CCS REGULATION

NEWSLETTER

Welcome to the CCS Regulation newsletter. This is produced by the **MIT Carbon Capture and Sequestration Technologies Program**. It is a quarterly report designed to keep the reader up to date with the current regulatory news and issues surrounding Carbon Capture and Storage (CCS).
For more information about the program please see http://sequestration.mit.edu

Interview with Dr. Ruben Juanes
Fracking and CCS

Dr. Ruben Juanes is an Associate Professor in Energy Studies in MIT's Department of Civil and Environmental Engineering. He is a computational geoscientist and engineer with a strong interest on the physics of multiphase flow in porous media. He has kindly shared his thoughts on the interaction of fracking and subsurface CO_2 storage.

• *What is fracking?*

Some geological formations have very low porosity and permeability (the natural ability to conduct fluids), they are classified as being 'tight'. If you want to extract hydrocarbons from these tight formations you cannot just rely on the natural permeability, as the production rate will be very low. In order to enhance this rate, the common practice in the oil industry is to fracture the rocks around the well thereby opening up the formation. This is known as hydraulic fracturing or fracking.

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• *How is this done?*

Fracking is achieved by injecting water into the well at a very high rate. This water overcomes the confining stress of the overburden and fractures the rocks in the surrounding formation.

• *How long have people been using fracking and where?*

Fracking has been used in the hydrocarbon industry for decades. More recently fracking has been combined with horizontal drilling thereby enhancing permeability at a much larger scale. The combination of these two technologies produces a horizontal well that is then hydraulically fractured at various intervals. This produces a much larger fractured area than would be achieved with a single vertical hole. This method has revolutionized the way some formations are produced, like oil and gas shales.

• *How is fracking going to have an impact on CCS?*

This could impact underground CO_2 storage because these shield formations are often thought of as the cap rock for saline aquifers where you want to store the CO_2. Typically this fine-grained rock is top of the geologic sequence and can be from a few meters to hundreds of meters thick. But if you fracture it to produce gas, then you could compromise the integrity of the cap rock.

Do you think that this is an issue?

I think that this is something to be aware about rather than an issue. Michael Celia, from Princeton, first pointed this out in a recent publication. He raised the point that there could be a conflict of interest between the production of gas and the storage of CO_2: If you use hydraulic fracturing to fracture the shales and then want to use that same rock as a the cap rock to prevent vertical migration of injected CO_2.

However, there is not one single stratum where you would inject the CO_2 and produce tight gas. You typically have multiple fine-grained layers acting as the cap rock within a formation and multiple sequences of high and low permeability horizons within the sedimentary basin. And while there could be an areal overlap between areas with potential shale production and saline aquifers, CO_2 injection would only be considered at specific depths and not throughout the entire depth range of the geologic basin. It is this 3 dimensionality that gives you the flexibility to accomplish both goals. One should be able to manage these two resources without conflict.

• *What is the future of CCS in the subsurface with fracking ?*

If CCS takes off there will be, in principle, plenty of storage space to begin with. But eventually, if these two operations begin to interact and interfere then there will probably be the need to define their interaction and require some kind of joint management.

We thank Ruben Juanes for his contribution to this newsletter.

For more question you can email Ruben Juanes at juanes@mit.edu

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Federal CCS Regulation News and Updates

March 27, 2012. The EPA proposed the New Source Performance Standards (NSPS). The standard requires new fossil-fuel electric generating units greater than 25 MW to meet a "standard of performance" of no more than 1000 pounds of CO_2 emitted per MW hour. This standard is under Section 111 of the Clean Air Act.
http://www.epa.gov/oecaerth/monitoring/programs/caa/newsource.html

March 10, 2012. NETL has issued a Funding Opportunity Announcement in support of the Carbon Storage Program titled "Technologies to Ensure Permanent Geologic Carbon Storage". The objective of the Funding Opportunity Announcement is to request applications that develop technologies and simulation tools to ensure geologic storage of CO_2.
http://www.carboncapturejournal.com/displaynews.php?NewsID=908

March 6, 2012. Sen. Bingaman (D-NM) introduced Clean Energy Standard Act of 2012. The proposal is a cap-and-trade scheme where credits would allotted to generators based on their emissions. This framework would allow for a variety of generation technologies and generators who produce fewer emissions per unit of electricity would be granted more credits.
http://ase.org/resources/sen-bingaman-introduces-clean-energy-standard-112th-congress

February 28, 2012. The National Enhanced Oil Recovery Initiative released recommendations to boost domestic oil production and reduce CO_2 emissions through the expanded use of EOR. The proposed federal tax credit would quadruple U.S. oil production from EOR, to 400 million barrels a year, while reducing CO_2 emissions by 4 billion tons over the next 40 years. The program would pay for itself within 10 years and have an estimated net return of $100 billion over 40 years. The incentive also would save about $610 billion on imported oil over the same period.
http://www.c2es.org/initiatives/eor

State CCS Regulation News and Updates

California

April 16, 2012. A California Senate Committee approved S.B. 1139 to allow the state to establish a regulatory framework for the permitting and operation of CCS projects at power plants and refineries. The measure sets a January 1, 2015, deadline for the state board to adopt a final methodology for CCS demonstration projects. Introduced on February 21, 2012, by Sen. Rubio (D) the bill eliminates current gaps between federal and state regulations governing CCS projects, including underground injection controls and protection of drinking water supplies. It directs the Division of Oil, Gas and Geothermal Resources to regulate CO_2 injection for EOR projects and the State Fire Marshal regulation of CO_2. intrastate pipelines.
http://www.californiaenvironmentallawblog.com/air/carbon-sequestration-bill-advances-in-california-legislature-1/

April 15, 2012. The California Council on Science and Technology released a new publication as part of California's Energy Future Project. The document "Electricity from Renewable Energy and Fossil Fuels with Carbon Capture and Sequestration" examines electricity generation through fossil fuel combustion with CCS.
http://www.carboncapturejournal.com/displaynews.php?NewsID=925&PHPSESSID=21ddmqu9duso3dkigo80g5htj7

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International Regulatory News

UK

April 3, 2012. The UK has relaunched its $1.6 billion CCS competition 5 months after the collapse of its last competition due to escalating costs. There are currently 16 companies in the competition.
http://uk.reuters.com/article/2012/04/03/us-britain-ccs-competition-idUKBRE8320GU20120403

April 10, 2012.The Department of Energy and Climate Change has published the first UK CCS Roadmap.
http://www.carboncapturejournal.com/displaynews.php?NewsID=922

April 25, 2012. The UK has pledged $97 million for CCS in emerging markets.
http://captureready.com/EN/Channels/News/showDetail.asp?objID=2668&isNew=

April 10, 2012. The UK Engineering and Physical Sciences Research Council and the Department of Energy and Climate Change (DECC) have announced a £13 million investment to establish a UK CCS Research Centre which will oversee a program of studies on all aspects of CCS.
http://www.carboncapturejournal.com/displaynews.php?NewsID=923

March 5, 2012. Scotland plans to fit all of its existing coal fired power plants with CCS by 2025. Currently all new construction coal fired power plants greater than 300 MW have to be built capture ready.
http://uk.reuters.com/article/2012/03/05/uk-scotland-energy-report-idUKTRE8240RN20120305

EU

April 17, 2012. The European Investment Bank (EIB) has raised around 182 million euros ($239.78 million) from the sale of 21.6 million European Union carbon permits in March, fetching an average price of 8.43 euros a ton. The bank has raised nearly 489 million euros ($645 million) since it started selling so-called EU Allowances (EUAs) in early December 2011.
http://af.reuters.com/article/energyOilNews/idAFL6E8FC5S320120412

South Africa

May 7, 2012. South Africa's Cabinet has endorsed the Carbon Capture and Storage Roadmap. The roadmap has been accepted so that CCS can help fossil fuel reliant South Africa to achieve its CO_2 emission reduction target of 34% by 2020, and by 45% by 2025.
http://www.southafrica.info/news/business/1968687.htm

WRI CCS Regulatory Matrix

April 12, 2012. WRI announced their online CCS Regulatory Matrix tool.

The CCS Regulatory Matrix is a program whereby the user can compare the similarities and differences between the key issues of the current CCS regulation. WRI aims to give the user an impartial view of the 4 regulatory frameworks which are currently available:
- The WRI CCS Guidelines,
- The US EPA's Class VI Regulation,
- The EU Directive 2009/31/EC and
- The IEA model Framework.

This tool does not favor any one regulatory type, but rather compares key issues.

The differences are noted as being between similar, mixed, dissimilar and incomparable. They are color coded for visual ease of viewing.

The major areas of similarities are: CO_2 definition and/or composition requirements, requirements for model updates, flexible monitoring area delineation, and siting requirements focused on geologic characteristics.

The main areas of dissimilarities are: Cement requirement, post closure definition and transfer of responsibility.

The CCS matrix can be found at http://www.wri.org/project/carbon-dioxide-capture-storage/proposal-matrix

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EPA sets Emissions Standards for New Power Plants

On March 27, 2012, the EPA released a proposal to limit the amount of carbon dioxide from all new power plants. The Carbon Pollution Standard, under the Clean Air Act, would for the first time, set national limits on the amount of carbon dioxide released from power plants.

The release of this proposal to limit CO_2 emissions came as unexpected to some, it was not a surprise at the Carbon Capture and Sequestration Technologies program here at MIT.

In 2009, Ashleigh Hildebrand stated an almost identical scenario in her thesis titled *Strategies for Demonstration and Early Deployment of Carbon Capture and Storage: A Technical and Economic Assessment of Capture Percentage*." She outlined that in order to curb greenhouse gases from coal-fired power plants " some level of government intervention is expected" and that "the EPA may make decisions regarding how to regulate carbon dioxide emissions from new coal-fired power plants". Instead of a cap-and-trade system which would "be designed to reduce emissions across the economy", the standard would "specifically address emissions from power plants due to their contribution to climate change."

Ms. Hildebrand went on to state that the proposed standard would need to be one which would "make carbon dioxide emissions from coal comparable to natural gas, or 'natural gas parity'. This may be represented as roughly 40-65% capture, dependent on the plants being compared, or emissions levels in the range of 800-1,100 lbs/MWh."

Howard Herzog, Director of the Carbon Sequestration Initiative at MIT states that "the EPA is following the lead of California in setting an emissions standard. Unfortunately, we do not see this proposed rule as advancing CCS technology.

According to the analysis done by Ashleigh, natural gas prices would need to be above $10/MMBtu for companies to even consider building coal plants with CCS to limit emissions to 1000 lbs/MWh. Given today's revolution in shale gas, it is unlikely to see sustained natural gas prices at those levels for decades to come. At the same time, DOE is cutting back on their CCS RD&D efforts. This leaves us with neither a strong market pull nor a strong technology push to help advance CCS."

In the proposed standard the EPA stated that they have no plans to put standards on existing coal fired power plants.

Sources

- Hildebrand, A.N., "Strategies for Demonstration and Early Deployment of Carbon Capture and Storage: A Technical and Economic Assessment of Capture Percentage," M.I.T. Masters Thesis, May (2009). <PDF>
- EPA Press release http://yosemite.epa.gov/opa/admpress.nsf/79c090e81f0578738525781f0043619b/9b4e8033d7e641d9852579ce005ae957!OpenDocument
- EPA New Power Standard Factsheet: http://epa.gov/carbonpollutionstandard/pdfs/20120327factsheet.pdf

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CCS Project News

Project Pioneer, Canada

April 26, 2012. TransAlta and partners have abandoned plans to build the $1.42 billion CCS Project Pioneer at the TransAlta owned Keephills power plant in Alberta. The decision was because they could not find any buyers for the CO_2 and no process to sell emission-reduction credits.
http://ca.reuters.com/article/businessNews/idCABRE83P15G20120426

Callide-A-Oxyfuel, Australia

April 22, 2012. The 700 MW power plant in Queensland, Australia is now firing with retrofitted CCS. CS Energy has modified one of the six steam boilers with oxyfuel capture technology.
http://www.industrialinfo.com/iirenergy/showAbstract.jsp?newsitemID=212950

Taylorville, USA

April 30, 2012. The Illinois EPA issued Tenaska's Taylorville Energy Center its final required air permit.
http://www.power-eng.com/articles/2012/05/illinois-epa-issues-taylorville-energy-center-its-final-air-permit.html

Hokkaido, Japan

March 26, 2012.The Japanese Government is beginning tests to capture 0.1 MT/Yr CO_2 emitted from power plants and factories and store it offshore in the seabed off Tomakomai, Hokkaido.
http://www.globalccsinstitute.com/institute/news/test-store-carbon-dioxide-under-seabed-begin-hokkaido

Latrobe Valley, Australia

April 9, 2012. It was announced that the $150 million of state and federal grants may be insufficient to build the $1.2 billion CCS power station.
http://www.power-eng.com/news/2012/04/09/funding-doubt-on-clean-coal-plant.html

Don Valley, UK

March 2, 2012. 2Co and Progressive Energy announced that their CCS project had passed the European Investment Bank's financial and technical due diligence test. This clears financial constraints for EU funding.
http://www.bloomberg.com/news/2012-03-02/2co-progressive-energy-say-carbon-capture-plants-pass-eib-test.html

Shand, Canada

March 20, 2012. SaskPower and Hitachi plan to build a $60 million CCS test facility at Shand power station in Saskatchewan, Canada.
http://saskpowercarboncapture.com/news?n=26

Caledonia Clean Energy Project, UK

March 21, 2012. Summit Group announced a bid with National Grid and Petrofac to build a CCS plant in Scotland.
http://phys.org/news/2012-03-summit-group-carbon-capture-storage.html

Kemper Country, USA

March 30, 2012. The Mississippi Supreme Court issued a temporary certificate to allow Southern Company to continue building the $2.8 billion Kemper Country CCS project. It had previously retracted the project's approval on March 15, 2012.
http://www.reuters.com/article/2012/03/30/idUSL2E8ETCUG20120330
http://www.reuters.com/article/2012/03/16/southernco-coal-idUSL2E8EFCBJ20120316

Otway, Australia

March 19, 2012. CO2CRC has successfully completed a second stage of research at the Otway Project in Southwest Australia. This stage focused on residual gas and dissolution trapping in saline aquifers.
http://captureready.com/EN/Channels/News/showDetail.asp?objID=2643&isNew=

Images:

Page 1: Pylons. http://www.eaem.co.uk/news/carbon-price-soars-post-fukushima-favouring-uks-electricity-market-reform

This newsletter was constructed using information from internet searches. All the websites used have been cited.

Holly Javedan compiled this report. For more information, questions and comments please email javedan@mit.edu. Thank you.