

Carbon Capture and Sequestration:
A Financial and Risk Management Perspective

October 8, 2008

Laura Ladd
Principal
Hewitt Ladd, Inc.
laura@hewittladd.com
w: (307) 734-4666
c: (307) 413-3334

The Financial Market's Perspective on CCS Starts with an Assessment of where CCS is In its Life Cycle

Sources: SEFI and New Energy Finance, 2008

The Availability and Composition of Financing Sources Are Largely Driven By Maturation of the Market

Total Transactions in Sustainable Energy* in 2007

Source	Value (\$bn)
VC/PE	19.8
Public Markets	121.4
Corp. RD&D	99.8
Gov't RD&D	17.1
Total Company Investment	550.1
Re-invested	13.0
Asset Finance	184.5
Small-scale projects	119.0
Total Investment	1148.4
M&A/REO	116.5
Total Deals	204.9

Note: Grossed up values based on disclosed deals. Adjusted for reinvestment. Geared re-investment assumes a 1 year lag between VC/PE/Public Markets funds raised and re-investment in projects. Figures marked * are based on industry estimates from various sources.

Source: New Energy Finance, 2008. New Energy Finance covers all sectors of clean energy: renewables (wind, solar, marine, geothermal, mini-hydro, biomass & biofuels, energy architecture (supply and demand side efficiency, smart distribution, power storage, carbon, capture and sequestration, hydrogen & fuel cells, carbon markets and services).

7

The Development of CCS is Still Heavily Reliant Upon Government Support

CARBON MITIGATION AND COAL PROVISIONS IN THE EMERGENCY ECONOMIC STABILIZATION ACT OF 2008

- **Carbon Capture and Sequestration (CCS) Demonstration Projects.** The bill provides \$1.5 billion in new tax credits for the creation of advanced coal electricity projects (Section 48A) and certain coal gasification projects (Section 48B) that demonstrate the greatest potential for carbon capture and sequestration (CCS) technology. Of these \$1.5 billion of incentives, \$1.25 billion will be awarded to advanced coal electricity projects, and \$250 million will be awarded to coal gasification projects. These tax credits will be awarded by the Department of Treasury through an application process, with applicants that demonstrate the greatest CO2 sequestration percentage receiving the highest priority. Applications will not be considered unless they can demonstrate that either their advanced coal electricity project would capture and sequester at least 65% of the facility's CO2 emissions or that their coal gasification project would capture and sequester at least 75% of the facility's CO2 emissions. Once these credits are awarded, recipients failing to meet these minimum levels of carbon capture and sequestration would forfeit these tax credits. The bill also clarifies that gasification projects producing transportation grade liquid fuels are eligible under Section 48B.
- **CO2 Capture Credit.** The bill provides a \$10 credit per ton for the first 75 million metric tons of CO2 captured and transported from an industrial source for use in enhanced oil or natural gas recovery and \$20 credit per ton for CO2 captured and transported from an industrial source for permanent storage in a geologic formation. Qualifying facilities must capture at least 900,000 metric tons of CO2 per year. The credit applies to CO2 captured and disposed of or used in the United States. The tax credit shall be adjusted for inflation.
- **Carbon Audit of the Tax Code.** The bill directs the Secretary of the Treasury to enter into an agreement with the National Academy of Sciences to undertake a comprehensive review of the tax code to identify the types of specific tax provisions that have the largest effects on carbon and other greenhouse gas emissions and to estimate the magnitude of those effects.

Source: Troutman Sanders LLC

8

The Question Remains: Is the Investment Level Sufficient to Bring Clean Coal and CCS to Commercial Scale and a Competitive Cost Structure Within the Required Timeframe to Be A Relevant Solution?

- Everyone wants to build the Nth plant—but no one wants to build the demonstration scale plants. Likely the federal government and/or consumers through the rate base will bear a significant portion of those costs. Will they be enough?
- How many plants does it take to get to the Nth plant? Approximately 8-10 and at a cost of \$3B/plant.
- Capital investment decision: build NGCC or clean coal with CCS? Less regulatory, environmental and carbon market uncertainty with NGCC. Nuclear vs. coal is the baseload question.
- Utilities are generally not prepared to take the risk required to get from demonstration to commercially developed IGCC with CCS.
 - "Lowest cost, most reliable"
 - Advanced cost recovery requirements
 - 6-8% typical rate of return, though IGCC with CCS is not a typical project

9

What Does this Mean for CCS? Project Financing Generally Doesn't Exist Due to Market Uncertainty and Lack of Understanding Regarding CCS Risk.

- "CCS is in the science project phase. It's not yet ready for prime time."
- "We're having a hard time putting together financing for widget factories that work, let alone for unproven technologies and concepts such as CCS."
- "It's going to take a multi-month rally and years of economic growth before there is a project financing market available for these projects."
- "In the case of CCS, the old adage about Wall Street is really true: The closer you get to Wall Street, the more pessimistic response you're going to get."
- "We're interested in financing projects that have a revenue stream associated with them. Long-term geological sequestration and storage of CO2 doesn't have a revenue stream. EOR projects are proven and we have financed a few of them, but permanent underground storage of CO2 is a different animal. These projects are viewed less favorably since they are an expense. If there is any applicable model it's in the financing of municipal solid waste projects where the revenue stream was the tipping fee at the landfill."
- "We really don't understand the project financing risks for CCS. When they realized that CO2 moved, they realized how little they knew about the risks."
- "It's not worth trying to determine the risk and financing model for CCS until there is a price associated with CO2."

Sources: Managing Directors of Structure Finance and Energy Markets for NY Investment Banks.

10

While We Can't Address the Overall Market Demand,
We Can Begin to Address Risk Management

Operational Liability Can Be Addressed
Through Historical Precedent and Existing Risk Management Frameworks

Environmental, health and safety risks
associated with CO₂ storage, transport
and injection.

↓

The private sector has a long, successful track
record of managing these risks with EOR and
other oil and gas activities.

↓

The private sector is well suited to absorb
operational risk, limited monitoring costs and
financial liability for at least 5-10 years.

Source: MIT, Liability of Carbon Dioxide Storage

11

Post-injection Liability Has More Risk Management Facets

Liability Categories	Example	Likelihood of Risk*	Type of Risk
Toxicological effects	Catastrophic release from a geological formation.	Unlikely. Effects would depend on concentration and duration of exposure.	Public health and safety issue.
Environmental effects	Groundwater contamination (e.g. acidification due to CO ₂ coming into contact with groundwater, displacement of brine which comes into contact with groundwater, or mobilization of metals which enter water supply. Ecosystem effects from increased CO ₂).	Uncertain.	Public health and safety issue.
Induced seismicity	Increased stress or pore pressure sufficient to produce seismic activity.	Not been observed but risk should be reduced through proper site selection.	Public health and safety issue.
Subsurface trespass	Stored CO ₂ wrongfully commingles with native substances which could've been used by property owner.	Uncertain.	Function of private property law. Tort causes of action include trespass, nuisance, negligence, strict liability. Statute of limitations issues?
Climate effects	Release of CO ₂ into the atmosphere.	Uncertain.	Contractual liability for non-performance.

*Demonstration projects would help create actuarial models of CCS risks and future liability mgmt. policies.
Source: MIT, Liability of Carbon Dioxide Storage

12

Risk Management and Insurance Experts Raise Pertinent Questions and Offer Valuable Insights

- **Who's best suited to take the risk?** Financial mechanisms must be implemented by the institution with the best fit to effectuate the goal—the institution best situated to implement and enforce terms and conditions designed to incentive sound operating behavior and assure funds are adequate and readily accessible to pay for the activities necessary to mitigate associated risks.
- **How might system design create vulnerabilities in the overall program?** The design and application of financial risk management mechanisms for CCS must balance incentives that foster early deployment with the potential for adverse site selection during to moral hazard, particularly as commercial-scale deployment evolves.
- **What are the benefits of risk pooling?** Consideration should be given to the liability and financial responsibility implications of industry pooling of sites based on geographic region, or site characteristics.
- **What are the limitations of financial risk management tools?**
 - When considering the design of financial risk mechanisms, it's important to remember that most financial instruments are "one-trick ponies" designed with one goal—protecting private party rights, not managing public goods (e.g. Letter of Credit).
 - Relatively few financial assurance instruments are designed as "promise to pay" or financial guarantees. The challenge of fit, interplay, and scalability become even more challenging when the events triggering the need for financial responsibility may not manifest for tens or hundreds of years.
- **What is the governing law of financial risk management tools?** Financial instruments are grounded in the certainty of contract law. It is critical to understand what events trigger the ability to call due the financial instrument and memorialize such events in a manner without ambiguity.

Source: BNA Inc Daily Environment Report, Vol. 2008, No 170, 9/3/08. Storing Carbon: Options for Liability Risk Management. Financial Responsibility. Chiara Trabucchi and Lindene Patton.

13

Risk Management and Insurance Experts Insights...Continued

What is the best way to assess risk? What frameworks make the most sense?

- The financial risk management framework should align with the CCS project lifecycle, whereby the CCS facility remains financially responsible for consequences arising during the operational phase from capture through post-closure. Specifically, the operator should demonstrate the ability to manage such risks, technically and financially, using well tested first-party assurances based upon financial capacity or third party mechanisms, such as annually renewable insurance policies. However because CCS is what the financial services sector calls a specialty or nonstandard risk, only a small part of the sector is equipped and qualified to analyze the risks and place capital at risk thereon. Thus to assure sufficient participation and a capital commitment for these risks from the financial services sector (through insurance, etc.) and the operating industry, a process similar to that followed with the advent of nuclear power risk management may be necessary, including antitrust waivers for participating parties.
- Once the project life cycle and operational conditions are defined, consequences and associated damages to private and public parties and god should be segregated according to the project's risk profile, including:
 - Time profile--when such events could occur,
 - Frequency profile--how often such events are expected to occur, and
 - Severity characteristics--the magnitude of damages that may result.

These consequences underpin pricing, and therefore face value, of the financial assurance instruments, including how much money will be needed, when and for whom.

Source: BNA Inc Daily Environment Report, Vol. 2008, No 170, 9/3/08. Storing Carbon: Options for Liability Risk Management, Financial Responsibility, Chiara Trabucchi and Lindene Patton.

14

Next Steps Based on Current Market Conditions?

- Stay Abreast of Financial Market Developments and Appetite for Risk**
 - Project finance as a whole
 - Effects of the election and a CO2 market regime
 - New project funding for CCS--Public and private sector
 - DOE Partnership progress with MMV and actuarial modeling
- Continue to Review Other State Activities**
 - FutureGen Illinois (IL SB1704)
 - State of Washington (WAC 173-218-115)
- Gather additional expert insight--December 3rd Presentation and Panel Discussion in Cheyenne**
 - Lindene Patton, Zurich Financial
 - Chiara Trabucchi, Industrial Economics
 - Rick Hawkinberry, The Willis Group
