

**Final Report of the
Advanced Coal Technology Work Group
January 29, 2008**

Introduction

The Clean Air Act Advisory Committee (CAAAC) in September 2006 charged a newly created subgroup to “discuss and identify potential barriers and opportunities to create incentives under the Clean Air Act to the development and deployment of advanced coal technologies.” The Advanced Coal Technology Work Group (ACT Work Group) membership was to represent a diverse group of views and perspectives, and was further charged to produce an interim report in six months and final recommendations within one year. The ACT Work Group’s membership can be found in Appendix A, along with the full charge to the group as made by the CAAAC.

This report presents the final recommendations of the ACT Work Group. During the course of the year, the group agreed to go beyond the limits of its charter and to discuss mechanisms that might be engaged to advance deployment of ACTs outside of the existing Clean Air Act. Additionally, the group agreed to develop its recommendations on principles of “substantial consensus.” Under that framework, subcommittees of the ACT Work Group developed recommendation language, based on technical presentations to the group, and the language was brought to the full group for editing and a vote. The Work Group achieved substantial consensus on the recommendations.

The group discussed, at length, the limits on the definition of “advanced coal technologies.” The group reached substantial consensus that the term can encompass a broad and evolving suite of innovative processes and technologies that are designed to reduce substantially the overall environmental footprint of coal-based processes. The Work Group focused much of its discussion on ACTs that lower GHG emissions from coal-based facilities, because there are existing regulatory gaps and uncertainty in programs, incentives, and other mechanisms to facilitate the deployment and use of such ACTs. Many of the Work Group recommendations therefore directly address the use of ACTs that lower GHG emissions from coal-based facilities, relative to their more conventional counterparts.

While the Work Group reached substantial consensus on the recommendations, the group did not achieve substantial consensus on how broadly certain recommendations should be applied. Specifically, opinions varied considerably for three recommendations: the incentives “toolkit” (#2), state actions (#4), and technology advancing agreements (#6). In discussing those recommendations there were three perspectives:

- Most Work Group members think these recommendations should generally be used as a mechanism to move coal-based production toward addressing greenhouse gas (GHG) emissions, but need not specifically include carbon capture and sequestration (CCS).
- Some members think these recommendations should apply broadly and without preference to all ACTs that reduce the environmental footprint of coal-based facilities (including technologies that reduce GHG emissions, criteria and hazardous air pollutants, waste, or water use).
- Some members think these recommendations should exclusively apply to technologies that include the capture of CO₂ for permanent sequestration. These members do not believe it is appropriate to direct taxpayer dollars or any other incentives toward coal-based projects in the absence of measures that also require the capture and sequestration of CO₂ emissions.

Finally, issues and proposed recommendations that did not achieve substantial consensus are provided in Appendix B to illustrate the breadth and content of the Work Group’s discussions.

The Work Group, by substantial consensus, agreed that an approach involving coordinated and complementary policies will provide the greatest opportunity to close existing gaps and reduce uncertainty, and it is in this spirit that the group presents its recommendations.

* * *

RECOMMENDATIONS

1. NATIONAL POLICIES

The Work Group has developed a package of recommendations to accelerate early commercial deployment of ACTs, including near-term, large-scale CCS. But widespread commercial deployment of these technologies likely will not occur without legislation that establishes a significant long-term market driver. National mandatory GHG reduction legislation, for example, can provide a carbon price signal that would encourage the widespread deployment of large-scale carbon dioxide capture and sequestration systems. It is critical that any national policy should include provisions that prioritize and encourage early deployment of ACTs – particularly CCS.

The work group concluded that while incentives can stimulate early commercial deployment of ACTs, particularly CCS, such incentives will not provide a market driver for widespread deployment of these technologies. Widespread deployment will be needed to meaningfully reduce U.S. GHG emissions and to reduce the overall environmental footprint of U.S. coal use. Early adopters of CCS and other ACTs will bear the greatest risk, due to factors such as technical uncertainties, liability, higher costs, and energy penalties. Because of the importance of early commercial projects in providing the experience needed for widespread deployment, public and private action, including risk-sharing, is urgently needed to accelerate and increase the number and size of early projects.

2. A “TOOLKIT” OF INCENTIVES

Government agencies (Federal/Tribal/State/Local) should use a variety of regulatory, financial and other incentives – including cost recovery, tax exemptions and credits, loan guarantees, accelerated depreciation, and long-term purchase contracts – to accelerate early commercial projects that utilize ACTs. Risk-tailored combinations of incentives should be applied as necessary in a coordinated fashion, taking into account the unique risk factors present in each commercial ACT project.

The best use of incentives will involve flexibility with respect to a range of terms and conditions. A single project may require more than one incentive, depending on the nature and importance of the risks the project faces and the capacity of the project’s sponsors to manage them. In the “toolkit” approach, government agencies and private entities would apply different incentives to address different risks cost-effectively.

3. EARLY DEPLOYMENT FUND

Congress should immediately create a CCS Early Deployment Fund, whether through comprehensive climate change legislation or separate legislation, to fund the additional costs and risks of CCS to developers. The quasi-governmental Fund would support the rapid deployment of at least 5-10 early commercial facilities that integrate CCS by paying for CO₂ sequestered. The majority of the supported facilities would be coal-based electricity generators. The Fund could be paid for by various mechanisms or a combination of mechanisms.

A CCS Early Deployment Fund would help reduce uncertainty about budget cycles and provide consistent, large-scale funding to enable critical early deployments of fully integrated CCS projects. The CCS Early Deployment Fund would help accelerate the deployment of CCS through: (a) funding the additional cost of CCS technologies, (b) increased support for permitting, and (c) initial liability treatment. While the work group focused on coal projects, it agreed that petroleum coke-based projects could qualify for this incentive if they offer large-scale CCS opportunities.

Funding. The fund, which would be structured to generate \$1 billion annually for five years, extendable to ten years, would cover the additional costs of CCS for at least 5 to 10 full-scale early commercial demonstrations of various technologies. The fund could be established through various mechanisms or a combination of such mechanisms:

- One option would be a temporary charge assessed on fossil fuel-fired electricity. Raising \$1 billion from fossil-based electricity, for example, would result in an increase of approximately 0.6% in electricity charges.
- Another option would be to use some portion of the proceeds from the auction of allowances provided in cap-and-trade legislation.
- The fund could also incorporate contributions from industry.

Fund implementation. Funds could be distributed via a reverse auction mechanism to ensure cost-effectiveness, and would offset the incremental costs of carbon capture and long term storage. Projects at both existing and new units would be eligible for support, and diverse generation and capture technologies would be tested. Funded projects would be required to capture and sequester large volumes of CO₂, would be located in different regions of the country, and would test various technologies.

Expanded support for permitting the first 5-10 CCS projects. The Fund would contribute resources, up to \$10 million annually, to provide capacity-building support for federal, tribal, state and local permitting authorities where applicable. Such resources would bolster the capability of various permitting staffs to analyze the novel legal and technical issues posed by CCS projects. These funds would supplement regular air, water, and other operating grants and not result in reduction of funds for other state purposes.

Initial liability treatment for Fund-sponsored projects. To address the absence of a risk management framework for the long-term storage of CO₂, the Fund's enabling legislation would establish long-term site stewardship and risk-management provisions for projects established by the fund. These early projects will provide important data to inform the development of an appropriate risk management framework.

To address the possible risk of liability for projects established by the fund, a shared liability approach should be implemented until a permanent framework is in place. Under this approach, the project participants, their contractors or assignees would be responsible for unexpected

releases during the injection period and for a reasonable period of time thereafter, until post-closure monitoring creates a reasonable expectation that the project is performing as expected. The time period would be informed by relevant regulations for post-closure performance standards.

4. STATE ACTIONS

State legislatures should take actions to enable public utility commissions and other appropriate state agencies to take steps to encourage the early commercial deployment of ACTs that enable the transition to CCS at coal-based facilities. As appropriate, and on a state-by-state basis, these steps could include: making reasonable cost recovery findings for costs associated with CCS and IGCC; providing for accelerated cost recovery for ACT projects; administering various incentives for ACT projects; requiring carbon emissions to be priced in integrated resource planning and needs determinations; and enabling long-term power purchase agreements where ACTs are employed.

5. IMPROVING THE EFFICIENCY OF EXISTING COAL PLANTS

- (a) EPA should immediately evaluate, in detail, the potential for achieving reductions in CO₂ emissions at existing coal-fired electricity generation facilities through increased plant efficiency projects, where such efficiency improvements will reduce or not cause increases in other regulated pollutants and will not delay the installation and commercial use of technologies that capture significant amounts of CO₂.**
- (b) EPA and other federal/tribal/state agencies should take advantage of opportunities to encourage/facilitate the deployment of technologies to increase the efficiency of existing coal plants, considering currently available information. The data resulting from the evaluation called for in 5(a) should also be considered once such data becomes available. Projects to increase the efficiency of existing coal plants should reduce CO₂, reduce or not cause increases in other regulated pollutants, and should not delay the deployment of technologies that capture significant amounts of CO₂.**

6. TECHNOLOGY ADVANCING AGREEMENTS

Stakeholders involved in the development of coal-based facilities should consider, where appropriate, entering into “Technology Advancing Agreements,” the purpose of which is to accelerate deployment of ACTs during the interim period of regulatory uncertainty or where regulations are new or not fully in force. Such agreements would be voluntary and would not limit any rights of stakeholders or interfere with any operation of law or regulation.

The Agreements would be pre-permit, project-specific agreements with negotiated terms and conditions intended to (1) advance environmental performances and technologies, and (2) increase project development and regulatory certainty.

Such agreements would enhance project certainty and advance environmental performance and technology until measures to address CO₂ and other greenhouse gases are adopted and fully implemented. The Agreements could include (but would not be limited to) terms and conditions to address: (1) the duration of the agreement; (2) steps to advance technology; (3) measures to reduce greenhouse gasses and other pollutants (offsets and control technologies); (4) mechanisms to increase project certainty; and (5) stakeholder agreements to support, or not oppose, the

proposed project in appropriate fora, such as public utility commission proceedings and other public hearings.

Such agreements would necessarily be designed on a case-by-case basis, and would not limit parties' rights to participate in regulatory and judicial proceedings nor interfere with the application of other regulations.

7. EPA'S UNDERGROUND INJECTION CONTROL (UIC) / SEQUESTRATION POLICIES

Given the unique properties and behavior of CO₂ and the potential national importance of geological sequestration, EPA should designate a new well class for geologic sequestration of CO₂ in its upcoming UIC rulemaking. EPA's Office of Water and the Office of Air and Radiation should coordinate closely to establish criteria for CO₂ injection and sequestration.

Given the unique properties and behavior of CO₂, the anticipated scale of geological sequestration, and the potential importance of this activity in national efforts to sequester CO₂, EPA should designate a new class of well in its upcoming rulemaking on geological sequestration. Creating a new class will ensure that EPA's program reflects the distinctive characteristics of injecting CO₂ for long-term storage and considers the risks and safeguards appropriate to such CO₂ injection. A new well class will also address concerns associated with regulating CO₂ injection through other sections of the UIC program, namely those designed to address the injection of hazardous or other waste.

EPA should settle questions related to UIC primacy as quickly as possible. The rulemaking should incorporate "adaptive" principles, including provisions for periodic review to allow incorporation of new data, and should take into consideration both individual wells and entire geological formations. In addition, the rulemaking proposal should include a thorough discussion of two important areas: (a) financial assurance mechanisms in the context of geological sequestration of CO₂; and (b) liability implications under other statutes (CERCLA, RCRA, etc.) and potential linkages and impacts (or lack thereof) for CCS projects.

8. EPA PUBLIC OUTREACH

EPA should immediately develop, in consultation with other agencies, a public outreach effort to explain carbon capture and sequestration. At a minimum, the effort should cover: reasons why CCS is needed in a coal context; the risks and benefits of using CCS; the security of CO₂ storage at properly selected and managed sites; and the need for demonstrations and commercial deployment.

The development and deployment of CCS technologies will present the public and other stakeholders with an array of new and important questions and issues, and improving public understanding of those issues is critical. For example, the public may oppose CCS without a clear understanding of the risks and benefits of CCS in relation to the broader costs and benefits of climate change policies. To address such issues and concerns while concurrently communicating the importance of developing and deploying CCS, an effective education and outreach campaign must be developed and implemented.

9. EPA ACCOUNTING PROTOCOL

EPA should, in consultation with appropriate agencies and stakeholders, develop an accounting protocol to quantify the CO₂ emissions from capture, transport, injection and storage of CO₂ in geologic formations. EPA should make use of existing protocols to the extent possible to encourage standardization and accelerate the protocol's development.

EPA should also provide recommendations to address additional questions that arise if a project seeks to quantify CCS reductions as an offset.

CCS projects can be encouraged through national GHG policies. There may be different GHG accounting issues whether facilities are required to hold allowances for emissions or whether CCS is considered an offset project. Identifying and addressing these accounting issues now will help ensure that financing of CCS projects is not delayed.

The Intergovernmental Panel on Climate Change (IPCC) recently released national GHG inventory guidelines for carbon dioxide capture, transport, injection and storage. A comprehensive CCS accounting protocol developed by EPA would provide more specific guidance for applying IPCC Guidelines in the United States. The accounting protocol should identify methods for quantifying CO₂ emissions from the entire CCS chain, and should consider various issues, including monitoring, reporting, quality assurance and control, and cross-border issues.

If CCS is undertaken as an offset project, additional accounting questions would arise. The Work Group recommends that EPA evaluate the relevant issues, such as assessing additionality, developing baselines, identifying and quantifying leakage, and analyzing permanence issues. Guidelines recently completed by other organizations should be considered.

10. EPA TRAINING PROGRAM FOR SEQUESTRATION PROJECTS

EPA should, as soon as practicable and working with other appropriate agencies, sponsor education and training programs for regulators and other officials involved in the permitting and monitoring of carbon capture and sequestration projects.

Given the novel technical and legal issues that will accompany carbon capture and sequestration projects, increased support for the training of regulators and other officials will help minimize project delays, and speed the transfer of knowledge necessary for wide-scale deployment.

11. CARBON DIOXIDE SPECIFICATIONS

A standards-setting body (ASTM or similar) should establish specifications for CO₂ quality, taking into consideration a variety of sources, transportation alternatives, and end uses.

Specifications for CO₂ currently exist for naturally occurring CO₂ that is transported and used for enhanced oil and gas recovery. With CCS, CO₂ could be generated, captured and transported from a variety of anthropogenic sources using different fossil-fuels (*e.g.*, coal, petroleum coke) and sequestered in a variety of geologic formations and for a variety of purposes. Establishing standard specifications for CO₂ depending on its source and end use would reduce the potential issues associated with the integration and development of new and existing infrastructure to capture, transport and sequester CO₂ and facilitate the transition to wide-scale CCS.

12. EXISTING AUTHORITIES UNDER THE CLEAN AIR ACT

EPA should take advantage of existing opportunities under the Clean Air Act, and current regulations, to promote the near-term deployment of ACTs that reduce the overall environmental footprint of coal-based facilities.

13. PIPELINE STUDY

The appropriate federal agencies, in consultation with other organizations, should promptly conduct a study examining CO₂ pipeline infrastructure issues in the context of developing a large-scale national CCS program.

This study should investigate and evaluate, among other topics, the following issues: current pipeline capacity and expected future needs; barriers to the development of needed infrastructure, including those related to the siting, financing, or regulatory jurisdiction; and steps needed to ensure adequate safety and protection of the environment. As part of this study, the appropriate agencies should develop a detailed database that links CO₂ sources, geologic storage capacity and pipeline infrastructure needed to transport CO₂, to be updated annually.

Appendix A

1. Charge to Work Group

To discuss and identify the potential barriers and potential opportunities to create incentives under the Clean Air Act to the development and deployment of advanced coal technologies.

This may include discussion of technical and economic information, environmental performance and characteristics, state and regional developments, and questions related to the Clean Air Act and the deployment of advanced coal technology.

The Work Group should also consider potential updates to the information in EPA's technical report entitled "The Environmental Footprints and Costs of Coal-Based Integrated Gasification Combined Cycle and Pulverized Coal Technologies," and carbon capture and sequestration, among others.

The Work Group's duration should be no longer than one year, with agreement to produce an interim report at six months, and a final report at the conclusion of the year. The Work Group's membership should reflect a diversity of stakeholder views and perspectives.

During the course of the year, the group agreed to go beyond the limits of its charter and to discuss mechanisms that might be engaged to advance deployment of ACTs outside of the existing Clean Air Act.

2. Advanced Coal Technology Work Group

Co-chairs

Ben Henneke, Clean Air Action Corporation
Anna Marie Wood, Porter & Hedges
Ben Hengst, U.S. Environmental Protection Agency

Work Group Members

Utilities

Daniel Cunningham, PSEG Services Corporation
John McManus and Frank Blake, AEP (American Electric Power)
Dean Metcalf, Xcel Energy
Sempra Energy
Vicky Sullivan, Southern Company

IGCC and Pulverized Coal Technology/Pollution Control Equipment Providers

James Burns, Shell Gas & Power
David Foerter, Institute of Clean Air Companies
Robert Hilton, Alstom Power, Inc.
Bruce Rising and Barbara Bankoff, Siemens Power Generation
Lisa Stolzenhaller, General Electric Energy

Coal Companies

N. "Maha" Mahasenan, Rio Tinto Energy America

State and Tribal Representatives

Sandra Ely and Mark Fesmire, New Mexico
Alvaro Linero, Florida
Christopher Romaine, Illinois

NGO/Environmental Organizations

Bob Gruenig, National Tribal Environmental Council
Mark MacLeod, Environmental Defense
Patrice Simms, Natural Resources Defense Council
Ann Weeks, Clean Air Task Force

Public Utility Commissions

Jim Welch, Commonwealth of Kentucky

Academic Institutions

William Auberle, Northern Arizona University
Anthony J. DeLucia, East Tennessee State University

Experts in Carbon Capture, Storage and Sequestration and other Approaches to Manage and Provide Incentives for CO2 Reductions

Larry Myer, Lawrence Berkley National Laboratory
Naomi Pena and Judi Greenwald, Pew Center on Global Climate Change

Other interests represented

Rick Bolton, Center for Toxicology & Environmental Health, L.L.C.
John Campbell, Caterpillar, Inc.
Steve Jenkins, CH2M Hill (permitting consultants/engineers)
Eugene Trisko, United Mine Workers of America
Robert Wyman and Nicole Buffa, Latham & Watkins (legal)

Federal Agencies (non-voting participants)

David Berg and Darren Molloy, Department of Energy
Paul Bollinger, Department of Defense
Michael Ling, William Stevens, and Robert Wayland, Environmental Protection Agency

3. Substantial Consensus

Pursuant to the Work Group Charter, the Work Group agreed to operate according to a “substantial consensus” principle. Substantial consensus meant that it was understood that not every member might completely agree with every decision the Work Group made. In those cases, the Work Group attempted to balance views to the extent possible in reporting on the recommendation and incorporating alternate viewpoints.

4. Work Group Activities

For an overview of Work Group activities, please visit the Work Group’s website at <http://www.epa.gov/air/caaac/coaltech.html>. The website lists meeting and conference call dates, and includes meeting summaries and all presentations made to Work Group members.

Appendix B

At the request of the Clean Air Act Advisory Committee, we have provided this appendix. The Work group felt that while these issues and suggested recommendations did not achieve substantial consensus (or where the Work Group did not have time in the case of #1 below), it was important to include them in an appendix to provide the CAAAC with a more complete understanding of other significant issues discussed.

#1 Statement on other CCS barriers

The Work Group recognized that successful large-scale deployment of CCS will require policymakers to address two additional areas for which the Work Group did not provide detailed recommendations: liability for CO₂ injection and storage, and property rights associated with that storage. Both of these areas have the potential to produce barriers to CCS, but after consideration of several policy options the Work Group chose not to recommend a specific approach, due primarily to time constraints.

#2

One recommendation which did not achieve substantial consensus, and originally discussed as part of the actions EPA might take under current Clean Air Act authority, stated that “EPA should reconsider its position on whether CO₂/GHG emissions from stationary sources are ‘subject to regulation’ under the CAA.”

#3

Another recommendation which did not achieve substantial consensus, also discussed as part of the actions EPA might take under current Clean Air Act authority, stated that EPA should “consider and evaluate those ACTs that capture CO₂ for sequestration in the BACT emissions limit determination for new coal-based EGUs,” and that “collateral environmental benefits of reduced CO₂ should be factored in to selecting a BACT emissions limit.”

#4

The Work Group discussed, but did not achieve substantial consensus on, whether and to what extent revisions to the NSR program should be considered.

#5

Another recommendation that did not reach substantial consensus recommended that for new fossil-based facilities, EPA develop CO₂ permitting guidance to encourage early commercial use of ACTs while simultaneously achieving CO₂ reductions. The recommendation made use of offsets, stating that “Where local conditions or costs preclude the use of CCS at a new facility, the guidance should strongly encourage the offset of at least 50% of actual plant CO₂ emissions during the first 5 years of operations, 100% during the next 5 years, and 100% of *all* CO₂ emissions (i.e., including CO₂ emissions from mining, transportation, etc.) thereafter.”