U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON ENVIRONMENT
SUBCOMMITTEE ON ENERGY

HEARING CHARTER

Science of Capture and Storage: Understanding EPA's Carbon Rules

Wednesday, March 12, 2014
10:00 a.m. – 12:30 p.m.
2318 Rayburn House Office Building

PURPOSE

The Subcommittees on Environment and Energy will hold a joint hearing entitled *"Science of Capture and Storage: Understanding EPA's Carbon Rules"* on Wednesday, March 12th, at 10:00 a.m. in Room 2318 of the Rayburn House Office Building. This hearing will explore the basis for the Environmental Protection Agency's (EPA) conclusion that carbon capture and storage systems (CCS) are adequately demonstrated as a technology for controlling carbon dioxide emissions in full-scale commercial power plants. Technical experts will focus on the potential use of CCS in both coal and natural gas fired power plants and the challenges associated with long-term geologic sequestration of carbon dioxide. The hearing will examine the EPA's rationale in proposing New Source Performance Standards (NSPS) for commercial power plants.

WITNESS LIST

Panel 1

- **David Hawkins,** Director of Climate Change Programs, Natural Resources Defense Council
- **Robert G. Hilton**, Vice President, Power Technologies for Government Affairs, Alstom Power Inc.
- **Robert C. Trautz**, Senior Technical Leader, Electric Power Research Institute
- **Scott Miller**, General Manager and CEO, City Utilities of Springfield Missouri, American Public Power Association

Panel 2

- **Janet McCabe,** Acting Assistant Administrator, Office of Air and Radiation, U.S. Environmental Protection Agency

BACKGROUND

Regulatory Context:

Section 111 of the Clean Air Act (CAA) establishes a unique technology-based mechanism for controlling emissions from stationary sources. Section 111(b) provides EPA authority to promulgate performance standards which apply to new and modified sources. Specifically, EPA is directed to set standards based on "the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated."[1] In setting the standard EPA is given some flexibility in that "emission limits may be established either for equipment within a facility or for an entire facility."[2]

Southern's Kemper Project in Progress: "The Kemper plant will use two commercial-scale TRIG™ units to gasify lignite (low-rank coal that is mined next to the facility) to produce syngas. After the syngas leaves the gasifiers, it will be cleaned and used as fuel for two combined-cycle power generating units with a net output of 582-megawatts of electricity." *Global CCS Institute Status of CCS.*

EPA first proposed a New Source Performance Standards (NSPS) for emissions for carbon dioxide (CO2) from power plants in 2012. However, after more than 2.5 million comments on the original proposal, EPA decided that a new approach was warranted and rescinded the original proposal.[3]

Simultaneously, on September 20, 2013 Administrator Gina McCarthy announced EPA's re-proposed CO2 NSPS for new fossil fuel-based electric generating units (EGUs), explaining, "These proposed standards reflect separate determinations of the best system of emission reduction (BSER) adequately demonstrated for utility boilers and IGCC units and for natural gas-fired stationary combustion turbines."[4]

Under the proposal, EPA concluded that CCS has been adequately demonstrated as a technology for controlling CO2 emissions in full-scale commercial applications at coal-fired EGUs, while reaching the opposite conclusion—that CCS is not adequately demonstrated—in the case of gas-fired EGUs. Based on this determination, EPA proposed an emissions limit for coal-fired sources of 1,100 lbs of CO2 per mega-Watt-Hour (MWH) and proposed standards for natural gas combined cycle sources

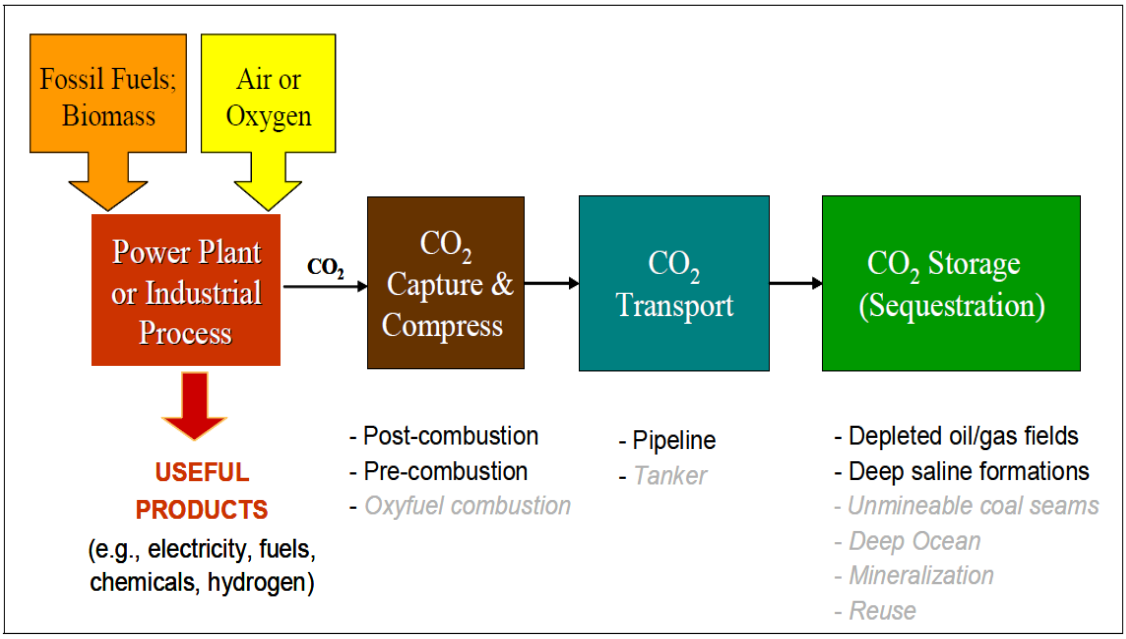
[1] Clean Air Act § 111(a)(1), 42 USCA § 7411(a)(1) (2006).
[2] http://www2.epa.gov/sites/production/files/2013-09/documents/111background.pdf
[3] Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units, Proposed Rule, Preamble p. 14-5, Sep. 20, 2013.
[4] *Id.* at 15.

from 1,000 to 1,100 lbs CO2/MWH depending on the size and type of unit.[5] Electric Generating Units that primarily fire biomass are exempted from the proposed rule.[6]

In examining the regulatory impact, EPA asserted that "coal units built between now and 2020 would have CCS, even in the absence of this rule." In light of this modeling, "EPA projects that this proposed rule will result in negligible CO2 emissions changes, quantified benefits, and costs by 2022."[7] EPA sought comment for its proposal.

Technical Background:

Carbon capture and storage (CCS) methods capture CO2 from fossil fuel combustion before it is released into the atmosphere and store it underground in geological formations. Unlike some emission control devices, CCS is not simply one piece of technology; it requires a system of coordinating elements for successful implementation. Broadly speaking, there are four links in the CCS chain: capture, compression, transportation, and storage. Each link in the chain poses separate and distinct technology challenges. Among these components, capture is the most technology-intensive and costly. Storage, on the other hand, poses the greatest liability and regulatory obstacles.



Source: E. S. Rubin, "Will Carbon Capture and Storage be Available in Time?" Proc. *AAAS Annual Meeting, San Diego, CA, 18-22 February 2010*, American Academy for the Advancement of Science, Washington, DC.

In the NSPS proposal, EPA notes four projects that—with significant governmental financial assistance—are designed to use some type of capture technology. Although none of these projects have been completed, EPA anticipates at least one of these demonstration projects

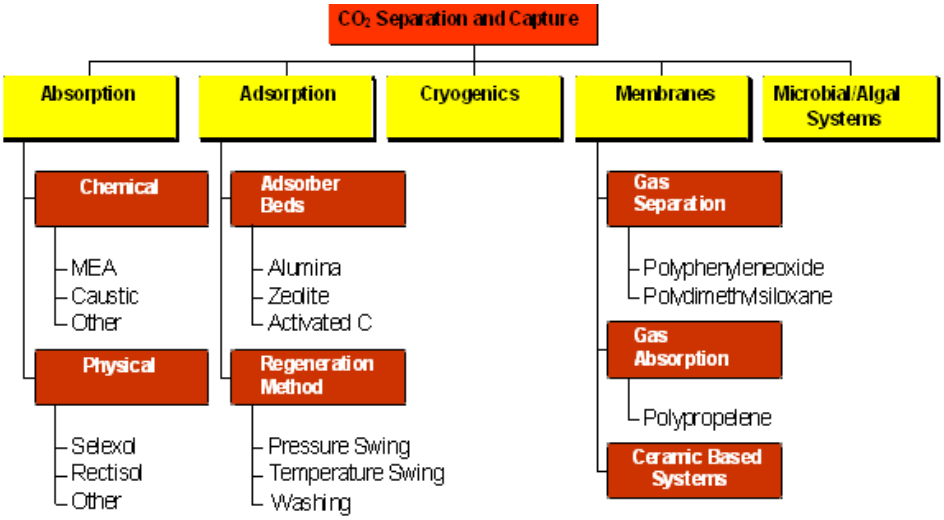
[5] *Id.* at 15-6.
[6] *Id.* at 30, fn. 8.
[7] *Id.* at 16-7.

will be operational in the near future. EPA cites Southern Company's Kemper County Energy Facility in Mississippi (pictured on p. 2), SaskPower's Boundry Dam CCS Project in Canada, The Texas Clean Energy Project in Odessa, and Hydrogen Energy California, LLC. Each of these projects, when completed, will utilize some elements of the CCS system EPA has selected in this proposal.

However, despite the promise of CCS technologies in power systems, currently there are no electric power plants operating with the CCS technology on a commercial scale.

Capture

CO2 capture may be achieved through pre-combustion, post-combustion, or oxy-combustion technologies. **Pre-combustion** removal methods typically require the high-concentration of CO2 associated with expensive gasification systems. **Post-combustion**, on the other hand, utilizes nitrogen-based solvents to scrub the CO2 from the flue gas. However, because post-combustion capture requires substantial heat input to release the CO2 and regenerate the solvent, it results in significant reductions in overall plant efficiency and a substantial increase in cost. A third process, **oxy combustion**, requires expensive and energy intensive air separation units. While oxy systems hold promise, they are more experimental. Overall, while capture technologies exist, the new challenges associated with operating at a larger scale will not become clear until after full-scale deployment.



Source: A.B. Rao and E.S. Rubin, "A Technical, Economic and Environmental Assessment of Amine-Based CO2 Capture Technology for Power Plant Greenhouse Gas Control," *Environmental Science & Technology.* *(See CRS Report 41325, p. 10.)*

Compression & Transport

Once the CO2 is captured, it must be compressed. As with capture, compression is an energy-intensive process. After compression, transportation to a storage site is required. Although dedicated CO2 pipelines have potential, technical challenges remain to ensure safe and reliable transport. Given the numerous policy and legal issues related to siting, permitting, and environmental requirements, creation of a full-scale CO2 pipeline infrastructure requires substantial capital investment and further regulatory development.[8]

[8] CONGRESSIONAL RESEARCH SERVICE, *Legal Issues Associated with the Development of Carbon Dioxide Sequestration Technology*. Feb. 8, 2011. Available at: http://www.crs.gov/pdfloader/RL34307.

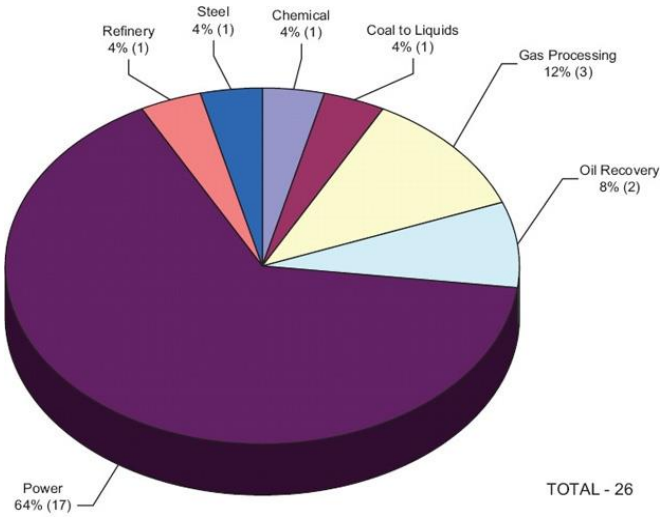
"To date, there are no commercial ventures in the United States that capture, transport, and inject large quantities of CO2 (e.g., 1 million tons per year or more) solely for the purposes of carbon sequestration." *CRS Report 42496, p. 24, Feb 10, 2014.*

Storage

The final step in a CCS system is storage. However, permanently storing emissions is highly dependent on neighboring geology to the power plant. Geological storage is potentially available in deep saline formations, depleted oil fields, un-mineable coal seams, or for enhanced oil or gas recovery (EOR). However, lessons learned from failed storage sites in Africa demonstrate that maps of promising geologic formations do not always equate to locations where carbon storage should occur. Consequently, unresolved issues related to property rights acquisition, pore space management, regulatory structure, environmental protection issues, and liability remain a challenge. Significantly, EPA is unable to release operators from liability and litigation risk if a problem occurs in storing the CO2.[9]

Because of these challenges and the potential to offset the significant cost of CCS, the proposed rule focuses on the use of the captured CO2 for enhanced oil recovery (EOR). EOR has been used as a way to increase production in depleted oil fields by injecting CO2 and pumping previously unrecoverable oil to surface. While EOR provides outstanding opportunities to increase oil production in some regions, many locations do not have access to an EOR market. Absent a robust EOR market, CO2 would simply be stored geologically. Some have questioned whether EOR operators would be able to meet new reporting requirements contained in the NSPS proposal.[10]

According to the Global CCS Institute's 2013 report, 64% of the 26 <u>cancelled or delayed</u> projects are in power generation.



Future of CCS Demand:

As discussions of new climate strategies continue, pressure for additional CO2 restrictions will likely increase. Simultaneously, worldwide energy demand, particularly in emerging economies, is growing rapidly. Much of the current and future demand for energy will

[9] CONGRESSIONAL RESEARCH SERVICE, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy.* Feb. 10, 2014. Available at: http://www.crs.gov/pdfloader/R42496.

[10] Philip M. Marston. GLOBAL CCS INSTITUTE. *A CO_2-EOR regulatory update from the US.* Feb. 17, 2014. Available at: http://www.globalccsinstitute.com/insights/authors/philipmarston/ 2014/02/17/co2-eor-regulatory-update-us.

continue to be supplied by fossil fuels. Consequently, projections suggest a strong long-term need for affordable technologies that can supply low-carbon energy from fossil fuels.[11]

Additional Reading:

CONGRESSIONAL RESEARCH SERVICE, *Carbon Capture: A Technology Assessment*. Nov. 5, 2013. Available at: http://www.crs.gov/pdfloader/R41325.

CONGRESSIONAL RESEARCH SERVICE, *Carbon Capture and Sequestration (CCS): A Primer*. July 16, 2013. Available at: http://www.crs.gov/pdfloader/R42532.

CONGRESSIONAL RESEARCH SERVICE, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy*. Feb. 10, 2014. Available at: http://www.crs.gov/pdfloader/R42496.

CONGRESSIONAL RESEARCH SERVICE, *Legal Issues Associated with the Development of Carbon Dioxide Sequestration Technology*. Feb. 8, 2011. Available at: http://www.crs.gov/pdfloader/RL34307.

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Philip M. Marston. GLOBAL CCS INSTITUTE. *A CO_2-EOR regulatory update from the US*. Feb. 17, 2014. Available at: http://www.globalccsinstitute.com/insights/authors/philipmarston/2014/02/17/co2-eor-regulatory-update-us.

Robert Meltz. CRS Legal Sidebar: EPA's Proposed CO2 Standards for New Fossil-Fuel-Fired Power Plants: Likely Legal Challenges. Sep. 26, 2013. Available at: http://www.crs.gov/LegalSidebar/details.aspx?ID=686&Source=search.

U.S. ENERGY INFORMATION ADMINISTRATION, *International Energy Outlook 2013: With Projections to 2040*. Available at: http://www.eia.gov/forecasts/ieo/pdf/0484(2013).pdf.

U.S. ENVIRONMENTAL PROTECTION AGENCY, *Draft UIC Program Guidance on Transitioning Class II Wells to Class VI Wells*. Dec. 2013. Available at: http://water.epa.gov/type/groundwater/uic/class6/upload/epa816p13004.pdf.

[11] *See e.g.*, U.S. ENERGY INFORMATION ADMINISTRATION, *International Energy Outlook 2013: With Projections to 2040*. Available at: http://www.eia.gov/forecasts/ieo/pdf/0484(2013).pdf.

U.S. ENVIRONMENTAL PROTECTION AGENCY, *Hazardous Waste Management System: Conditional Exclusion for Carbon Dioxide (CO2) Streams in Geologic Sequestration Activities*. Dec. 17, 2013. Available at: http://www.epa.gov/wastes/nonhaz/industrial/geo-sequester/prepub-co2-sequestration.pdf.

U.S. ENVIRONMENTAL PROTECTION AGENCY, *Mandatory Reporting of Greenhouse Gases: Injection and Geologic Sequestration of Carbon Dioxide; Final Rule*. 40 CFR Parts 72, 78, and 98. Dec. 1, 2010. Available at: http://www.gpo.gov/fdsys/pkg/FR-2010-12-01/pdf/2010-29934.pdf.

U.S. ENVIRONMENTAL PROTECTION AGENCY, *Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units*. 40 CFR Part 60. Sep. 20, 2013. Available at: http://www2.epa.gov/carbon-pollution-standards/2013-proposed-carbon-pollution-standard-new-power-plants.