



CCUS Developments and Carbon Markets

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EPA Policy and Carbon Markets

- + EPA has dual Approach to Regulating Greenhouse Gas (GHG) Emissions
 - + Tailoring Rule—Permitting of Larger Emitting Facilities and Case by Case Application of Reduction Technologies
 - + Development of Emissions Standards for New, Modified and Existing Sources
- + Questions as to Allowing Carbon Credits or Offsets to Play a Role in These Programs

EPA Greenhouse Gas Permitting Program: Texas Example

- + EPA Promulgates Tailoring Rule
- + After Texas Refuses to Implement GHG Permitting Program, through State Implementation Plan (SIP), EPA Issues Federal Implementation Plan (FIP)
- + EPA Region 6 in Dallas begins reviewing GHG Permit Applications for projects in Texas, but fails to hire sufficient staff to handle workload

Practical Dilemma in Texas

- + Texas Not Winning Lawsuits Challenging EPA GHG Regulatory Program (Although One Case Now Before US Supreme Court)
- + Permit Applications Begin to Pile up at EPA in Dallas
- + Potentially Billions of Dollars of Projects in Texas Not Able to Progress
- + Industry Lobbying in 2013 Texas Legislative Session Results in Bill to Require TCEQ to Take over Federal GHG Permitting Program; Governor Perry signs

Transition Process of GHG Permitting Program to Texas

- + EPA-TCEQ Working to Transition Program to TCEQ
 - + TCEQ Proposed Rules to Implement GHG Permitting in Texas 10/23/13
 - + TCEQ Hearing on Rules on 12/05/13
 - + EPA and TCEQ working on Work Share Program Whereby TCEQ Processes Much of Permit Prior to Transition of Program to Texas
 - + First Group of Permits Currently Being Worked by TCEQ
 - + TCEQ Estimates That Program Will Be Delegated to TCEQ by June 2014

Carbon Capture, Utilization and Storage Issues in GHG Permitting Program

- + Best Available Control Technology
- + Case-by-Case Evaluation of Technologies to Reduce Emissions from a Particular Source
- + EPA Has Concluded That Carbon Capture is Technologically Possible
- + Review Focuses on Economics

CCS and GHG Permitting: Best Available Control Technology Evaluation

- + Under Prevention of Deterioration (PSD) Program, Case-by-Case Evaluation of Best Available Control Technology (BACT)
- + Step 1 – Identify all available control technologies.
- + Step 2 – Eliminate technically infeasible options.
- + Step 3 – Rank remaining control technologies.
- + Step 4 – Evaluate and document remaining control technologies.
- + Step 5 – Select BACT.

Economic Evaluation of CCSU

- + Step 4 of BACT Evaluation Where Economics Are Evaluated
 - + Applicants Argue CCUS Not Technically Feasible, Despite EPA's Position
- + Permit Applicants May Rely on Certain EPA or Other Sources for Costs
 - + E.g., *Report of the Interagency Task Force on Carbon Capture and Storage* (August 2010) (14 Executive Departments and Federal Agencies)

Carbon Capture and Compression Estimates

- + Costs for carbon capture and compression from natural gas power plants derived from DOE/EPA reports
- + IF one assumes a 90% capture rate and emissions of 3.0, million tons per year, the cost for capture and compression is \$86/ ton CO₂ (could be in excess of \$100/ton CO₂: $\$86/\text{ton CO}_2 * (90\% * 3,000,000 \text{ ton CO}_2 / \text{yr}) = \258 million/yr (Cost of CO₂ Capture)
- + Therefore, the annualized cost would be approximately \$258 million per year, or higher
- + Costs to Construct Natural Gas Combined Cycle Power Plant \$600-\$800 million

Cost for CO₂ Transport

- + If one assumes a CO₂ Pipeline 25 miles away, it is not certain that capacity exist for CO₂ from potential plant, or that owner of pipeline will accept CO₂ from power plant because of potential EPA regulation
- + Cost of capital to build pipeline to CO₂ main line may be \$17 to \$75 million, with an annual O&M cost estimated at \$800,000 to \$3.7 million

Sierra Club Comments on One Application for Natural Gas Power Plant

- + The Region Should Have Considered Alternative Locations for the Proposed Project Where Carbon Sequestration Is More Readily Available
- + Many oil fields in Texas use CO₂ for enhanced oil recovery (EOR). Texas is by far the largest importer of CO₂ for EOR, and virtually all of that CO₂ comes via pipeline from naturally occurring underground CO₂ reservoirs in the Four Corners states. Locating the plant close to an EOR site would allow [the applicant] to sequester its CO₂ and receive revenue to offset the costs of carbon capture, compression and transport

Sierra Club Argument re CCUS Cost Analysis

- + EPA Region 6: cost estimate adequately approximates cost of a CCUS control for project and are high compared to overall project costs
- + Sierra Club: cost estimates are unsupported and incorrect
 - + Record lacks a site-specific cost analysis of CCUS
 - + Does not include estimate of revenue from EOR; Texas market for EOR robust, opportunities exist near site and elsewhere in Texas; conservative estimate of the market price for CO₂ is \$33/tonne
 - + Basis for rejecting CCUS in relation to overall costs of project is invalid
 - + Environmental (water) and energy penalty are not sufficiently supported
 - + EPA must consider partial CCUS

Current Status on CCS or CCUS/EOR and GHG Permitting

- + Under Current Pricing Assumptions, Costs Prohibitive for CCS or CCUS/EOR
- + Sierra Club Comments Do Not Change Reality That a Developer Would Find It Very Difficult to Finance a Natural Gas Power Plant with CCUS at This Point
 - + Wholesale Power Prices Very Low
 - + Currently, Merchant Plants Are What Are Likely to Be Built, Absent Creation of Capacity Market or Other Reliability Program in ERCOT Market
 - + Financing Very Challenging for Power Plants in Texas

PSD Permitting and New Source Performance Standard

- + EPA Region 6 Cost Analysis in Evaluating PSD Permits
- + EPA HQ Cost Analysis for New Source Performance Standards and Existing Plants
- + Question of How EPA Defends Differing Analyses
- + Ultimately May Present Challenge for GHG Limits on New and Existing Power Plants

EPA RCRA Conditional Waste Exemption: Regulation of Injected CO₂

- + EPA Reviewing RCRA Waste Conditional Exemption
- + Regulation of Injected CO₂
 - + When EOR and when CCS?
 - + Will CO₂ be considered a “waste”
- + How Will Treatment of Injected CO₂ Affect Economics of Injection Processes?
- + To What Extent Can Projects Obtain Financing If Potential for CCUS to Become a Waste Management Facility?
- + Long-Term Monitoring Concerns

Financing CCUS

- + If Assume \$80 to \$100 per Ton for CCUS, How Could a Power Plant or Other Entity Cover Those Costs?
 - + Sale of CO₂ for EOR: \$30 to \$40 per Ton
 - + Government Incentive: EOR is eligible for tax credit for \$10/ton of CO₂ and saline injection is eligible for \$20/ton.
 - + Carbon Credit: If available, probably \$14 or less per tonne (metric)
 - + This revenue would still fall below cost of carbon capture
 - + Issue of regulated and deregulated electricity markets

EPA Programs: Potential Carbon Trading and Carbon Markets

- + A Carbon Credit or Offset Could Generate Income to Offset Cost of EOR or CCS.
- + Potential for Developing Carbon Trading under Section 111 of the CAA
 - + Section 111 requires EPA to develop “categories of stationary sources” and promulgate standards of performance for sources within such categories”
 - + Typically a technology-based approach
 - + Moving to an industry-wide approach within a state may present challenges
 - + Experts differ in view of whether any trading or offsetting could be supported under 111

Carbon Trading: Clean Air Act Issues

- + In the Clean Air Mercury Rule, EPA established under 111(d) an optional power sector mercury emissions cap-and-trade program that states and tribes can join to achieve the required mercury emission reductions
- + Inside the Electric Generation Unit (EGU) fleet
- + Outside the EGU fleet

Current State Programs

- + Regional Greenhouse Gas Initiative
 - + Established 2003
 - + Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island, and Vermont
 - + Goal to cap and reduce CO₂ emissions from the power sector
 - + CCS not one of the offset categories currently approved
 - + Allowance (not offset) values have typically been \$3 or less
 - + Offset market has been lacking, but cap is tightening
- + California AB 32
 - + Industry wide GHG reduction program
 - + Does not currently allow offset for CCUS
 - + Allowance values have been \$12-\$14
 - + Offsets can be used to meet up to 8 percent of compliance obligations

Voluntary Carbon Markets

- + Purely voluntary reductions
- + Companies purchase for variety of reasons, pre-compliance, public relations, part of Carbon Disclosure Project program to reduce emissions
- + Standards Groups
 - + Verified Carbon Standards
 - + No current standard or any in development
 - + American Carbon Standard
 - + Greenhouse Gas Accounting Framework for Carbon Capture and Storage Projects
 - + DRAFT Greenhouse Gas Emissions Reduction Measurement and Monitoring Methodology for Carbon Capture and Storage Projects in Oil and Gas Reservoirs

Voluntary Carbon Markets

- + Voluntary Carbon Credit Market
 - + Bi-lateral sales
 - + Pricing dependent on buyer's perceived value
 - + Prices typically less than \$10 per tonne

European Union

- + European Union Established Emissions Trading Scheme
- + Evaluating Market for CCS Certificates (CCSCs)
 - + Designed in such a way as to avoid any negative interaction with the existing ETS
 - + ETS has been oversupplied, crashing carbon market, Dec 2013 4 Euros, historic highs near 30 Euros
 - + The CCSCs would be tradable instruments and would be granted for each tonne of CO₂ stored in the EU from 2015 onwards
 - + 2021-2025, each 100 tonnes of CO₂ emitted would require surrender of 99 EUAs and 1 CCSC).
 - + From 2026 onwards, CCSC requirement would increase by 1 in 100 each year, i.e. by 2030 the minimum compliance requirement for each 100 tonnes of CO₂ emitted would be 6 CCSCs and 94 EUAs

Kyoto Protocol

- + Modalities and procedures for carbon dioxide capture and storage in geological formations as clean development mechanism project activities
- + Ongoing discussions of CCS and carbon credits
- + Not applicable to US as the Kyoto Protocol never adopted by US
- + Current CER credit prices less than 1 Euro because of collapse of EU ETS market price



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Carbon Trading Law and Practice, published by
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<http://www.oup.com/us/catalog/general/subject/Law/EnvironmentalLaw/EnergyandNaturalResourceLaw/?view=usa&ci=9780199732210>

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