



# UNITED Carbon Sequestration Council STATES

April 7, 2011

## Sequestration News

*The Administration's budget request and Congressional budget issues have continued to be the center of attention. A shutdown of Government operations seems to be a real possibility, but there is still time to avert it. Also, this week Congress voted down several proposals for limiting EPA's authority to regulate GHGs.*

### Administration and Congressional Budget Actions

As of the date of this newsletter, the Congress has still not reached agreement on an FY 2011 Appropriations Bill or on another Continuing Resolution and has little time remaining in order to avert a Government shutdown. If a Government shutdown does occur, Secretary Chu indicated in a Wednesday memo to all Federal employees that the DOE may be able to continue to operate for a limited time using prior year appropriations: "... unlike most other federal agencies, the Department has no-year appropriations. This would allow us to continue operating for a limited time. Therefore, if a new funding bill is not enacted Friday, all DOE Federal employees are still expected to report to work as usual on their next scheduled work day."

### Senate & CCS

Senators Bingaman, Barrasso, Rockefeller and Murkowski introduced a CCS related bill ([S. 699](#)). The proposed Bill authorizes up to \$10,000,000,000 for ten demonstration projects, but the funds still need to be appropriated. The Bill defines a demonstration project as one that stores at least one million tons of CO<sub>2</sub> annually. It also attempts to address CCS liability protection.

### EPA and CCS

The Washington Post reported that the Senate this past Wednesday rejected a Republican measure that would limit the Environmental Protection Agency's authority to regulate greenhouse gas emissions. The measure, proposed by Senate Minority Leader Mitch McConnell and Senator James Inhofe as an amendment to a small-business bill that the Senate has been working on since mid-March, failed Wednesday on a 50-to-50 vote. Sixty votes were necessary for passage. Four Democrats (Senators Joe Manchin, Ben Nelson, Mary Landrieu and Mark Pryor) joined most Republicans in voting for the measure; one Republican, Senator Susan Collins, joined Democrats in voting against it.

The Senate also rejected three Democratic EPA-related amendments. Senator Max Baucus' amendment would have provided exemptions for agriculture and smaller greenhouse gas emitters from the EPA's permitting process. Senator Jay Rockefeller's amendment would have delayed EPA rules for two years. Senator Debbie Stabenow's amendment would have delayed the rules for two years, exempted agriculture and provided a tax credit to clean energy technology manufacturers.

The House on Wednesday was also considering [a measure sponsored by House Energy and Commerce Committee Chairman Fred Upton \(R-Mich.\)](#) that would prevent the EPA from regulating greenhouse gas emissions under the Clean Air Act. Democrats proposed 12 amendments to the measure, only one of which was passed by the House on Wednesday. A vote on final passage of the measure is expected Thursday. The amendment that passed was sponsored by Representative Jerry McNerney. It offered clarification that voluntary programs addressing climate change are exempted from the bill's provisions.

The 11 amendments rejected Wednesday included one sponsored by Representative Henry Waxman that would have added a section to the Upton bill stating that "Congress accepts the scientific findings of the Environmental Protection Agency that climate changes is occurring, is caused largely by human activities, and poses significant risks for public health and welfare." That amendment failed on a 184-to-240 vote; one Republican, Representative Dave Reichert voted with most Democrats in favor of the measure, while three Democrats, Representatives Dan Boren, Collin Peterson and Nick Rahall opposed the measure along with most Republicans.

### ***President's Energy Security Speech***

On March 30<sup>th</sup>, President Obama gave a speech at Georgetown University on energy security. He reiterated the points he made in his January State of the Union address, including a call for a clean energy standard (CES) that would include an array of clean energy sources such as renewables, efficient natural gas, nuclear, and clean coal. President Obama said a CES will be critical to driving private investment but added that government funding is also necessary. He called for a one-third reduction in oil imports by 2025. The President said identifying underdeveloped resources of oil domestically and offering incentives for the expedited development and production of both oil and gas will help reduce reliance on foreign sources of oil. No specific actions were identified.

### ***CCS EOR Opportunities***

The application of CCS EOR to the Residual Oil Zone (ROZ) provides a huge potential for large amounts of domestic oil recovery and increasing demand for CO<sub>2</sub>. Steve Melzer of Melzer Co<sub>2</sub>nsulting explained the concept at the annual meeting of the Interstate Oil & Gas Compact Commission in November. Conventional CO<sub>2</sub> flooding involves only the main pay zones, but geological evidence indicates that below the main pay zone there can be a thick ROZ that contains sufficient residual oil for profitable CO<sub>2</sub> EOR. Geological evidence supporting ROZs is presented in the newsletters ([www.permianbasinccs.org/newsletter.htm](http://www.permianbasinccs.org/newsletter.htm)) for PTTC's "CCS Training in the Permian Basin Project." ROZ research continues in projects supported by the Research Partnership to Secure Energy for America ([www.rpsea.org](http://www.rpsea.org)).

Abu Dhabi National Oil Co. is studying a proposal to expand the injection of CO<sub>2</sub> into fields for EOR. During the World Future Energy Summit, held in Abu Dhabi, an official from the Adnoc unit of Abu Dhabi Co. for Onshore Oil Operations said that based on a successful pilot project using 60 tons a day of carbon dioxide in the Rumaitha field, the company has identified larger areas of the field to inject 1,750 tons a

day of CO<sub>2</sub>, according to a statement by CO<sub>2</sub> EOR Strategy Advisor Ghaniya Bin-Dhaaer al-Yafei. Abu Dhabi Co., or Adco, is looking at ways to reduce its use of as much as 40 percent of the 5 billion cubic feet of natural gas produced daily in the United Arab Emirates to allow the natural gas to be used to meeting soaring power and industrial demand. Gas is used for EOR, increasing pressure inside reservoirs to push more crude out. Capturing harmful greenhouse gas emissions is also part of the emirate's strategy to become a leader in alternative energy, in collaboration with its renewable energy company Masdar. Potential sources of CO<sub>2</sub> for injection would be from Emirates Steel Industries PJSC, as well as the Habshan field. <http://www.bloomberg.com/news/2011-01-18/abu-dhabi-studying-proposal-to-expand-carbon-capture-and-storage.html>

## **EU and CCS**

The EU is preparing to spend more than £1 billion on helping Britain capture and get rid of carbon dioxide. As a consequence, the productive life of North Sea oilfields could be extended significantly and raise £60 billion in tax revenues. A new study by Durham University academics estimates that the extra tax revenues will be raised by the UK Treasury if carbon capture is adopted by North Sea oil companies. Professor Jon Gluyas, the director of Durham University's Centre for Research into Earth Energy Systems, carried out the study which is now being considered by both the UK's Department of Energy and the EU as part of their funding plans for North Sea oil regeneration. Brussels has given British power engineering companies until February to come up with plants that will take CO<sub>2</sub> via pipelines out to depleted oil or gas fields in the North Sea. Industry sources say that EU financial backing could be worth at least £400 million for each of four CO<sub>2</sub> capture plants that the Government is seeking to build. <http://www.independent.co.uk/news/business/news/carbon-dioxide-capture-plans-could-add-16360bn-to-uk-coffers-2179582.html>

Engineers at Leeds University plan to conduct a test scheme for deep underground coal seams that are too expensive to mine, as part of a €3 million (£2.5 million) international project funded by the European Commission. Waste greenhouse gases will be stored in the rock. Tested in numerous small-scale trials worldwide, underground coal gasification (USG) technology was applied on an industrial scale in the former Soviet Union and is still operating in Uzbekistan. But the proposed scheme for on-site, underground CO<sub>2</sub> storage is new. Researchers will assess the viability of the scheme at the test site in Bulgaria where coal is buried more than 1,200 meters underground. Bulgarian company Overgas will coordinate the project in partnership with the Geological Institute of the Bulgarian Academy of Sciences, Institute for Solid and Fuels Technology Applications (Greece), Instituto Superior Técnico of the Technical University of Lisbon (Portugal), DMT (Germany), Geo-ForschungsZentrum Potsdam (Germany) and UCG Engineering (UK). The international team, including the Leeds engineers, will use data from this site to model the complete process – including combustion, gas extraction and CO<sub>2</sub> storage. <http://www.theengineer.co.uk/news/project-to-assess-benefits-of-underground-coal-burning/1006804.article>

Irish firm Providence Resources announced completion of the first phase of the AMEC conceptual development study for the ULYSSES salt cavern gas storage project in the Kish Bank Basin, offshore eastern Ireland. The ULYSSES Project began in 2008 to assess the natural gas storage and carbon sequestration potential of the Kish Bank Basin. The initial phase of the study was carried out by AMEC plc, and included planning, capacity modeling, infrastructural integration and gas sourcing. The work confirmed that the construction of an offshore natural gas salt cavern storage facility at the ULYSSES location is both economically and technically feasible. "The initial results from the AMEC ULYSSES study are very encouraging as they provide a range of potential project sizes and development concepts which

could be built to meet market requirements,” said John O’Sullivan, technical director for Providence. “In outline, if developed, ULYSSES could deliver 50% of Ireland’s storage capacity as set out in EU directives through one dedicated offshore facility whilst also providing security of supply through the cold winter months...”

<http://www.pennenergy.com/index/petroleum/display/1003309048/articles/pennenergy/petroleum/pipelines/2011/01/providence-resources.html>

## **Australia and CCS**

Climatewire reported that an Australian firm, Calix, has developed an “Endex Reactor” which captures flue gas CO<sub>2</sub> with a specially treated lime, and then regenerates the lime (and produces a concentrated CO<sub>2</sub> stream) in a calciner. Ultimately, it appears that the CO<sub>2</sub> is contained in a cement compound resembling dolomite. The company is seeking to demonstrate the process in 10 MW scale units in Australia and the UK.

An executive at Worley Parsons Ltd. said that the Group of Eight nations’ target to have 20 large-scale CCS projects running by 2020 is “arguably achievable.” At a conference in Abu Dhabi, Peter Brooks, executive director at the Sydney-based company, Australia’s biggest engineering company, said that “Eleven projects will be operational by 2012-13, so the G8 goal is largely achievable.” Only 85 out of 243 projects globally are large-scale, integrated projects, meaning that they capture and store more than 1 million tons of carbon dioxide a year, Brooks said. According to him, of these, only eight are operational, and three are in the “execute stage,” while the remaining 74 are in various stages of development. To meet the IEA’s recommendation 100 large projects would need to be running by 2020.

<http://www.bloomberg.com/news/2011-01-18/g8-s-2020-co2-capture-target-achievable-worleyparsons-says.html>

## **Canada and CCS**

The concern expressed by a Canadian couple and a consultant that CO<sub>2</sub> from the Weyburn EOR operations might be escaping to the surface on the couple’s property, the Petroleum Technology Research Centre issued materials which stated, *“They examined every claim made in the report, from carbon isotope ratios said to be markers of the CO<sub>2</sub> underground at Weyburn, to discussions of high CO<sub>2</sub> readings in the soil, to claims of open faults. They found no data in the report that can support the assertions that CO<sub>2</sub> has migrated through the geological storage system to the surface.”*

<http://www.ptrc.ca>

<http://www.cbc.ca/technology/story/2011/01/17/environment-co2-capture-leak.html?ref=rss>

A January 18 article in *Nature* describes a pilot scale (120,000 tpy CO<sub>2</sub>) version of amine CO<sub>2</sub> scrubbing, with a reported price of \$30-35 per tonne CO<sub>2</sub> (\$20/tonne without purification steps). The CO<sub>2</sub> is used in food and beverages, and it is unclear from the article how much the captured CO<sub>2</sub> is compressed. There is speculation that some of the cost reduction simply reflects the lower costs of construction of power-related systems in China. A Canadian company, EmberClear, has licensed a suite of technologies from Huaneng Group, which developed the system.

<http://www.nature.com/news/2011/180111/full/469276a.html>

## Other CCS News

CO2 Solution Inc. announced that it has extended the carbon capture Joint Development Agreement (JDA) with Codexis, Inc. originally announced December 15, 2009. Under the JDA, Codexis and CO2 Solution have collaborated on the development of carbonic anhydrase biocatalysts and processes to improve the efficiency of capture of carbon dioxide from power plants and other large stationary emissions sources.

Program results to date have shown that the combined CO2 Solution / Codexis proprietary technologies have the potential to significantly lower the capital and operating cost barriers associated with conventional technologies to capture carbon dioxide from power plant effluent gases. This progress led to CO2 Solution and Codexis entering into an exclusive Collaboration Agreement with an unnamed third party, described as a global leader in energy and infrastructure projects with over 5 billion dollars in annual sales, on December 3, 2010, covering the development and pilot scale testing of the technology for coal-fired power plants. Under the JDA, CO2 Solution's proprietary enzymatic method for the efficient capture of carbon dioxide from coal-fired power plants will be coupled with Codexis' directed enzyme evolution technology. The JDA will be extended until the later of June 30, 2012, or six months after the expiry of any third-party collaborations. <http://www.prnewswire.com/news-releases/co2-solution-announces-extension-of-joint-development-agreement-with-codexis-114113084.html>

Scientists who laid the foundations for Codexis technology were recently awarded the Draper Prize. Frances Arnold, Ph.D. and Willem P.C. "Pim" Stemmer, Ph.D., were announced as the 2011 recipients of the prestigious Charles Stark Draper Prize from the National Academy of Engineering for their individual work in directed evolution. Directed evolution allows researchers to guide the creation of certain properties in proteins and cells. It is used today in labs around the world and is the basis of the Codexis core technology platform. Drs. Stemmer and Arnold contributed to development of directed evolution through separate, individual research. Dr. Stemmer, co-founder of Maxygen, developed the DNA shuffling directed evolution technology which became the core technology for Codexis when it was spun out of Maxygen in 2002. He is currently CEO of Amunix, a protein pharmaceuticals company. In October 2010, Codexis acquired the Maxygen directed evolution intellectual property portfolio. Dr. Arnold, who served as a scientific consultant to Codexis, is the Dick and Barbara Dickinson Professor of Chemical Engineering and Biochemistry at the California Institute of Technology. For more information on their research and the NAE award, see <http://www.nae.edu/awards/>. <http://finance.yahoo.com/news/Codexis-Congratulates-prnews-2043261965.html?x=0&.v=1>



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