Trends, Challenges and Next Steps in CCS Regulation

6th International Energy Agency (IEA)
CCS Regulatory Network Meeting
27-28 May 2014
IEA Paris

Wendy B. Jacobs
Professor and Director
Emmett Environmental Law & Policy Clinic
Harvard Law School
Phone: 617-496-3368
Email: wjacobs@law.harvard.edu

CCS Trend in the United States

From promise to retrenchment

From confidence to uncertainty

2009

Head of American Electric Power (AEP) predicts:

> "AEP will be able to retire 25 percent of its coal-burning power plants and install advanced carbon-capture equipment on the remaining 75 percent. *** 'This is still an extremely expensive undertaking, but the answer is near at hand,' said Mr. Morris."

Wall Street Journal, *Big Utility Turns Bullish on Carbon Capture* (Dec. 9, 2009)

2010

President Obama directs CCS task force to develop a "plan to overcome the barriers to the widespread, cost-effective deployment of CCS within 10 years, with a goal of bringing 5 to 10 commercial demonstration projects online by 2016."

Presidential Memorandum—A Comprehensive Federal Strategy on Carbon Capture and Sequestration (Feb. 3, 2010)

Today

Only one commercial-scale, CCS-equipped, coal-fired power plant project is in advanced construction

> Southern Co's Kemper County CCS plant, "already running over budget and behind schedule … has suffered new setbacks. *** And while [Department of Energy Secretary] Moniz says that 'we're going to need not 10, maybe 100 of these plants across the country,' it might be a triumph to finish just one."
>
> Washington Post, *The Coal Plant to End All Coal Plants?* (May 16, 2014)

Today

Despite $6+ billion in federal funds available to develop and demonstrate CCS since 2008, only:

- Two industrial CCS projects in operation
- One commercial scale coal CCS project in advanced construction
- Four coal CCS projects and one industrial CCS project under development

CAUSES OF RETRENCHMENT

- Capture: high cost to build and operate capture equipment
- Absence of legislative or regulatory drivers
- Low cost of natural gas
- Sequestration: uncertainties about long-term liability; pore space and aquifer ownership challenges
- Transport: need to build additional infrastructure to transport to non-EOR sequestration sites

Capture Costs

- **Capital cost premium of 76 percent**

  CBO 2012: $3,070/kw with CCS; $1,740/kw without CCS

  NOTE: Capital costs for Kemper County, with 65% capture, are nearly 300% higher than would be required for conventional coal plant

  - Is this an outlier ?

- **Operating cost premium also 76 percent**

  CBO 2012: $104/ mw-hour with CCS; $59/mw-hour without CCS

- **Existing subsidies insufficient to close cost differential**
  - IRC § 45q: tax credit of $20 per ton captured and sequestered, $10 per ton captured and used for EOR
  - Expires after credits claimed for 75m tons
  - Total stimulus funds available for CCS are $3.4bn
    - Kemper plant costs $5.5bn

Kemper County (owned by Southern Company)

- Pre-combustion capture of 65% , then EOR
- Located close to coal supplies, EOR sites
- Cost is $5.5bn, more than double the original estimate
- Project received $270m in stimulus funds, $133m in federal investment tax credits

  even so, cost is still$4.1bn more than a conventional coal-fired plant

- Expected to open in May 2015

FutureGen 2.0

- Oxy-combustion technology
- Designed to capture more than 90% of CO_2 emissions, to be sequestered in saline aquifers
- Total cost expected to be $1.68bn
  - Is this realistic given Kemper County?
- Record of Decision for Final Environmental Impact Statement issued in January 2014
- Operation expected to commence in approximately 2017

Kern County California Project

- Pre-combustion gasification technology
- Designed to generate electricity from petroleum coke and coal and capture 90% of CO_2 emissions
- Estimated to cost $4 bn

  $400m in federal grants

  $437m in investment tax credits
- Projected to open in 2018, but "many aspects of the Buttonwillow project remain unresolved, including disposal of byproducts generated by the plant."

LA Times, *Kern County Farmers Question Just How "Clean" New Coal Plant Would Be* (May 24, 2014)

Absence of Legislative and Regulatory "Drivers" Of CCS

- Absence of federal carbon price dampens private incentive to invest in RD&D

  Several CCS projects were abandoned shortly after proposed federal legislation failed in Congress

- Current low cost of natural gas and high cost of CCS means that NSPS/ESPS not expected to result in new CCS projects
- States are precluded from adopting feed-in tariffs for CCS under existing federal law

Low Cost of Natural Gas

- Even assuming EOR revenues, predictions are that natural gas prices would have to be at least$9/MMBtu for coal-fired power plants with partial capture to be preferred over NGCC units.

- Yet, predicted price of natural gas remains below $9/MMBtu (2012 dollars) through 2040

Sequestration Issues

- Long-term liability
  - Questions about efficacy of long-term containment contribute to skepticism about CCS among policymakers and the public
  - Uncertainty about long-term liability is of concern to industry
- Ownership of and access rights to subsurface
  - At present, unexhausted demand for EOR exists
  - Exclusive reliance on EOR is not sound long-term policy
  - Lack of clarity about pore space and deep aquifer ownership across U.S.
- New laws needed
  - To govern post, post-closure liability and ownership of subsurface
  - To incentivize early movers and insulate them from potential trespass, nuisance and other potential claims

Transport

- Substantial new transportation infrastructure will be needed to support sequestration at non-EOR wells
- Transport of CO_2 over moderate distances is considered both technically and economically feasible

  Approximately 4,000 miles of pipeline currently exists for CO_2 transport to EOR sites

Next Steps

- Raise public awareness
- Create incentives for RD&D, early movers, retrofits
- Be transparent about where CCS fits among federal priorities for funding and use of federal property
- Revise federal and state laws

PUBLIC AWARENESS

- Need to find better ways to educate the public about climate change and the need for action
- Need to find ways to make climate change "tangible" for the uninformed and skeptics
- Need to provoke public demand for action in U.S.

NOTE: Communities in Pacific Northwest have blocked coal export terminals (e.g., Oakland, CA) due in large part to their concerns about climate change

Strategic RD&D

- Demonstrate CCS on natural gas plants
- Focus on innovations that can be used to retrofit
- Pursue innovations that can be adopted internationally, especially China and India
- Coordinate RD&D internationally
- Balance need for "transformational technologies" with need for incremental improvements to established technologies to lower costs
  - Examples : new solvents, solid sorbents, and membranes capable of reducing the energy needed to separate and capture CO_2

Legislative Action

- Establish stringent or escalating carbon price at national level to spur private investment
- Maintain and expand federal RD&D funding
- Maintain and expand federal subsidies for early movers
  - perhaps investment tax credit for retrofits with capture; less stringent emission limits in exchange for capture
- Revise liability rules to favor early movers
  - perhaps indemnifications and other liability protection
- Clarify ownership of subsurface
  - perhaps federal ownership of deep aquifers or eminent domain
- Allow states to establish feed-in tariffs

Questions to be Resolved

- Where does/should CCS fit among funding and property use priorities of the U.S. federal government?
- How can/should Congress empower sub-national governments in U.S.?

Potential Federal Incentives

- Extend investment tax credits to retrofits (e.g., IRC § 48A)
- Federally-funded insurance for non-EOR sequestration
- Charge fees to fund more federal investment and protection of early movers and retrofitters
- Federal indemnities for early movers
- Access to federal and state land

State and Local Incentives

- Include CCS in Renewable Portfolio Standards
- Provide long-term off-take agreements
  - States can authorize *public* entities to enter contracts that guarantee a buyer to purchase the output from a given project w/o running afoul of the Federal Power Act
    - E.g., Indiana Finance Authority entered into a 30-year purchase contract from a CCS gasification project
- Allow cost recovery from ratepayers

More State and Local Incentives

- Set price on carbon

  e.g., California's AB 32, RGGI

- Create legal framework to encourage early movers

  limit trespass and nuisance claims

  clarify ownership of pore space

  limit long-term liability

- Tax incentives

  E.g., reductions and credits against corporate/franchise tax, property tax, sales tax, or severance tax on oil recovered using anthropogenic CO_2

Laws Potentially Applicable to Capture

- Clean Air Act: various pollutants
- Clean Water Act: cooling water and storm water
- RCRA: for substances removed from CO_2 stream
- Superfund: for disposal of substances removed from CO_2 stream
- State laws:
  - Analogs to federal laws
  - Breach of contract
  - Violation of CO_2 emission limits

Laws Applicable to Sequestration

- Safe Drinking Water Act: UIC Program
- Clean Air Act: monitoring and reporting laws, compliance with emission limits
- State laws
  - Personal injury, property damage, natural resource damage
  - Breach of contract
  - Trespass
  - Nuisance
  - State analogs of RCRA, CERCLA, etc.

Bio for Wendy B. Jacobs, Esq.

Wendy B. Jacobs is a Clinical Professor at Harvard Law School and Director of the Emmett Environmental Law and Policy Clinic. In the Clinic, she and her students work on a variety of complex environmental law and policy projects focusing on renewable energy, sea level rise, regional storm water management and other aspects of climate change adaptation, sustainable aquaculture, hydraulic fracturing, carbon capture and sequestration, mountaintop removal mining, and improved oversight and management of offshore drilling. Prior to joining Harvard Law School, Ms. Jacobs practiced administrative and environmental law as a partner in the Boston law firm Foley Hoag LLP for nearly 20 years, and before that as an appellate attorney and special litigator for the U.S. Department of Justice in its Environment Division in Washington, D.C. Ms. Jacobs received her J.D. with honors in 1981 from Harvard Law School, where she was an editor of the Harvard Law Review.

Since 2008, Ms. Jacobs has been writing about carbon capture and sequestration including a roadmap, white papers, and model liability legislation, which are available on the Emmett Environmental Law & Policy Clinic website: http://blogs.law.harvard.edu/environmentallawprogram/clinic/clinic-publications/

She recently wrote a chapter on the subject for inclusion in the book *Global Climate Change and U.S. Law*, which has recently been published by the American Bar Association (SSRN Abstract ID: 2379600) and is available online at: http://blogs.law.harvard.edu/environmentallawprogram/files/2013/03/Ch.-17-Global-Climate-Change-and-US-Law.pdf

Publications & Links

Available online at the Emmett Environmental Law & Policy Clinic website, http://blogs.law.harvard.edu/environmentallawprogram/clinic/clinic-publications/

- **Working Paper: Proposed Liability Framework for Geological Sequestration of Carbon Dioxide (November 2010):** proposes a detailed liability framework for carbon capture and sequestration to provide certainty, assuage public concerns, and remove barriers to CCS projects.
  - *Appendix A: CCS Liability Act of 2010 (model statute)*
  - *Appendix B: Risks of Geological Sequestration*
  - *Appendix C: Sequestration Liability Frameworks Enacted by States, Countries*
  - *Appendix D: 2009 Roadmap Recommendations for a Liability Regime*
  - *Appendix E: Federal Trust Fund Models and Analysis*

References

- CBO, *Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide* (2012) at 7, 8, 11.
- Jan Eide, *Rethinking CCS: Strategies for Technology Development in Times of Uncertainty*, (Masters Thesis 2013).
- Energy Information Agency, Annual Energy Outlook 2014, Table A13, Natural Gas Supply, Disposition, and Prices.
- Patrick Falwell, *State Policy Actions to Overcome Barriers to Carbon Capture and Sequestration and Enhanced Oil Recovery* (Sept. 2013).
- Peter Folger, *Carbon Capture and Sequestration: Research, Development, and Demonstration at the U.S. Department of Energy* (Feb. 2014).
- Herzog, *Scaling Up Carbon Dioxide and Storage*, 33 Energy Econ. 597 (2011); CBO, *Federal Efforts to Reduce the Cost of Capturing and Storing Carbon Dioxide*, 2012 at 8.
- Herzog & Eide, *Rethinking CCS: Moving Forward in Times of Uncertainty* 1 Cornerstone 44, 47 (2013).
- International Energy Agency, *Technology Roadmap: Carbon Capture and Storage* 15 (2013).
- Wendy B. Jacobs, Carbon Capture and Sequestration, Global Climate Change and U.S. Law (Jody Freeman and Michael Gerrard, eds., ABA 2014).
- Wendy B. Jacobs, Working Paper: Proposed Liability Framework for Geological Sequestration of Carbon Dioxide (and appendices) (November 2010).
- Presidential Memorandum—A Comprehensive Federal Strategy on Carbon Capture and Sequestration (Feb. 3, 2010).
- Wall Street Journal, *Big Utility Turns Bullish on Carbon Capture* (Dec. 9, 2009).
- Washington Post, *The Coal Plant to End All Coal Plants?* (May 16, 2014).