The Struggle to Preserve Coal: Clean Coal, the EPA's Final Rules Related to Carbon Capture and Sequestration (CCS) and the Current Fate of CCS in the U.S.

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Background

In his recent State of the Union address, President Obama stressed the importance of clean energy, and noted that, "[s]ome folks want wind and solar. Others want nuclear, clean coal and natural gas. To meet this goal, we will need them all . . . ."[1] The term "clean coal" is commonly used in connection with the employment of technologies such as carbon capture and sequestration (CCS) to achieve significant reductions in carbon dioxide (CO2) emissions from coal-fired power plants and other large industrial sources.

Coal reserves remain abundant in the United States, China, and other parts of the world. With global demand for electricity continuing to increase, the use of coal for existing power plants continues to be a reliable and affordable option. However, the advantages of coal-fired power plants—including a currently reliable, plentiful and affordable supply of coal—are tempered with certain disadvantages, including the emission of greenhouse gases that contribute to global warming. The conundrum posed by clean coal arises out of the tension between the desire for the continued use of an abundant fossil energy resource, and the realization that greenhouse gas emissions should be reduced to mitigate present and future global warming and climate change.

While opponents of "clean coal" often contend that it is not a true clean energy alternative, the U.S. Environmental Protection Agency (EPA) has taken the position that:

> Fossil fuels are expected to remain the mainstay of energy production well into the 21st century, and increased concentrations of CO2 are expected unless energy producers reduce CO2 emissions to the atmosphere. For example, CCS would enable the continued use of coal in a manner that greatly reduces the associated CO2 emissions while other safe and affordable alternative energy sources are developed in the coming decades.[2]

The reality today is that, on a global scale, many countries continue to rely heavily on coal for electricity. And yet, there exists increasing pressure for cleaner technologies to be implemented in order to reduce greenhouse gas emissions. In the U.S., coal supplies more than half of electricity consumed by Americans,[3] and it is reported that, "coal-fired power plants are the largest contributor to U.S. greenhouse gas (GHG) emissions, and coal combustion accounts for 40 percent of global [CO2] emissions from the consumption of energy."[4] In China, coal supplies 80 percent of the country's electricity, and "China now uses more coal than the United States, Europe and Japan combined, making it the world's largest emitter of gases that are warming the planet."[5] As coal-fired power plants continue to exist, clean coal technologies seek to provide an answer to the question of how coal can be burned more efficiently and cleanly. If countries aim to preserve the option of using coal, then effective clean coal technologies must be in place to reduce greenhouse gas emissions.

Carbon Capture and Sequestration

A key element in the utilization of clean coal technologies is CCS. CCS is considered to be one of the most viable methods of "trapping" the CO2 that is otherwise released into the atmosphere by many domestic and international power plant facilities, industrial operations and other stationary sources of CO2. CCS is a process that generally involves four steps: (1) the capture of CO2 before it is emitted to the atmosphere; (2) the compression of CO2 into a "supercritical" state to enable transport; (3) the transportation of such CO2 (for example, via pipelines); and (4) the injection of CO2 underground in geologic formations, including depleted oil and gas fields or saline formations, for permanent storage.[6]

The effectiveness of CCS has been studied extensively for many years and has been the subject of numerous major international conferences since the early 1990s.[7] In addition, CCS-related technologies draw from over three decades of experience in injecting and monitoring CO2 in the deep subsurface for the purpose of enhancing oil and natural gas production by the U.S. oil and natural gas industry.[8] The Intergovernmental Panel on Climate Change (IPCC), a scientific body consisting of almost 200 member countries, has noted that, "[f]or well-selected, designed and managed geological storage sites, the vast majority of the CO2 will gradually be immobilized by various trapping mechanisms and, in that case, could be retained for up to millions of years."[9]

Using Enhanced Oil Recovery to Incentivize CCS

While CCS technology has been developed, it has not yet been demonstrated on a commercial basis. In order for companies to make the necessary investments in CCS, a large-scale demonstration project should be completed. This process will require the existence of a rational regulatory framework and the appropriate incentives so that the cost of "clean energy," which is the cost passed on to utilities' ratepayers, is reasonable in the context of its overall environmental benefits.

One way to effectively reduce the costs of producing clean electricity is to combine CCS with "enhanced oil recovery." This would allow a utility company to monetize the CO2 it created during the power generation process by selling it to oil companies. The oil companies can use the purchased CO2 to "flood" oil and gas from deep-seated geologic formations. Ultimately, the CO2 is "trapped" or "sequestered" in these formations and is not allowed to escape into the atmosphere. By allowing oil companies to use CO2 for enhanced oil recovery, it provides a market for the CO2 as the oil companies will pay for it in order to increase the productivity of their oil holdings. One of the keys, however, to combining CCS with enhanced oil recovery is the creation of regulatory and permitting processes which will encourage the necessary investment by utilities and oil companies.

EPA's Final Rules Related to CCS

On November 22, 2010, the EPA finalized two rules related to CCS: a reporting rule which establishes greenhouse gas reporting requirements for facilities that carry out geologic sequestration of CO2; and an underground injection control rule which establishes requirements that regulate the underground injection of CO2.[10]

The reporting rule, titled *Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide Injection*,[11] is promulgated under the authority of the Clean Air Act (CAA) and came into effect on December 31, 2010. This final rule establishes greenhouse gas monitoring and reporting requirements for facilities that conduct geologic sequestration of CO2 and all other facilities that inject CO2 underground, and consists of two subparts, RR and UU. Subpart RR requires facilities that conduct geologic sequestration, including Class VI wells, to report all CO2 that is received, injected, produced, and emitted from surface leakage or from CO2 equipment leakage or venting.[12] In addition, facilities under Subpart RR must develop and implement an EPA-approved site-specific monitoring, reporting and verification (MRV) plan, and report the amount of CO2 that is geologically sequestered using a mass balance approach and annual monitoring activities.[13] The annual reporting cost of each facility under Subpart RR is estimated to be $320,000.[14] Subpart UU covers all other facilities that inject CO2 into the subsurface, including wells used for enhanced oil and gas recovery, or any other purpose. Under Subpart UU, facilities are required to report basic information on CO2 that is received for injection, with an annual cost of reporting estimated to be $4,000.[15]

The underground injection control rule, titled the *Federal Requirements Under the Underground Injection Control (UIC) for Carbon Dioxide Geologic Sequestration Wells*,[16] is promulgated under the authority of the Safe Drinking Water Act (SDWA)[17] and came into effect on January 10, 2011. This final rule applies to owners and operators of wells that will be used to inject CO2 underground for the purpose of long term storage[18] and aims to achieve two main objectives. First, it establishes new federal requirements for the underground injection of CO2 for the purpose of long-term storage in geologic formations, including minimum requirements for the proper management of CO2 injection and storage. Second, it establishes a new well class (known as a Class VI well).[19]

Along with the new class of injection well, this final rule also sets forth the minimum technical criteria for Class VI wells, including: (i) site characterization to ensure that the Class VI wells are located in suitable formations; (ii) computational modeling of the area of review for the geologic sequestration project (GS Project), taking into account the physical and chemical properties of CO2; (iii) periodic reevaluation of the area of review to verify that the CO2 plume is moving within the subsurface as expected; (iv) well construction using materials capable of withstanding contact with CO2 over the lifespan of the GS Project; (v) robust monitoring of the CO2 throughout injection; (vi) “comprehensive post-injection monitoring and site care following cessation of injection” to ensure the safety of the underground sources of drinking water; and (vii) “financial responsibility requirements to ensure that funds will be available for all corrective action, injection well plugging, post-injection site care (PISC), site closure, and emergency and remedial response.”[20]

Legal and Regulatory Barriers to the Deployment of CCS in the U.S.

While new technologies such as CCS offer a viable solution for near-term reduction of greenhouse gas emissions, there are a host of barriers to the deployment of CCS including, “economic challenges related to climate policy uncertainty, first-of-a-kind technology risks, and the current high cost of CCS relative to other technologies.”[21] In addition, the deployment of CCS in the U.S. also depends on whether the legal and regulatory framework will adequately govern CCS without being overly costly, burdensome and prohibitive. As the current EPA regulations are minimum requirements established under the authority of the CAA and the SDWA, the EPA is working on devising a solution that facilitates the near-term deployment of CCS while providing some legal certainty and regulatory guidance as to how CCS projects can proceed. However, the EPA’s approach does not comprehensively regulate CCS. There are, for example, questions as to which federal or state agencies have jurisdiction over particular aspects of CCS projects. These issues may hinder accomplishing the long-term goal of widespread, cost-effective, and commercial-scale deployment of CCS.

It has been suggested that the best approach may be the implementation of one comprehensive and consistent regulatory program that is "designed to address all stages of CCS (from the point of capture through long-term stewardship), articulate all potential liabilities, and address all goals of a comprehensive framework . . . harmonizing provisions with future climate regulations."[22] In addition, the potential long-term legal and financial liabilities associated with widespread deployment of CCS remains an unresolved issue. Finally, despite the barriers noted above, the lack of comprehensive climate change legislation has been identified by the Interagency Task Force on Carbon Capture and Storage (a task force established by President Obama in February 2010 and co-chaired by the Department of Energy (DOE) and the EPA) as the key barrier to CCS deployment:

> Widescale cost-effective deployment of CCS will occur only when driven by a policy designed to reduce GHG emissions. Ultimately, comprehensive energy and climate legislation will provide the largest incentive for CCS deployment as an option for climate change mitigation, because it will create a stable, long-term, market-based framework to channel private investment into low-carbon technologies.[23]

The task force has also warned that, without adequate and appropriate financial incentives such as a carbon price, climate change legislation and a comprehensive, clear and consistent statutory framework that addresses long-term liabilities associated with CCS, "there is no stable framework for investment in low-carbon technologies such as CCS."[24]

Conclusion

Until there are sufficient financial incentives, the fate of CCS in the United States remains uncertain. Encouraging the use of CCS through enhanced oil recovery should provide the economic motivation necessary for utilities and oil companies to work with the government to find the necessary solutions to these issues.

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[1] President Barack Obama, Second State of the Union Address (Jan. 25, 2011), *available at* http://www.whitehouse.gov/the-press-office/remarks-president-state-union-address.

[2] U.S. Environmental Protection Agency (EPA), Final Rule, *Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells*, 75 Fed. Reg. 77,230, 77,234 (Dec. 10, 2010).

[3] U.S. Department of Energy (DOE), *Energy Sources- Coal*, *available at* http://www.energy.gov/energysources/coal.htm.

[4] Executive Summary: Report of the Interagency Task Force on Carbon Capture and Storage at 3 (Aug. 2010), *available at* http://www.epa.gov/climatechange/downloads/ES-CCS-Task-Force-Report-2010.pdf (hereinafter *CCS Executive Summary*).

[5] Keith Bradsher, *China Outpaces U.S. in Cleaner Coal-Fired Plants*, N.Y. Times, May 10, 2009, at A1.

[6] *See* DOE/National Energy Technology Laboratory, *Carbon Dioxide Capture and Storage RD&D Roadmap* at 8 (Dec. 2010), *available at*

http://www.netl.doe.gov/technologies/carbon_seq/refshelf/CCSRoadmap.pdf.

[7] *See Findings and Recommendations by the California Carbon Capture and Storage Review Panel* at 6 (Dec. 2010), *available at* http://www.climatechange.ca.gov/carbon_capture_review_panel/documents/2011-01-14_CSS_Panel_Recommendations.pdf.

[8] *See Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells*, 75 Fed. Reg. at 77,234.

[9] Working Group III of the Intergovernmental Panel on Climate Change (IPCC), *IPCC Special Report: Carbon Dioxide Capture and Storage* at 14 (Sept. 2005), *available at* http://www.ipcc.ch/pdf/special-reports/srccs/srccs_wholereport.pdf.

[10] *See* EPA, Press Release, *EPA Finalizes Rules to Foster Safe Carbon Storage Technology* (Nov. 22, 2010), *available at* http://www.epa.gov/agingepa/press/epanews/2010/2010_1122_2.htm.

[11] EPA, Final Rule, *Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide*, 75 Fed. Reg. 75,060 (Dec. 1, 2010).

[12] *Id.* at 75,065.

[13] *See* EPA, *Fact Sheet for Geologic Sequestration and Injection of Carbon Dioxide: Subparts RR and UU* at 1 (Nov. 2010), *available at* http://www.epa.gov/climatechange/emissions/downloads10/Subpart-RR-UU_factsheet.pdf.

[14] *See id*.

[15] *See id.*

[16] *See Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells*, 75 Fed. Reg. 77,230.

[17] Safe Drinking Water Act, Pub. L. No. 93-523, 88 Stat. 1660.

[18] *See Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells*, 75 Fed. Reg. 77,230.

[19] EPA, *Fact Sheet: Underground Injection Control (UIC) Program Requirements for Geologic Sequestration of Carbon Dioxide Final Rule*, EPA 816-F-10-073 at 1 (Nov. 2010), *available at* http://water.epa.gov/type/groundwater/uic/upload/GS-fact-sheet-111210.pdf.

[20] *See Federal Requirements Under the Underground Injection Control (UIC) Program for Carbon Dioxide (CO2) Geologic Sequestration (GS) Wells*, 75 Fed. Reg. at 77,233.

[21] *Report of the Interagency Task Force on Carbon Capture and Storage* at 8 (Aug. 2010)*, available at* http://www.epa.gov/climatechange/downloads/CCS-Task-Force-Report-2010.pdf.

[22] *Id.* at 102.

[23] *Id.* at 123.

[24] *CCS Executive Summary, supra* note 4 at 6.