



Coal News and Trends

June 2009

Upcoming Web-Based Seminars:

- **Clean Coal Technology Webinars**

The International Trade Administration will host a series of web-based seminars throughout 2009 highlighting opportunities for U.S. clean coal technology, mining, and coal-fired power generation companies in overseas markets. The seminars will provide country-specific market overviews for U.S. companies interested in establishing or expanding exports in the clean energy sector. The series will be led by U.S. & Foreign Commercial Service energy/trade specialists in the targeted market. The dates and times for the upcoming webinars are as follows:

- *Opportunities for U.S. Companies in the Coal, Mining, and Power Generation Sectors of Vietnam, June 10, 2009*
- *Opportunities for U.S. Companies in the Coal and Mining Sectors of Australia and Philippines, June 30, 2009*

To register for this event or for additional information please refer to:

<http://www.buyusa.gov/pittsburgh/coalwebinars2009.html>, or contact

Shannon.Fraser@mail.doc.gov, 202-482-3609, or Steve.Murray@mail.doc.gov, 412-644-2819.

Coal Industry Trade Leads:

- **Coal-Fired Power Plant in Kenya, Kenya Electricity Generating Company**

The Kenya Electricity Generating Company (KenGen) completed a feasibility study for the construction of a 300 MW coal-fired power plant in the Mombassa region. The study advances the implementation of a coal fired power plant to be comprised of two units of 150 MW each and estimated to cost U.S. \$700 million. KenGen recently put forward a notice for Expression of Interest for a joint venture partner who will take on 60 percent equity, with KenGen owning the remaining 40 percent. Information on the EOI is available at:

<http://www.kengen.co.ke/Tenders.aspx?TenderId=0>

U.S. companies interested in this project are encouraged to contact Mary Masyuko, Commercial Specialist at the U.S. Embassy in Nairobi, at Mary.Masyuko@mail.doc.gov.

Upcoming Industry Events:

- **Clearwater Coal Conference, Clearwater, FL, May 31-June 4, 2009**

The Clearwater Clean Coal Conference program covers innovative and evolving technologies in a forum that encourages the exchange of information regarding power generation and policy issues. State-of-the-art information on coal utilization will be presented via technical papers, tutorials, panels, and plenary sessions. The International Trade Administration will provide an overview of 'Issues and Opportunities for Coal in Developing Countries' as part of the program of events. For additional information, please refer to: <http://www.coaltechnologies.com/>, or contact William.Lawton@mail.doc.gov, (954) 356-6640.

- **Coal-Gen Conference, Charlotte, NC, August 19-21, 2009**

Coal-Gen 2009 is the place for coal and power sector attendees to learn about the current state of the coal industry, including the challenges and opportunities ahead, current topics affecting coal-fired power plants, and the latest products and services. The International Trade Administration will provide an overview of 'Federal Climate Change Legislation and Implications for the U.S. Coal Industry' as part of the technical sessions. For additional information, please contact Shannon.Fraser@mail.doc.gov, 202-482-3609, or refer to <http://www.coal-gen.com/index.html>.

- **International Pittsburgh Coal Conference, Pittsburgh, PA, September 21-24, 2009**

The International Pittsburgh Coal Conference is hosted by the University of Pittsburgh, Swanson School of Engineering. As an outgrowth of a series of conferences spanning more than three decades, this annual event highlights coal utilization both in the United States and internationally. The conference is dedicated to providing a unique opportunity for in-depth and focused exchange of technical information and policy issues among international representatives from industry, government, and academia. For additional information or to register for the event, please refer to: <http://www.engr.pitt.edu/pcc/2009conf.html>, or contact Shannon.Fraser@mail.doc.gov, 202-482-3609.

Policy Analysis:

DOE Regional Partnership Begins Core Sampling for Large-Volume Sequestration Test Deployment Test to Investigate Carbon Storage in Brine-Saturated Formation http://fossil.energy.gov/news/techlines/2009/09033-CCS_Core_Sampling_Begins.html

Washington, D.C. – The Plains CO₂ Reduction (PCOR) Partnership, one of seven members of the U.S. Department of Energy's Regional Carbon Sequestration Partnerships program, has begun collecting core samples from a new characterization well near Spectra Energy's Fort Nelson natural gas processing plant in British Columbia, Canada. Core sampling, along with a sophisticated well logging program that the partnership is conducting, is an important step in proving the viability of carbon storage in brine-saturated formations.

The Fort Nelson project is on track to become one of the first commercial-scale carbon capture and storage projects in a saline aquifer in North America. With plans to inject over two million tons per year of carbon dioxide (CO₂), the project—an international collaboration that includes Spectra Energy, the Province of British Columbia, Natural Resources Canada, the PCOR Partnership, and the U.S. Department of Energy (DOE)—will also be one of the largest carbon sequestration projects in the world. Geologic carbon sequestration is expected to play an important future role in mitigating greenhouse gas emissions and combating climate change.

The project is one of two large-volume tests that the PCOR partnership is undertaking in the development phase of the DOE partnerships program, which focuses on large-volume carbon storage; the second test is planned for the Williston Basin in North Dakota. The partnership is also conducting four smaller-scale sequestration tests at locations across the Great Plains. All of the projects share the program goal of developing the technology, infrastructure, and regulations to implement large-scale CO₂ sequestration. As an added benefit, the projects are supporting more than 400 jobs that will continue through 2017.

Core sampling and well logging help determine a site's geologic suitability for safe and permanent storage of CO₂. Coring of the Elk Point rock formations at Fort Nelson will provide researchers, geologists, and reservoir experts with characterization data of the carbonate formations that will be used to store the CO₂ and the impermeable shale layers above that will act as a cap rock to contain the CO₂. As part of these activities, numerous geomechanical and geochemical tests designed to evaluate the performance of the reservoir and containment rocks will be performed.

The information collected from the core samples, together with tests and well logging, will be critical in developing simulation models and the anticipated design and implementation of CO₂ injection.

The project is expected to involve the eventual transportation of CO₂ from Spectra Energy's Fort Nelson natural gas processing plant to the injection site.

To ensure the safe storage of CO₂, the PCOR partnership will implement a comprehensive monitoring, verification, and accounting (MVA) plan for the project. Drilling, coring, and injection all provide opportunities to develop a set of cost-effective MVA protocols that can be applied in other locations to promote the safe, permanent storage of CO₂.

The development phase is the third phase of the Regional Carbon Sequestration Partnerships initiative. The characterization phase (2003–2005) defined opportunities for carbon capture and storage. The validation phase (2005–2009) generally involves small-scale field tests. These earlier phases determined that the PCOR partnership region has the geological potential to sequester more than half of the region's anticipated CO₂ emissions over the next 100 years.

The PCOR Partnership is managed by the University of North Dakota Energy & Environmental Research Center and includes more than 80 public and private partners in all or part of nine states (North Dakota, South Dakota, Minnesota, Montana, Wyoming, Nebraska, Iowa, Missouri, and Wisconsin) as well as four Canadian provinces (British Columbia, Alberta, Saskatchewan, and Manitoba). The National Energy Technology Laboratory manages the Regional Carbon Sequestration Partnerships program on behalf of the DOE Office of Fossil Energy.

DOE Study Monitors Carbon Dioxide Storage in Norway's Offshore Sleipner Gas Field

U.S. World-Acclaimed Marine Institutes Partner with Europeans in North Sea

http://fossil.energy.gov/news/techlines/2009/09032-DOE_Study_Monitors_CO2_Storage.html

Washington, D.C. – In a newly awarded project, researchers funded by the U.S. Department of Energy (DOE) are partnering with European scientists to track injected carbon dioxide (CO₂) in the world's first and longest running carbon storage operation located at the Sleipner gas field in the North Sea. The researchers—from the Scripps Institution of Oceanography at the University of California, San Diego, and the Lamont-Doherty Earth Observatory (LDEO) in New York—will conduct surveys on the seafloor to monitor injected CO₂ in the 1 kilometer-deep reservoir, where more than 10 million tonnes of CO₂ have been stored to date.

"This international effort demonstrates the commitment of the United States, and other countries that produce or use fossil fuels, to decrease greenhouse gas emissions by finding new ways to capture and safely store CO₂," said Dr. Victor Der, Acting Assistant Secretary for Fossil Energy. "The Office of Fossil Energy's Carbon Sequestration Program will benefit from this collaborative U.S.-European North Sea study by adding to our portfolio of successful technologies for CO₂ monitoring, verification, and accounting in geologic reservoirs."

An ocean vessel will position sensitive gravity meters on the seafloor using a ship-tethered remotely operated vehicle carrying the instruments. Data from the instrument packages on the seafloor will be transmitted to operators aboard the ship. Academic researchers from Scripps and LDEO will collaborate with their Norwegian colleagues from StatoilHydro in the analysis of the results. The project will create approximately eight full-time jobs per year, which will be supported throughout the two-year project.

The technology to be used in the project recognizes that, as gas is injected into the sandstone reservoir, the density of the formation is altered as water in the pore spaces is displaced by lower density CO₂. This density change affects the strength of the Earth's gravity field. Gravity surveys performed by the scientists at different times provide snapshots of the CO₂ plume migration deep below the seafloor. Surveys performed by Scripps in 2002 and 2005 validated the gravity technique as an effective monitoring tool and assessed CO₂ reservoir conditions for those years.

Since 1996, about one million tonnes of CO₂ per year have been injected into the Sleipner reservoir. CO₂ that is produced along with natural gas is separated on the production platform and re-injected into a sandstone formation at a depth of about 1,000 meters below sea level to prevent venting the gas to the atmosphere. A 80-meter-thick shale cap rock holds the CO₂ securely in place.

From 2004 to 2006, DOE supported an earlier research project at the Sleipner field, the now-completed CO₂STORE project, through its membership in the Carbon Sequestration Leadership Forum (CSLF). The CSLF, a voluntary, Ministerial-level international climate change initiative, facilitates the development and deployment of improved, cost-effective technologies for carbon capture and storage through collaborative efforts. The 22 members of the CSLF (21 nations plus the European Commission) account for 75 percent of all manmade CO₂ emissions.

Lessons learned from monitoring the Sleipner CO2 sequestration project reservoir can be applied elsewhere in Europe, the United States, and worldwide. DOE sponsors research at other international CO2 storage operations, including the Australian Otway Basin project, Germany's CO2SINK project, the Algerian In Salah gas field storage project, and Canada's Weyburn-Midale CO2 storage and enhanced oil recovery project.

The project is managed by the Office of Fossil Energy's National Energy Technology Laboratory.

Small-Scale Carbon Sequestration Field Test Yields Significant

Lessons Learned

Information from Ohio Project Will Aid Future Sequestration Efforts

http://fossil.energy.gov/news/techlines/2009/09031-CCS_Test_Yields_Valuable_Informati.html

Washington, D.C. – The Midwest Regional Carbon Sequestration Partnership, one of seven regional partnerships created by the U.S. Department of Energy (DOE) to advance carbon capture and storage technologies, has completed a preliminary geologic characterization and sequestration field test at FirstEnergy's R. E. Burger Plant near Shadyside, Ohio. The project provided significant geologic understanding and "lessons learned" from a region of the Appalachian Basin with few existing deep well penetrations for geologic characterization.

The initial targets for the geologic storage of carbon dioxide (CO2) at the site were the Oriskany and Clinton Sandstones at depths between 5,500 and 8,000 feet in the Appalachian Basin. This region is geologically complex and little is known about these formations, especially in the western portion of the basin. Since the nearest well penetrations are more than 20 miles away from the Burger injection well, any and all data collected from the region is useful in determining the suitability of potential field test locations for CO2 storage in the future.

Results of the formation evaluation indicated that the porosity, void space, and permeability of the target formations were lower than expected. The pressure in the formations also rose unexpectedly with very low injection rates. This does not mean that the entire western flank of the Appalachian Basin will show these same rock properties; instead, it confirms the complex nature of the formations within the basin. The work demonstrates the importance of extensive drilling, formation evaluation, and testing to characterize and identify appropriate formations for CO2 storage within the Appalachian Basin prior to injection.

Other lessons learned include the following:

- *Site Selection*—Although the Burger site was determined not to be in the optimal location for CO2 storage from a geologic perspective, it was an excellent place to drill and test because of the extensive cooperation provided by FirstEnergy and the potential to co-locate the storage site with the plant. Data derived from rock property models and characterization information suggested that the site would have good geologic storage potential; however, the pressures necessary to inject CO2 into the target formations proved to be much higher than anticipated. Additional testing methods must be developed to provide more information about the character of geologic formations chosen for injection testing. Power plants in the Appalachian region may eventually need to transport CO2 relatively short distances to areas that have adequate storage formation characteristics.
- *Design of Robust Formation Imaging, Evaluation, and Testing Program*—Because of the geologic complexity of this region, a robust wire line logging, imaging, and testing program should be designed and implemented at every potential geologic storage site considered within the region. Stakeholder understanding of the type of data collected from the various logging and testing tools and its interpretation will benefit future siting decisions. This evaluation plan will decrease overall costs at future field test sites. If economically feasible, drilling a pilot hole prior to drilling the injection hole would be ideal to develop a robust logging, coring, and testing program.
- *Formation Stimulation*—As part of the project design process, project developers should request the ability to hydro-fracture the formation to create fractures that extend from a borehole into the targeted formation. This could provide a better injection rate into rocks that have moderate porosity and low effective permeability.
- *Well Completion*—Project developers should also consider plans to complete the well at the target formation. Given the low permeability and porosity that exist at some areas in the

Appalachian Basin, care should be taken so that well drilling and construction operations do not reduce or eliminate the effective permeability that is naturally present.

- *Communications*—Continuous communications with all stakeholders, including those who are non-technical, is vital throughout the field testing process, especially at key decision points, including collection of data to allow informed decision-making.

Ultimately, the goal of geologic sequestration field testing is to successfully demonstrate the viability of safely storing injected CO₂ in geologic formations. To achieve this goal, DOE will continue to collect pertinent geologic information as part of its characterization phase within the Appalachian and other basins. Drilling deep wells into proposed injection zones, performing formation evaluations to understand their rock properties, and testing injection capability within the zones are all necessary to develop a clear understanding of the overall potential of geologic formations to store CO₂.

As DOE and its partners continue to gain understanding and experience related to geologic carbon storage by extensive characterization and injection of CO₂ at various sites across the United States and Canada, various best practices will be developed for undertaking sequestration projects. These best practices will provide guidance on site selection through monitoring of stored CO₂ after injection and well closure.

The Midwest Regional Carbon Sequestration Partnership is managed by the Battelle Memorial Institute, headquartered in Columbus, Ohio. The characterization and test were sponsored by the DOE Office of Fossil Energy's National Energy Technology Laboratory, with support from FirstEnergy, Praxair, and the Ohio Geological Survey.

Secretary Chu Announces \$2.4 Billion in Funding for Carbon Capture and Storage Projects

Funds to Advance Research, Development and Deployment of Carbon Capture and Storage Technologies and Infrastructure

http://fossil.energy.gov/news/techlines/2009/09029-DOE_Announces_Stimulus_Funding.html

Washington, D.C. – U.S. Secretary of Energy Steven Chu recently announced at the National Coal Council meeting that \$2.4 billion from the American Recovery and Reinvestment Act will be used to expand and accelerate the commercial deployment of carbon capture and storage (CCS) technology. The funding is part of the Obama Administration's ongoing effort to develop technologies to reduce the emission of carbon dioxide, a major greenhouse gas and contributor to global climate change, into the atmosphere while creating new jobs.

"To prevent the worst effects of climate change, we must accelerate our efforts to capture and store carbon in a safe and cost-effective way. This funding will both create jobs now and help position the United States to lead the world in CCS technologies, which will be in increasing demand in the years ahead," said Secretary Steven Chu. The Department is posting Notices of Intent to issue this funding, supporting the following initiatives:

Clean Coal Power Initiative: \$800 million will be used to expand DOE's Clean Coal Power Initiative, which provides government co-financing for new coal technologies that can help utilities cut sulfur, nitrogen and mercury pollutants from power plants. The new funding will allow researchers broader CCS commercial-scale experience by expanding the range of technologies, applications, fuels, and geologic formations that are tested.

Industrial Carbon Capture and Storage: \$1.52 billion will be used for a two-part competitive solicitation for large-scale CCS from industrial sources. The industrial sources include, but are not limited to, cement plants, chemical plants, refineries, steel and aluminum plants, manufacturing facilities, and petroleum coke-fired and other power plants. The second part of the solicitation will include innovative concepts for beneficial CO₂ reuse (CO₂ mineralization, algae production, etc.) and CO₂ capture from the atmosphere. In addition, two existing industrial and innovative reuse projects, previously selected via competitive solicitations, will be expanded to accelerate scale-up and field testing:

- Ramgen Modification (\$20 million): funding will allow the industrial-sized scale-up and testing of an existing advanced CO₂ compression project with the objective of reducing time to commercialization, technology risk, and cost. Work on this project will be done in Bellevue, WA.
- Arizona Public Services Modification (\$70.6 million): funding will permit the existing algae-based carbon mitigation project to expand testing with a coal-based gasification system. The goal is to produce fuels from domestic resources while reducing atmospheric CO₂ emissions. The overall

process will minimize production of carbon dioxide in the gasification process to produce a substitute natural gas (SNG) from coal. The host facility for this project is the Cholla Power Plant located in Holbrook, AZ.

Geologic Sequestration Site Characterization: \$50 million will fund a competitive solicitation to characterize a minimum of 10 geologic formations throughout the United States. Projects will be required to complement and build upon the existing characterization base created by DOE's Regional Carbon Sequestration Partnerships, looking at broadening the range and extent of geologic basins that have been studied to date. The goal of this effort is to accelerate the determination of potential geologic storage sites.

Geologic Sequestration Training and Research: \$20 million will be used to educate and train a future generation of geologists, scientists, and engineers with skills and competencies in geology, geophysics, geomechanics, geochemistry and reservoir engineering disciplines needed to staff a broad national CCS program. This program will emphasize advancing educational opportunities across a broad range of minority colleges and universities and will use DOE's University Coal Research Program as the model for implementing the program.

The funding from the Recovery Act is a direct investment in CCS-related infrastructure encompassing a diverse portfolio of research and demonstration among electric power and industrial facilities, academic institutions, and other organizations operating across the United States. DOE's Recovery Act projects will stimulate private sector infrastructure investments due to the significant amount of cost sharing that will occur in all large-scale projects to be selected for implementation. These combined public and private investments will establish a proving ground for creating a safe, reliable, widely-available, environmentally-responsible, and affordable CCS infrastructure.