states and several cities asked a federal appeals court to make the Environmental Protection Agency reconsider its decision not to regulate heat-trapping greenhouse gases as air pollutants. According to the article, it could take several months for a ruling from the US Supreme Court. *Washington Post*, April 10, 2005, http://www.washingtonpost.com/wp-dyn/articles/A40500-2005Apr9.html (registration required). For an in-depth discussion on the background of the case see, "Crazy on Carbon Dioxide," *National Review*, April 8, 2005, http://www.nationalreview.com/comment/lewis200504080955.asp

"Green Goal." The 2006 FIFA World Cup in Germany is to be the world's first climate-neutral major sporting event. Germany plans to offset greenhouse gases that cannot be prevented by improving energy efficiency, or by replacing conventional energies with renewable ones. In order to prevent the major sporting event from causing any lasting damage to the atmosphere, an estimated 100,000 tonnes of GHG emissions will be prevented elsewhere through climate projects in South Africa and South East Asia. The costs of around one million euros will be borne by the World Cup Organizing Committee. *German Press and Information Office*, April 12, 2005, http://wm2006.deutschland.de/EN/Content/World-Cup-News/News-items/2005/green-goal-on-our-way-to-the-first-climate-neutral-FIFA-world-cup-2006.html

"Climate Research Faulted Over Missing Components." Investigators, from the Government Accountability Office, conclude in a report that none of the 21 studies of climate change that the administration plans to publish by September 2007 explicitly address the potential effects in eight areas specified by a 1990 law, the Global Change Research Act. The areas include agriculture, energy, water resources and biological diversity. Without such an assessment, the accountability office said, "it may be difficult for the Congress and others to use this information effectively as the basis for making decisions on climate policy." *New York Times*, April 22, 2005, http://www.nytimes.com/2005/04/22/science/22warm.html (registration required)

"US senators urge climate action." A joint resolution tabled by Democratic Senator Dianne Feinstein and co-sponsored by thirteen other Democrat and Republican senators urges the US to demonstrate international leadership and responsibility in climate change issues. The resolution was tabled in February, and currently sits in the Foreign Relations Office of the US Senate. The Senate resolution also asks the US to support the long-term target of limiting the increase in global temperature to 2 degrees Celsius above pre-industrial levels, the same target the EU has set. *Point Carbon*, April 27, 2005, http://www.pointcarbon.com/article.php?articleID=8022&categoryID=881 (subscription required)

Geology

"Identification of early opportunities for CO_2 sequestration – worldwide screening for CO_2-EOR and CO_2-ECBM projects." Using a Geographical Information System (GIS) to combine worldwide CO_2 point sources and oil and coal fields, this study highlights two potential enhanced oil recovery (EOR) projects and two potential enhanced coal bed methane recovery (ECBM) projects as potential early opportunities for CO_2 sequestration. Case 1 consists of a hydrogen plant in Saudi Arabia, which could sequester 0.26 Mt/year CO_2 in a depleted oil reservoir at a net saving of approximately 3 EUR/t CO_2. EOR case 2 is a hydrogen plant in California, which has to be retrofitted in order to generate a pure CO_2 stream. Approximately 0.28 Mt CO_2 could be stored annually. Mitigation costs were estimated at 9–19 EUR/t CO_2, depending on the availability of steam for CO_2 regeneration. In cases 3 and 4, circa 0.68 and 0.29 Mt CO_2 from ammonia plants in China and Canada could be sequestered annually in coal fields for ECBM production at approximately 5 and 6 EUR/t CO_2, respectively. *Energy,* Volume 30, Issue 10, July 2005, http://www.sciencedirect.com/science/journal/03605442 (subscription required)

"Geologic storage of carbon dioxide and enhanced oil recovery I: Uncertainty quantification employing a streamline based proxy for reservoir flow simulation." This paper proposes a work flow for co-optimization of oil recovery and geologic CO_2 storage. An analytic streamline based proxy for full reservoir simulation is proposed and tested. Streamline trajectories represent the three-dimensional velocity field during multiphase flow in porous media and so are useful for quantifying the similarity and differences among various reservoir models. The proxy allows rational selection of a representative subset of equi-probable reservoir models that encompass uncertainty with respect to true reservoir geology. The streamline approach is demonstrated to be thorough and rapid. *Energy Conversion & Management,* Volume 46, Issue 11-12, July 2005, http://www.sciencedirect.com/science/journal/01968904 (subscription required)

"Geologic storage of carbon dioxide and enhanced oil recovery II: Cooptimization of storage and recovery." In this study, several strategies are tested via compositional reservoir simulation to find injection and production procedures that ''cooptimize'' oil recovery and CO_2 storage. Flow simulations are conducted on a synthetic, three dimensional, heterogeneous reservoir model. The results show that traditional reservoir engineering techniques such as injecting CO_2 and water in sequential fashion, a so-called water-alternating-gas process, are not conducive to maximizing the CO_2 stored within the reservoir. A well control process that shuts in (i.e. closes) wells producing large volumes of gas and allows shut in wells to open as reservoir pressure increases is the most successful strategy for co-optimization. *Energy Conversion & Management,* Volume 46, Issue 11-12, July 2005, http://www.sciencedirect.com/science/journal/01968904 (subscription required)

Technology

"An assessment of mine methane mitigation and utilization technologies." In this study the existing and developing technologies for coalmine methane mitigation and utilization are classified, with a discussion of the features of different technologies to identify potential technical issues for each technology when implemented at a mine site and to identify the best options for mine site applications. A technical assessment of these technologies for use at a Queensland coal mine is presented, with a preliminary economic assessment of some technologies that were determined to be technically feasible. *Progress in Energy and Combustion Science,* Volume 31, Issue 2 (2005), http://www.sciencedirect.com/science/journal/03601285 (subscription required)

"Students Design System for Removing Carbon from Power Plant Emissions." Students from Clarkson University have designed an innovative and efficient method for removing and storing carbon dioxide emitted in coal-fired power plant flue gas. "Their solution is a highly creative one," said Stefan Grimberg, professor of Civil and Environmental Engineering and team advisor. "Their process uses steel slag, which is a byproduct of the steel manufacturing process and has very little market value, to extract the carbon dioxide. The result is the production of calcium carbonate (limestone) and hydrated slag, both of which can be sold and used by other industries. So the students have used a waste product to solve their problem and the resulting products have considerable market value." *NewsWise*, April 15, 2005, http://www.newswise.com/articles/view/511159/

"Mallet gas processing facility uses membranes to efficiently separate CO_2." The Cynara membrane system at Occidental Oil & Gas Corp.'s Mallet CO_2-removal facility in Sundown, Texas, has processed 100 MMscfd of gas with an online availability greater than 99% since 1994 and is being expanded to process an additional 100 MMscfd of gas. This article reviews the rationale for selecting membranes and the factors contributing to the successful 10-year operation of membranes at the facility. When properly applied, membranes have a long life and low operating cost. At the Mallet facility, membranes have proven to be a reliable, cost-effective solution during the 10+ years of operation. *Oil & Gas Journal*, April, 11, 2005, http://ogj.pennnet.com/home.cfm?si=ogj (subscription required)

"Sequestration of fermentation CO_2 from ethanol production." This study shows that if the off-gases produced during the fermentation of sugars to fuel–ethanol were captured and, for example, injected deep underground to keep them from the atmosphere, then the production of ethanol could lead to the net removal of CO_2 from the atmosphere in addition to avoiding gasoline-related CO_2 emissions by using the ethanol as a transportation fuel. The authors give estimates of net CO_2 emissions for current systems for the production of fuel–ethanol, these systems modified to sequester fermentation CO_2, and gasoline-related CO_2 emission offsets. They also consider future developments that might affect the scope and economic feasibility of the sequestration of fermentation CO_2. *Energy,* Volume 30, Issue 10, July 2005, http://www.sciencedirect.com/science/journal/03605442 (subscription required)

Technology, Cont'd

"High performance SOFC/GT combined power generation system with CO_2 recovery by oxygen combustion method." The authors investigate carbon dioxide recovery from SOFC/GT combined power generation systems in which a gas turbine with carbon dioxide recycle or water vapor injection is adopted as the bottoming cycle. In these systems, fuel gas is first introduced to a SOFC, and its exhaust fuel gas is afterburned by pure oxygen. Carbon dioxide or water vapor is also injected into the combustor to reduce the combustion gas temperature. The obtained combustion gas, which is composed of only carbon dioxide and water vapor, is introduced to a gas turbine in the bottoming cycle The overall efficiency of the system with carbon dioxide recycle reaches 63.87% (HHV) or 70.88% (LHV). *Energy Conversion & Management,* Volume 46, Issue 11-12, July 2005, http://www.sciencedirect.com/science/journal/01968904 (subscription required)

Terrestrial

"Canadian Farmers to receive cash to fight global warming." After eight years of negotiations, the Canadian federal government signed a $1-million agreement that will pay farmers to keep carbon dioxide in their land by not tilling. The three-year pilot project covers 210 farmers across the country, with 100 of them in Saskatchewan. Zero-till farming has been a common practice on the prairies as a means to prevent soil erosion. More recently, it's been promoted as a way to help Canada meet its international commitment to reduce greenhouse gas emissions. John Bennett, a spokesman for the Saskatchewan Soil Conservation Association, said agriculture could reduce Canada's cost of compliance for its Kyoto targets by between 40 and 60 percent. *CBC News*, April 8, 2005, http://sask.cbc.ca/regional/servlet/View?filename=carbon-farming050408

"Alarm bells over plantations." In 1996 the Australian Federal Government announced its 2020 forestry vision, which sparked a tax advantages and other incentives to encourage plantations that would serve as carbon sinks. In response to massive forest fires in Indonesia in 1998, CSIRO scientists began to question whether production forests could actually be a source of carbon dioxide pollution. This article highlights research on the consequences of controlled regeneration burning when calculating carbon sequestration for Australian forests. *The Mercury*, April 3, 2005, http://forests.org/articles/reader.asp?linkid=40495

"Protection of soil carbon by microaggregates within earthworm casts." Study finds direct involvement of earthworms in providing protection of soil carbon in microaggregates within large macroaggregates leading to a possible long-term stabilization of soil carbon. *Soil Biology and Biochemistry,* Volume 37, Issue 2, February 2005, http://www.sciencedirect.com/science/journal/00380717 (subscription required)

Ocean

"Proposal to Fight Global Warming May Threaten Oceans." Focuses on research by MBARI scientists and researchers from LSU and FSU who have suggested capturing carbon dioxide gas from factory smokestacks and pumping it two miles under the ocean's surface. Freezing temperatures at that depth turn the CO_2 into a slushy solid, which sinks to the ocean floor. According to *Morning Edition*, the researchers found that freezing gas to combat global warming may significantly harm marine life. *NPR*, April 1, 2005, http://www.npr.org/templates/story/story.php?storyId=4571038

"Japan researchers look to seaweed in fight against global warming." A group of private and academic research institutes is studying the viability of building a seaweed plantation in the Pacific Ocean to absorb carbon dioxide and produce biofuel. The plan is to place 100 floating fishing nets in the Pacific Ocean, each measuring 10 kilometers by 10 kilometers. Seaweed such as sea grape, which can reach 20 meters in length in a year, will grow from the nets. Seaweed discharges hydrogen and carbon monoxide gases when it is exposed to extremely heated water vapor. Methanol and other biofuel can be synthesized from the gases. Because the biofuel is made from carbon hydride, which is created from carbon dioxide through photosynthesis, no extra carbon dioxide is discharged into the atmosphere when the fuel is burned. In this sense the fuel holds a very great advantage over fossil fuels, says the article. *The Yomiuri Shimbun*, April 19, 2005, http://www.grandforks.com/mld/grandforks/news/world/11431501.htm

"Role of Marine Biology in Glacial-Interglacial CO_2 Cycles." It has been hypothesized that changes in the marine biological pump caused a major portion of the glacial reduction of atmospheric carbon dioxide (by 80 to 100 parts per million) through increased iron fertilization of marine plankton, increased ocean nutrient content or utilization, or shifts in dominant plankton types. This study analyzes sedimentary records of marine productivity at the peak and the middle of the last glacial cycle and shows that neither changes in nutrient utilization in the Southern Ocean nor shifts in plankton dominance explain the CO_2 drawdown. Iron fertilization and associated mechanisms can be responsible for no more than half the observed drawdown, the study states. *Science,* April 1, 2005, http://www.sciencemag.org/content/vol308/issue5718/index.shtml (subscription required)

Trading

"Australian states agree to cap and trade GHG emissions." State and territory governments in Australia have made the decision to develop a nationwide emissions trading scheme, despite lack of support from the federal government. Victoria and New South Wales have been the main drivers behind the agreement, which states that greenhouse gas emissions should be capped and permits traded. The final design of the scheme has not yet been worked out. *Point Carbon*, March 31, 2005, http://www.wbcsd.org/plugins/DocSearch/details.asp?type=DocDet&ObjectId=14042

"IPE/ECX Muscle in on Carbon Market with Low Fees." London's International Petroleum Exchange (IPE) and Dutch-based European Climate Exchange have raised the stakes in the battle for Europe's carbon dioxide market by charging ultra-low trading fees. In a bid to become the central pool of liquidity in the carbon market, the two exchanges launched CO_2 futures trading on the IPE's electronic platform, charging fees that dealers say will undercut most rival bourses and brokers. *Planet Ark*, April 21, 2005, http://www.planetark.com/dailynewsstory.cfm/newsid/30482/story.htm

"California eyes cap-and-trade plan to trim greenhouse gases." The California Energy Commission's Climate Change Advisory Committee is eying "cap-and-trade" proposals, similar to what has worked to limit smog and acid rain, to reduce greenhouse gases that contribute to global warming. The article discusses the benefits and potential drawbacks to implementing such a plan in California when neither GHG emissions nor electricity stop at state borders. *Associated Press*, April 7, 2005, http://www.wbcsd.org/plugins/DocSearch/details.asp?type=DocDet&ObjectId=14113

"Cap and trade system gaining support." At a congressional briefing, Robert Donkers, an environmental counselor to the European Commission, said that American companies based in Europe are looking for a nod from the administration that would open the door for their partners and other corporations within U.S. borders to participate in the European Union's "cap-and-trade" trading system. Donkers said American companies overseas are having "positive" experiences with the trading system, which has been in effect since January. He also said the EU's carbon dioxide trading so far has yielded prices between euro 7 to 16.45 ($9.00 to $21.32) since the beginning of the year. The trading price for April rests around euro 13 ($16.85), he said. *U.P.I.*, April 27, 2005, http://www.wbcsd.org/includes/getTarget.asp?type=DocDet&id=14499

"A tangle of assets and liabilities." Article discusses a new challenge faced by accountants in the post-EU-ETS world – how to treat emissions allowances in financial statements. According to the article, treatment of these new assets and liabilities was set out in the International Financial Reporting Interpretations Committee guidance on emissions trading, or IFRIC 3, issued in December last year. However, the interpretation has created an accounting headache for companies. The article discusses the heart of the issue, an accounting mismatch between assets and liabilities. *Financial Times*, April 28, 2005, http://www.wbcsd.org/includes/getTarget.asp?type=DocDet&id=14500

"Green Mountain Energy Company Goes Carbon Neutral." As part of its corporate commitment to sustainable business practices and focus on improving the community in which it does business, Green Mountain Energy Company announced its participation in the Environmental Protection Agency's "Climate Leaders Program." Starting in 2005, Green Mountain Energy Company plans to offset a full 100 percent of its carbon dioxide emissions, according to the press release. *Business Wire*, April 20, 2005, http://home.businesswire.com/portal/site/google/index.jsp?ndmViewId=news_view&newsId=20050420006087&newsLang=en

"Montana Power Plant will meet the Oregon Standard for CO_2 Emissions." The Climate Trust announced that it will receive $500,000 to purchase greenhouse gas offsets on behalf of Montana-based Basin Creek Power and the Montana Environmental Information Center. The purchase will be the first offset transaction emanating from the Big Sky state. The offset funds will be used to acquire CO_2 offsets according to The Climate Trust's application of the Oregon Standard for CO_2 emissions, one of the most stringent GHG standards for power plants in the country. The offsets will count against the CO_2 emissions of Basin Creek Power's 55 MW natural gas facility in Butte, Montana. *Climate Trust Press Release*, April 18, 2005, http://www.climatetrust.org/pdfs/PR/Basin%20Creek%20Press%20Release.pdf

Events

May 2-5, 2005, **The Fourth Annual Conference on Carbon Sequestration**, Alexandria, VA. For more information, visit http://www.carbonsq.com/ or contact Exchange Monitor Publications at (202) 296-2814.

May 2-3, 2005, **Fourth Annual GreenTrading Summit: Emissions, Renewables & Negawatts**, New York, NY. This year's summit will break new ground on green hedge funds, carbon sequestration trading, new advances in renewable energy trading, the new demand response regimes creating financial negawatts, software tools for forward curve generation and new green finance innovations. To obtain more information, visit http://www.greentradingsummit.com/

May 10-12, 2005, **Second International Conference on Clean Coal Technologies for the Future,** Sardinia, Italy. Sponsored by SOTOCARBO, IEA Clean Coal Centre, DOE, and Assessorato all'Industria Regione Autonoma della Sardegna. Contact: Eugenio d'Ercole, info@cct2205.it Conference website http://www.cct2005.it/

May 11-13, 2005, **CARBON EXPO 2005,** Cologne, Germany. The annual trade fair and conference dedicated to the carbon market co-organized by World Bank, International Emissions Trading Association (IETA), and Koelnmesse. For more information, please visit http://www.carbonexpo.com

June 1-3, 2005, **Coal Power Project Development,** Denver, CO. The conference will bring together policy planners, utility executives, and leading coal power project developers to examine current plans and future prospects for project development. They will provide the details of how public policy decisions, transmission planning and expansion, and technological advancement will affect utility resource planning and project financeability. To register or obtain more information, please visit the event website at http://www.infocastinc.com/coal.html, or call (818) 888-4444.

June 19-22, 2005, **2005 American Association of Petroleum Geologists Annual Convention**, Calgary, Canada. The purpose of this combined oral and poster session is to bring together researchers active in the field of CO_2 and acid gas injection in oil and gas reservoirs, coal beds and deep saline aquifers, whether for EOR, ECBM or sequestration, to present current operations, field and laboratory experiments, and integrated studies for the evaluation of sequestration sites and the long-term fate of the injected gases. For more information about the meeting and submission of abstracts please visit http://www.aapg.org/calgary/technical/index.cfm

August 2-11, 2005, **IAMAS 2005 Conference: Carbon Cycle and Climate Symposium**, Beijing, China. The aim of this session is to encourage multiple-disciplinary approach in studying carbon cycles and its interactions with climate. Topics of relevance include: regional and national carbon inventories, CO_2 emissions from land use change and fires, measurements or modeling of net CO_2 exchange of terrestrial ecosystems, land surface models including carbon dynamics in global climate models, interactions between carbon cycle and climate in the past, present and future and applications of model-data fusion in regional and global carbon cycle studies. Conference website: http://www.iamas2005.com Contact: Ying Ping Wang – Yingping.wang@csiro.au

September 15-16, 2005, **Reduction of Emissions and Geological Storage of CO_2: Innovation and Industrial Stakes**, Paris, France. The symposium intends to bring together researchers, industrialists, economists, and financiers to examine the role the geological storage of CO_2 can play in reducing emissions of greenhouse gases, and the means to be used to finance such operations. For additional information visit http://www.CO2symposium.com

September 26-30, 2005, **7th International CO_2 Conference,** Broomfield, CO. The purpose of this conference is to bring together scientists from different disciplines to communicate the most recent results pertinent to the global carbon cycle, with an emphasis on the contemporary increase of atmospheric carbon dioxide. Topics will include atmospheric and oceanic measurements and monitoring networks, terrestrial ecosystems and land use change, carbon cycle process models, source/sink inverse models, the ice core record, new observational techniques, long-term potentials and vulnerabilities of carbon sequestration, and more generally, the human impact on the carbon cycle. For more information: http://www.cmdl.noaa.gov/info/icdc7/

October 9-14, 2005, **2005 International Conference on Coal Science and Technology (ICCS&T)**, Okinawa, Japan. The conference will cover the latest aspects of coal including, combustion, conversion, co-use with biomass and waste, reduction/elimination of environmental load from coal use, and clean coal technologies. For more information regarding the conference please visit the conference website at http://unit.aist.go.jp/energy/iccst

November 13-17, 2005, **Greenhouse 2005: Action on Climate Control,** Melbourne, Australia. There is a clear need for industry, scientists, and government at all levels to work closely together to tackle this significant environmental issue. Demand is strong for the latest information on the science, the likely impacts of climate change, adaptation strategies, and approaches to reducing atmospheric greenhouse gas concentrations. The Conference will cover these themes as well as international issues, policy development, communication and education. For more information: http://www.greenhouse2005.com Contact: Paul Holper - paul.holper@csiro.au

Recent Publications

"International Initiatives." The Spring 2005 edition of *Clean Coal Today* contains an article that highlights the Australian Cooperative Research Center on CO_2 (CO2CRC). The newsletter can be found at http://fossil.energy.gov/programs/powersystems/cleancoal/publications/cctoday_spring_05_final.pdf

"Isolation and determination of cultural characteristics of a new highly CO_2 tolerant fresh water microalgae." Fresh water microalgae, which has high CO_2 tolerance, were isolated and its cultural characteristics were investigated. The microalgae showed maximum growth at 10% CO_2 enriched air flowing condition, and a good growth rate in a broad range of physically controllable conditions, including CO_2 concentration up to 70%, CO_2 enriched air flow rate, temperature and pH value. The results indicated the feasibility for fixing CO_2 from stack gases. *Energy Conversion & Management,* Volume 46, Issue 11-12, July 2005, http://www.sciencedirect.com/science/journal/01968904 (subscription required)

"Co-production of hydrogen, electricity and CO_2 from coal with commercially ready technology." This two-part paper investigates performances, costs and prospects of using commercially-ready technology to convert coal to H_2 and electricity, with CO_2 capture and storage. Part A, "Performance and emissions," focuses on plant configuration, performance, and CO_2 emissions. Part B, "Economic analysis," focuses on the cost of producing H_2 and electricity, with and without reduced CO_2 emissions. *International Journal of Hydrogen Energy,* Volume 30, Issue 7, July 2005, http://www.sciencedirect.com/science/journal/03603199 (subscription required)

"The Role of Technology Development in Accelerating U.S. Mercury and Carbon Dioxide Emission Reductions." As part of a panel on Power Sector Emission Issues, Ned Helme, President of the Center for Clean Air Policy, addressed the role of technology development in hastening reductions in mercury and carbon dioxide before an audience at the 13th annual EIA Annual Energy Outlook and Modeling conference in Washington, DC on April 12. At the presentation Helm recommended that legislative approaches include incentives for IGCC with carbon capture and sequestration, whether with or without a cap. Such incentives can help reduce carbon dioxide emissions while preserving coal-fired power generation, he said. To view the presentation slides, visit http://www.ccap.org/pdf/EIA%20presentation_Apr_12_05.pdf

Legislative Activity

"Senator Byrd Calls for Mandatory Carbon Policy." On Monday April 11, Senator Byrd (D-WV) introduced the International Clean Energy Deployment and Global Energy Markets Investment Act of 2005 (S.745) along with cosponsors Senators Bingaman (D-NM), Jeffords (I-VT), and Kerry (D-MA). The Act aims, among other things, to strengthen US cooperation with developing countries in addressing critical energy needs and global climate change; to promote sustainable economic development; increase access to modern energy services; reduce greenhouse gas emissions; and strengthen energy security and independence in developing countries through the deployment of clean energy technologies. More information via Congressional Record (S3416-S3417) at http://frwebgate.access.gpo.gov/cgi-bin/getpage.cgi?dbname=2005_record&page=S3416&position=all and Thomas at http://thomas.loc.gov/cgi-bin/bdquery/z?d109:SN00745:@@@P

"House Passes Energy Bill With Costello Clean Coal Provisions." By a vote of 249 to 183, the House approved a wide-ranging energy bill on April 21st. The legislation includes several clean coal initiatives authored by U.S. Congressman Jerry Costello (D-IL). The Costello provisions would authorize $1.8 billion over nine years for research and demonstration projects in advanced clean coal technologies with the goal of reaching emission levels comparable with natural gas. The provision would also increase funding for fossil energy research and development and create national centers for coal research. It would also authorize at least $40 million to create a program to develop advanced technologies to remove carbon dioxide from coal emissions and permanently sequester it below ground. *Suntimes News*, April 27, 2005, http://www.suntimesnews.com/2/news_archive/apr_05archives/0427house.htm.
For additional information see, "Energy Bill Is Passed By House," *Washington Post*, April 22, 2005, http://www.washingtonpost.com/wp-dyn/articles/A7459-2005Apr21.html (registration required)

This newsletter is produced by the National Energy Technology Laboratory and presents summaries of significant recent events related to carbon sequestration. If you'd like to join the e-mail distribution list, email majordomo@list-manager.netl.doe.gov with "subscribe sequestration" in the body of the message. We encourage you to pass this along to interested persons. Contacts: Scott Klara, scott.klara@netl.doe.gov or Sarah Forbes, sarah.forbes@netl.doe.gov.