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## Highlights 2009 CCS Conference

### The Eighth Annual Conference on Carbon Capture & Sequestration

**WYOMING GOVERNOR FREUDENTHAL, AEP CEO MIKE MORRIS, KEY GLOBAL LEADERS  
ADDRESS 700+ PARTICIPANTS AT 2009 ANNUAL CCS CONFERENCE**

The Eighth Annual Conference on Carbon Capture and Sequestration, sponsored by ExchangeMonitor Publications & Forums in partnership the National Energy Technology Laboratory, the Department of Energy and several leading companies and organizations directly involved in CCS projects, again attracted more than 700 participants representing some 20 countries to Pittsburgh. Led by keynote speakers like **Wyoming Governor Dave Freudenthal, American Electric Power CEO Michael Morris, Natural Resources Defense Council Director of Climate Programs David Hawkins and the Department of Energy's acting Assistant Secretary for Fossil Energy Victor Der**, the conference explored all facets of CCS, from financing and policy issues to transportation and regulatory frameworks. In addition, more than 250 technical papers were presented on the latest CCS research and technology development



# Special 2009 CCS Conference Report...

## FEDERAL INVESTMENT THE KEY TO COMMERCIAL DEPLOYMENT OF CCS

PITTSBURGH—Carbon capture and sequestration technology will need significant government investment if it is to be deployed at the commercial scale, financiers and industry executives told attendees at the 8<sup>th</sup> Annual CCS Conference earlier this month. The financial industry, which already would be somewhat risk averse when considering involvement in a CCS project, has become even more reluctant as the lending market has tightened with the worldwide economic downturn. In addition, in most areas of the country, rate increases have not kept pace with the costs of deploying CCS, meaning “project financing then becomes almost entirely dependent on government support,” Barclays’ Theodore Roosevelt IV explained. “Public utility commissions are rightfully viewed as political entities and the truth is, despite consumer complaints, the rates have not kept up to the capital investments, which are at historical lows. Because PUCs are inconsistent in their rulings ... gaining financing from that sector becomes either impossible or prohibitively costly.”

General Electric’s Director of Gasification Operations Tim Huskey also emphasized the need for significant government support, pointing out that CCS projects are an immense financial burden on private industry. “At that commercial size, commercial scale ... [these companies] are paying for a lot of people that are going to be following them, so it’s probably appropriate for the government to provide incentives,” Huskey explained, adding that some legislative vehicle for advancing CCS would be the best first step to ramping up even greater sources of government funding. “If there’s no assurity on some price or some value of that emission, it’s going to be very hard for that technology provider to move forward,” Huskey explained. “Cap-and-trade is appropriate for emissions reductions...[but] it won’t motivate a technology revolution.”

### Government Investment Increasing

The Obama Administration, at least in the early stages, appears to be listening. Though the President’s Fiscal Year 2010 budget request includes a cut for the Department of Energy’s coal R&D funding from current levels, the American Recovery and Reinvestment Act includes more than \$3.4 billion for CCS development and deployment over the next two years. “If there’s a way to bring more money to the table for CCS, I think that’s a good thing,” said DOE acting Assistant Secretary for Fossil Energy Victor Der, adding, “It’s a learn by doing process that allows us to move CCS forward better, faster and cheaper.”

Der told conference attendees that driving down the expense of CCS would not only be important to the U.S., but globally as well. “[Commercial CCS deployment] is not going to happen in developing economies unless we find a way to bring that cost down,” Der said, adding that Secretary of Energy Steven Chu “is interested in doing true collaboration on an international basis. He wants to be able to share that ‘know-how.’”

### Information the Best Stimulant to Public Support

Government funding and a risk-averse financial sector aren’t the only stop-ups for CCS deployment, Roosevelt said. “Let’s do a bit of reconnaissance here,” Roosevelt said, noting that public opinion about capturing and storing CO<sub>2</sub> emissions could play a huge role in how involved the government is going to be in helping get CCS deployed. “The field of public opinion, unfortunately, also is one in which much of the financial requirements for the power sector must be rested,” Roosevelt said, adding that environmental groups have played a significant role in how U.S. energy consumers view the idea of ‘low-carbon’ or ‘clean coal’ technologies. “The pollenization of science on both sides is diminishing the trust that the public places in [CCS] and those who speak for it,” he said.

That’s why explaining to the public how CO<sub>2</sub> is captured and stored is important, explained John Barry, Vice President of Unconventionals and Enhanced Oil Recovery for Shell International. “Public acceptance is an issue which I think I underestimated,” Barry said, adding that it can be “potentially a deal-breaker for many projects.” If done right, though, explaining the mechanics of storing CO<sub>2</sub> is relatively easy to do, said Frank Shilling of the Center for CO<sub>2</sub> Storage at the Helmholtz Centre Postdam in Germany. Through simple demonstrations with CO<sub>2</sub> in beverages and sandstone absorptions of CO<sub>2</sub> in water, Shilling said locals were able to visualize and understand why CO<sub>2</sub> storage would not be a dangerous addition to their backyards. “We tried to involve the local public,” Shilling explained. “We tried to explain why and what we were are doing. The locals want to be involved. It’s their backyard.”

### EOR May Reduce Cost, But Not An Absolute Fix

As cost prohibitive as CCS currently seems, however, there are ways those costs can be reduced, many speakers at the conference said, most notably through the sale of captured CO<sub>2</sub> emissions for use in enhanced oil recovery (EOR). At roughly \$20 per ton of captured CO<sub>2</sub>, EOR is also far more attractive for companies seeking to capture their CO<sub>2</sub> while also lowering costs. “There isn’t very much money in CO<sub>2</sub> storage. You need to do it in an eco-

conomic way,” explained Shell’s Barry. Beneficial reuses of CO<sub>2</sub>—especially with historically viable options like EOR—can help significantly, according to Barry and ExxonMobil Vice President of Environmental Policy and Planning Sherri Stuewer. “There are a number of project opportunities that we’re pursuing right now,” Stuewer explained, noting that ExxonMobil’s LaBarge, Wyoming CCS project sells a portion of its CO<sub>2</sub>.

But EOR isn’t the silver bullet that will be needed to reduce costs associated with CCS, Enbridge’s Alternative and Emerging Energy Vice President Chuck Szmurlo said. “It’s always everyone’s first choice but the volumes for that are not as big as the targets.” Enbridge, which is a large player in gas transportation and distribution in both Canada and the U.S., is currently at work on several CCS projects in Canada, although Szmurlo said that in order for the technology to go commercial, government intervention and consortiums would be much needed. “Energy security is not a free thing,” he told the audience. “We need to begin that clean energy dialogue that includes U.S. cooperation with the Canadian CCS projects.” Such a collaboration seems likely, as the President met with Canadian Prime Minister Stephen Harper (*GHG*, Vol. 4, No. 7) and a Montana-Saskatchewan partnership is already underway.

### Reducing Transport Costs Could Be Key

Additionally, Szmurlo estimated that at an anticipated cost of \$60-100 per metric ton of CO<sub>2</sub> for capture and storage, transportation of the CO<sub>2</sub> alone could also be a huge portion of the CCS financing pie. Szmurlo’s cost estimates put transportation costs at approximately \$20-36 per MT, versus roughly \$25-45 per MT for CO<sub>2</sub> capture. With estimates for transportation of CO<sub>2</sub> in the same cost neighborhood as capture, sequestration siting will likely be a key aspect in reducing overall CCS deployment costs. “Siting CCS projects is fundamentally more complicated than traditional power projects,” Hydrogen Energy International’s Director of Technology and Engineering Mark Davies said. “Keeping everything close keeps the cost down.”

Plentiful saline aquifer space provides a close and abundant resource for storing CO<sub>2</sub> emissions and cutting costs, according to Sally Benson, director of the Global Climate and Energy Project at Stanford University. “There are certain clusters where there are a large number of emissions sources [in the U.S.]...and they match up very nicely with the location of some large saline aquifers,” Benson noted. In Canada, where Enbridge is currently working on the Alberta Saline Aquifer Project (ASAP)—in which they hope to complete several pilot-scale CCS projects by 2015—Szmurlo said that the project sites were also “selected based on proximity to pipelines.”

### CO<sub>2</sub> as a ‘Slurry Pipeline’?

As another cost-saving measure, Szmurlo also advocated using CO<sub>2</sub> as a ‘slurry pipeline’ for transporting solids. “We’ve been using water to transport coal for a long time and we know that I can be done. And as it turns out, from research that [Enbridge has] done, CO<sub>2</sub> is a much better storing agent than water for storing solids,” Szmurlo explained. Although on its own, the process wouldn’t necessarily be profitable, Szmurlo stressed that “if you’re going to transport the CO<sub>2</sub>...anyways for environmental reasons, we think it makes a lot of sense to carry a hitchhiker to pay some of the costs and reduce overall costs” incurred by the industry and the public. “Many hands make light work,” Szmurlo said of the concept, which would have the benefit of delivering goods dry, rather than wet like traditional water transport. Once used for transportation, the CO<sub>2</sub> could then be used in either CO<sub>2</sub> storage or EOR, he said. ■

### REGULATORY FRAMEWORKS FOR CCS DOMINATES DISCUSSION AT CONFERENCE

PITTSBURGH—Long-term pore space liability for carbon capture and sequestration should be the responsibility of the federal government—not individual states, or even those sequestering CO<sub>2</sub> emissions—Wyoming Governor Dave Freudenthal (D) said during remarks at the 8<sup>th</sup> Annual Carbon Capture and Sequestration Conference earlier this month. “There is no corollary in oil and gas law for injection of massive amount of material,” Freudenthal said of CO<sub>2</sub> storage. Enhanced oil recovery (EOR) practices via CO<sub>2</sub> injection have long been used in the oil and gas business for extracting hard-to-reach oil reserves, but sequestering CO<sub>2</sub> for long-term storage and pollution mitigation is an area that is still quite experimental, Freudenthal explained. “I think it’s an important concept. At some stage we’re going to have to have a program that provides for a backup. It’s my view that we’re going to transferring [the risk] to the federal government,” he said.

### Wyoming Makes Industry Carry Risk

Although Freudenthal said the federal government should be ready to accept the long-term responsibility for storing CO<sub>2</sub> emissions, he noted the need for states to begin action now on creating frameworks to accommodate large-scale storage. “We decided to take a crack at it,” Freudenthal said of Wyoming’s HB 58 legislation, noting that the emerging regulatory environment for CCS “is a very complicated question”—especially when deciding who should take on the liability of stored emissions that will likely be in the ground for years. “We decided that the

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state owns the pore space,” Freudenthal said, but added that for the long-term matter of liability, “we confirmed, from our point of view that the injector has liability for the material for the life of the material.” That means that in the event of CO<sub>2</sub> leakage or escape—which Stanford University’s Global Climate and Energy Project Director Sally Benson noted is actually very low—the injector would largely be responsible for any resulting damage.

Other CO<sub>2</sub> storage legislation in Wyoming includes HB 57, which stipulates that the mineral rights of subsurface space supercedes the right to sequester CO<sub>2</sub> in a particular location; and HB 80, which requires those looking to sequester CO<sub>2</sub> to make agreements with at least 80 percent of landowners who could be affected by subsurface storage of emissions.

### **Other States Offer Different Alternatives**

Regulatory approaches for sequestering CO<sub>2</sub> largely vary between states, with many still lacking any sort of legal framework at all. In Illinois, the proposed site for the near-zero emissions FutureGen plant, the state would assume liability for injected CO<sub>2</sub> emissions and any resulting consequences. In states like Texas, where untapped oil reserves are abundant, legislators have looked at offering tax incentives for CO<sub>2</sub> storage, as well as the possibility of taking on legal liability. Speaking of Wyoming’s approach, Freudenthal acknowledged, “It is probably the most complex piece of legislation and the one where we’re furthest out on the limb.”

### **Academics Say Federal Involvement Important**

When it comes to the level of involvement from the federal government, academic policy experts at the CCS conference had varying perspectives. “In the U.S. we have this incredible patchwork of frameworks,” said Granger Morgan, head of Engineering and Public Policy at Carnegie Mellon University. He said there are two key regulatory issues emerging at both the federal state levels—legal access to deep geological pore space ownership and how to develop solutions for the liability of an injected plume’s long-term stewardship. “We think there needs to be new federal legislation that says CCS serves a national interest,” Morgan said, adding that the best way to pursue a federal route for pore space injection would include an expanded federal program for the Environmental Protection Agency’s UIC permitting program, an adequate dissemination of information to inform mineral right holders and give active user’s primacy, an enhanced permitting process for legal rights to inject in pore spaces

and legislative constraints on tort claims regarding pore space injection.

Concerning liability issues, Morgan said the creation of a ‘Federal Geologic Sequestration Board,’ independent of state and federal agencies, for approving projects and granting licenses could be an effective method for increasing the efficiency and bureaucratic issues associated with trying to deal with some of overlapping, piecemeal approaches currently in place. The independent board could also be tasked with overseeing a single, national and performance-based fund to cover the costs of long-term stewardship and possible future remediation of issues associated with utility and mineral interest affect by the storage of CO<sub>2</sub> emissions. “Whatever the numbers are, you don’t want to have to build up a pool like that in every state,” Morgan said, adding, “We think you need to build a bunch of commercial-scale plants and get the experience.” Morgan declined to comment, however, on how much it would cost to implement such a board or fund. “Am I ducking? Yes. Because I don’t know what the number is.”

Stanford’s Benson also noted the importance of a federal program for resolving some of the major issues associated with liability and pore space ownership. “The institutional issues—the liability issues—are really slowing things down,” Benson said. “A government-sanctioned effort to bring together all the right people ... would go a long way to making [CCS] more attractive for accelerated deployment.” She added, “I think CCS creates really unique challenges. These are not groups of people who have worked together in the past. We need to gain experience. We need to engage the private sector. ... Beyond institutional issues, let’s start by solving [the issues] by getting all the right people around the table.”

### **Interim Approach Could be Used Now**

Although the most efficient method for permitting and pore space injection and liability will ultimately take much time and analysis at the federal level, Carnegie Mellon’s Program Manager for Engineering and Public Policy, Sean McCoy, said an interim approach could be taken to speed up commercial-scale deployment. “A number of commercial-scale plants could be built today using ad-hoc arrangements. A new regulatory framework could be put in place now,” McCoy explained, noting that Carnegie Mellon would be working this year to produce a comprehensive manual that would include some of the best perceived ways to create a national framework for carbon capture and geologic sequestration, including recommendations for siting, liability, pore-space ownership, and the EPA’s UIC permitting process.

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## Private Insurance Another Option

Some conference panelists said, though, that comprehensive regulatory frameworks aren't the only way for industries interested in CCS technologies to protect themselves against major risks. One example put forth was new, and first-of-a-kind, insurance options offered by Zurich Financial Services. Some of the insurance options offered by Zurich include risk management for transportation of compressed CO<sub>2</sub> emissions either for storage or EOR injection, operation of the actual injection process—the point at which Benson noted the risk of an unexpected event is most likely, plugging and post-closure of sequestration wells, and the liability of long-term stewardship.

Zurich CEO Lindene Patton said how CCS is deployed will greatly depend on how risks associated with sequestration and transportation are identified. “If we deploy CCS with a ‘fat tail,’ that’s not good for any of us,” Patton said, explaining that a fat tail occurs “when you put together a risk profile and you’ve forgotten or not realized that risk increases over time because you’ve mischaracterized your risk suite.” While Patton noted that the risks associated with the long-term, if not permanent, storage of CO<sub>2</sub> “rarely, if ever goes to zero,” Zurich’s insurance services for protecting industry help provide protection of private industry assets. “There are lots of options here. Insurance is not the only one ... but we are making the first step,” Patton explained. “This is the part where you need political leadership and people need to insist upon it before we move forward.”

## New Regulations Still Important

Patton also noted that while prior liability frameworks, such as the 1957 Price-Anderson Act that provides liability protection for nuclear-related accidents, give some idea of what the government could be diving into with geologic sequestration, “not one” addresses stewardship. Patton also warned that Zurich’s insurance options “will not substitute for public policy leadership.” An interim report issued by Carnegie Mellon also warns that “if such a balance is not struck through legislation that establishes a general regulatory framework for CCS, the issues will be resolved through individual suits in the courts, and may not achieve [an] optimal balance of social objectives” from both industry and the government.

Additionally, Patton said that while Zurich is “willing to put a stake in the ground ... to deal with fortuitous risks,” like most other non-CCS related insurance, if a client knowingly injects CO<sub>2</sub> improperly or carelessly disregards certain aspect on long-term CO<sub>2</sub> monitoring, Zurich would not insure them against private or government lawsuits or

finances. “One of the potential events that can result from CCS is you could have migration of the gas ... that goes into potable water. Insurance does not help anymore when you’re continuing a wrongful act—letting gas escape to potable water or the atmosphere when you know it is happening.” When asked about the costs of insuring private or government geologic sequestration and other aspects of CCS, Patton noted that the price signals offered by Zurich also provide an idea of whether or not a project should move forward. “My advice to people is that if you find our premium rates are not competitive ... don’t ignore the price signal we are sending you.” Insurance costs could be in the neighborhood of \$5,000 per \$1 million per annum, although it is likely that as more carriers come into the marketplace annual rates would likely become more competitive—not unlike CCS deployment itself. ■

## PUBLIC OUTREACH KEY TO CCS PROJECT SUCCESS, EXPERTS SAY

PITTSBURGH—The permitting process for carbon sequestration projects and local public awareness are key drivers in a project’s success, panelists said during a discussion headed by Sarah Wade of the World Resources Institute at the 8<sup>th</sup> Annual CCS Conference, held here earlier this month. Panelists discussed how several projects have made it through the permitting process and what kinds of recommendations they would make to other utilities and research organizations looking to do the same. “It’s best to have varying degrees of technical information. Be prepared for the full-range of audience knowledge,” said West Coast Regional Sequestration Partnership (WESTCARB) Outreach Coordinator Richard Myhre of the public hearing process for new sites.

## Public Outreach and Info Important

Although the hearing process varies from state to state, and in some states is not required at all, most of the panelists agreed that it was an important part of properly informing the public about new development plans. “In Illinois, you can get a permit without holding a public hearing, but if someone requests a hearing, it can delay your permitting process,” warned Sallie Greenberg, Communications Coordinator with Illinois State Geological Survey. Another panelist, Judith Bradbury of the Midwest Regional Carbon Sequestration Partnership (MRCSP), stressed that even if hearings are not required, dissemination of information for the public is still very important. “The public meetings really need to be supplemented,” Bradbury said, adding, “It’s really important to see the meeting not as a be all and end all, but as a process for keeping the people informed.

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Additionally, local news outlets can also play a key role in the permitting debate, said Gary Garrett who works with the Southern States Energy Board and SECARB. In many projects, Garrett said, the editorial board of a local newspaper can play a central role in the success of a project. “Don’t sell the use of social media short,” agreed Steve Gates, Senior Communications Manager with the American Coalition for Clean Coal Electricity. Gates said the use of media and editorial boards are “a positive way to energize people—to make them feel like they’re a part of something.” Gates also noted that “those who are going to be most receptive are those on the lower end of the economic scale,” since any effort to scale back energy costs will net them the most significant relative savings. Representation is also a key part of the public information process, according to the panelists. “The spokesman makes a big difference when you’re in a community where the utility is used to being there,” Garrett explained. Greenberg agreed, saying, “If a region has familiarity with oil and gas or natural gas storage...the concept of what you’re trying to do is not as hard to get across.”

### **Stiff Opposition Hard to Overcome**

While the panelists noted that most communities where geologic storage is most viable tend to be familiar with the process and are often welcoming of it, there will likely be opponents, many of whom have the weight of a large environmental community behind them. “There are some communities that no matter what you do, they’re never going to see sequestration as an opportunity,” Greenberg explained. The panelists noted, however, that the best way to gain support is to have people on hand willing to answer questions. “The really nice idea about the public meetings is to have some experts on hand to answer questions. There’s always some people who might ask some controversial questions,” Garrett said. For fence-sitters or those new to the idea of CO<sub>2</sub> storage, panelists said the most frequent concerns and questions regarding included fears that the community would become a dumping ground for others’ CO<sub>2</sub>, geologic repercussions like leakage, and why a particular site in their community was selected. Overall, however, as long as the public is given adequate and updated information, the panelists agreed that in most cases community support isn’t too difficult to garner. ■

## **STUDY: CHINA’S CO<sub>2</sub> STORAGE POTENTIAL GREATER THAN INITIALLY THOUGHT**

PITTSBURGH—China could have more storage potential for captured CO<sub>2</sub> than initially anticipated, according to an early assessment conducted by Battelle Memorial Institute’s Pacific Northwest Division. “There does appear to be significant potential in the geologic storage basins of China,” said Robert Dahowski, lead researcher of the study, *China: Regional Opportunities for CO<sub>2</sub> Capture and Storage*. Although it has not yet been published, Dahowski shared the latest details of the Battelle study at the 8<sup>th</sup> Annual CCS Conference here earlier this month. “We think there is more capacity than previously thought [in China],” Dahowski said, which he explained will be important, since the emerging nation has more than 1,600 sources of CO<sub>2</sub> and emits nearly 4,000 megatons of CO<sub>2</sub> per year.

### **China’s Storage a Viable Future Option?**

Of the potential 2,300 gigatons of storage capacity estimated by Dahowski, approximately 2,288 GT of that would come from deep saline formations onshore, making up roughly “99 percent of [China’s] total onshore potential.” The 1 percent remaining in onshore subsurface storage potential, according to Dahowski, would come from depleted oil fields, enhanced oil recovery, and unmineable coal seams. Dahowski conceded, however, that the Battelle findings are incomplete and still contain “a number of uncertainties.” But if the study’s projections are correct, the cost of storing CO<sub>2</sub> could be far-reduced, since it wouldn’t have to be shipped offshore or elsewhere to be stored. “Ninety-one percent of large CO<sub>2</sub> point sources have a storage candidate within 100 miles [in China],” Dahowski said, adding that up to 83 percent of sources have storage options within just 50 miles them.

The areas where CO<sub>2</sub> storage seems to lack in China is near coastal regions, where Dahowski said onshore storage options are much more difficult to find. But while CO<sub>2</sub> storage in China is demonstrably more limited than other countries, if even a small portion of Battelle’s projections are correct, Dahowski said it would be a viable interim solution. “If only 10 percent of projected capacity is available, CCS would still be a viable option for China,” Dahowski said. “I think we will see significant advances in China looking at CCS and other advanced energy technologies,” he added. ■

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