

**Clean Air Act Advisory Committee
Advanced Coal Technology Work Group Meeting
Double Tree Hotel Crystal City
March 29, 2007**

Meeting Objectives

- **To receive information about external events related to the Work Group's efforts**
- **To continue discussions on how the barriers, opportunities and tools identified thus far could be used to accelerate the use of advanced coal technology**
- **To discuss framework for six-month interim report**

Welcome and Overview

Ben Henneke, Clean Air Action Corporation, welcomed the group and discussed the meeting objectives. He mentioned that there would be some time for announcements about advanced coal technology (ACT), a discussion on barriers and opportunities, and a discussion about the interim report. He asked if there were any questions about the agenda.

Gene Trisko, United Mine Workers, said he had would not be able to attend the late afternoon discussion on the interim report. He asked if EPA would be providing some input on the interim report in the form of working drafts. Anna Wood, EPA, responded yes, if the Work Group decides that would be helpful.

Mr. Henneke added that the expectation is that the interim report will be kept short enough that there will not be a ton of edits. Hopefully the Work Group can cover most of it.

Mr. Trisko said that he thought the remarks offered by Rob Brenner at the first meeting provided a clear overview of ACT and should be somehow incorporated in the report as background material.

Principles and Recommendations from the U.S. Climate Action Partnership

Anna Wood, EPA, introduced presenters Nikki Roy, Pew Center on Global Climate Change, and Larry Boggs, General Electric.

Mr. Roy said The Pew Center, which studies climate change, is mainly involved in three lines of work: 1) commissioning peer reviews reports on all aspects of climate change, 2) projecting the voice of the progressive business community, and 3) working with policy makers at the state, local, federal, and international levels to advance sound climate policy.

The Pew Center is a founding member of the U.S. Climate Action Partnership (US CAP). A year ago General Electric (GE) recognized that there was a climate change position that was not being heard loudly in Washington. GE decided to work with four NGOs to make that voice louder and more specific. Over approximately nine months, representatives of the four NGOs and ten companies developed the recommendations which were listed in the brochure that was

distributed to Work Group members. From the beginning, it was CEO-level commitment and involvement that made this project successful.

Mr. Roy directed the Work Group to page eleven of the brochure, which he felt was the single most important page of the brochure. The statement stresses that US CAP is a growing coalition committed to staying together until a law is passed that works for the U.S., the states, and the environment.

Mr. Boggs stressed again that the Partnership is a CEO effort. He showed a slide listing the launch participants. The green participants are NGOs and the blue participants are companies. New members that have accepted their invitation to join the Partnership are listed in the second column.

Mr. Boggs next reviewed the conclusions of the document *A Call for Action*. Conclusions include: we know enough to act, the U.S. is capable of handling the climate change issue, and we can prosper in this new world because we are an innovative society and a technology leader. The solution has to be flexible, mandatory, an economy wide program, and a program that includes different approaches for different sectors. Mr. Boggs next reviewed the key principles of the US CAP.

The US CAP tried to develop recommendations that were both environmentally effective and economically sustainable. One of the guiding principles is to look at what can be done in the next 20-30 years. The problem will not be solved in one piece of legislation; it will take a lot of time. Mr. Boggs stressed that the aspirational goals, listed on slide seven, are goals and not mandatory standards under U.S. law because they are international goals that cannot be enforced. The group agreed to set three targets off of current levels with three timetables for an economy-wide cap and trade program. This includes not only power generation, but also transportation and other sectors of the economy. Mr. Boggs next reviewed the economically sustainable list on slide seven.

US CAP plans to double its membership, participate in the Congressional process to get several of the economically sustainable recommendations into law as fast as possible, and explore the transportation/international issue in more detail.

Mr. Roy introduced colleagues Janet Pablo, PNM, and Jason Lynn, Caterpillar.

Rick Bolton, Center for Toxicology and Environmental Health (CTECH), asked if the group had discussed incentives. Mr. Boggs said the group has discussed incentives, but they have not drawn conclusions. They do, however, believe there is going to be a need for tax incentives and they believe regulatory changes are necessary. They also think that capital formation needs to be addressed.

Vicky Sullivan, Southern Company, asked what Mr. Boggs meant by “requirements” for carbon capture and storage. Mr. Boggs said this meant that there needs to be a regulatory program in place that addresses monitoring and citing. Additionally, liability, ownership issues, and pipelines also need to be addressed. They want to talk about changing the Department of

Energy's (DOE) demonstration project. They also think there need to be three major coal-fired level projects implemented immediately because coal-fired electricity generation is significant. The uncertainty in carbon capture technology, however, is delaying the deployment of these projects. Mr. Boggs stressed that everything needs to be done quickly.

David Foerter, Institute of Clean Air Companies, asked in the context of a US CAP, how to define advanced coal technology or clean coal technology. Mr. Boggs said that GE and US CAP want the broadest technology potential possible. Mr. Roy said a market signal needs to be sent across the economy and inventors and investors will subsequently deliver the technologies.

Bob Gruenig, National Tribal Environmental Council, asked Mr. Boggs to expand upon his statement about allocations recognizing different impacts on regions of businesses. Mr. Boggs said there is heavy reliance on fossil fuels, particularly in the US and this needs to be dealt with. Mr. Boggs said some believe the allocation process is the best way to address this issue, but he recognizes that there are other ways to address it as well. Mr. Roy responded that allocation and safety valves are two of the most controversial issues within the group and everyone recognizes that to be relevant, they need to say more than they have to date, but the question is timing. There are three tensions about allocation: 1) those that are coal reliant and would like a high level of allocation based on historic emissions, 2) those from the clean energy group that would like allocation based on electricity output, and 3) those from the environmental community that think there should not be a high level of allocation because of wind falls. These three tensions will have to be addressed in the political process. Mr. Roy said they need to add substantive guidance with regard to the political process.

Ms. Pablo said US CAP would rather settle this issue than have it be settled somewhere else. Mr. Boggs added that one of the founding views is that this issue should not be left to the normal process. The members of US CAP want to take part in controlling their destiny. They did not deal with transportation in much detail and hope transportation companies will join their discussion, but they want to create a process where people can come and reach accommodations to help move the process in the direction that will make this economically sustainable, and environmentally effective. Ms. Pablo said the Hill is begging for concrete information.

Bob Wyman, Latham and Watkins, asked with regard to the safety valve question, if the group had talked about ranges of prices and time frames. Have they discussed whether it should be transitional or indefinite in duration? Have they discussed what would be done with the revenues? Have they discussed the relationship between the safety valve and the geographic and temporal extension of offset opportunities? Is there a linkage there?

Mr. Roy said the language in the recommendations was very carefully negotiated. He read the key issues: if use cost control measures must be designed to enable a long term price signal that is stable and high enough to drive investment in low emitting technologies including carbon capture and storage. In other words, if you are seeing a cost control measure that is undercutting this, it does not meet the test. It must ensure the integrity of an emissions cap over a multi-year period. The recognition is that they do want to protect the economy against crazy market swings. There are several tools that could be used to do this including a safety valve, but they do not want to do this in a way that undercuts their top priority. This is about technological

transformation. If you do not sustain a market signal that drives technological transformation, your policy has failed.

Mr. Wyman asked if there had been any discussion about the concept of issuing credit in advance of the reductions as a way of encouraging capital intensive investment. US CAP had not discussed this.

Tony DeLucia, East Tennessee State University, said the Clean Air Act Advisory Committee (CAAAC) has had a subcommittee in the past called “Linking Land Use, Energy, Transportation, and Air Quality” and it seems that these players, along with healthcare, comprise the sectoral decisions. From the standpoint of healthcare, Mr. DeLucia said he believes there is a tremendous movement in green health that could be intimately involved as well as health professional associations. Mr. Roy said that before recently they have not had a rational debate about climate policy and sustainable policy in general. Once they begin to have this rational conversation, it will give them a sounder base to deal with the issues that Mr. DeLucia brought forth.

Daniel Cunningham, Public Service Enterprise Group (PSEG), said it seems that US CAP is about getting a strong, unified, national, multi-sectoral program together in a common effort and then engaging in the international community to address this problem. Before the US can unite, there are going to be other programs that will start up. He asked if US CAP has had discussions about how these programs might be integrated into a national program. Could these efforts draw on success of a national program? Mr. Roy said there are a lot of reasons to move quickly with legislation. One being, if you do not, there will be a patchwork of state programs. From the perspective of the Pew Center, they recognize and salute the work of the leading states that create the models on which most federal environmental laws have been built. That said, for any environmental policy and especially this one, you do not want patchwork programs. Developing a federal program will take the pressure off the states. They have not discussed preemption; however, as state governors get more strongly associated with these programs, they are going to get pressure to fight against preemption. Mr. Boggs added that there will be good roles for states, but the price of carbon needs to be as broad as possible. There are roles, however, where states have the best place and there should not be a federal program. Mr. Boggs said he did not think there would be a federal land use program.

Sandra Ely, New Mexico Environmental Department, said it is true that states have been laboratories for the Clean Air Act and a lot of good work has come from the states which has been adopted by the federal government. This is also the case with climate change. It is important that the Feds will learn from the states and whatever program develops will be a floor, but it is also important that the states have the opportunity to go further if needed. Mr. Roy said at this level, no one disagrees. However, there are two questions: 1) what attributes of a state policy will move things along constructively; and 2) what might vulcanize the system to move inefficiently. An efficient federal floor will free states so that they can focus on areas where they can lead.

Jeff Hopkins, Rio Tinto Energy America, asked if economic costs entered the discussion. Do you have an estimate for what US CAP would cost? Mr. Boggs said yes, they have an estimate, but they do not believe the proposal is sufficiently detailed enough to cost this amount. Even if

looking at emissions over time, it would be difficult to predict the cost. The expected reductions do not take into account offsets, safety valve or other cost control measures. Mr. Lynn added that there has been discussion about the cost of not acting. The concern is that the cost would be greater. The longer we wait to make the investments and deploy the technology, the cost will be greater. This is factored into some of the decisions as well.

Michael Ling, EPA, asked if the group was approaching New Source Review (NSR) from the perspective of NSR acting as a barrier to efficiency improvements or being used as a tool to use a regulatory program to drive greater efficiency improvements. Mr. Boggs said they think of it as a barrier. Ms. Pablo clarified that they have not agreed on NSR. From some of the utilities perspectives, it is worthwhile to look at pieces of NSR; however, this is as far as they have gone. The group has not advocated an overhaul of NSR. It may be worthwhile to explore some limited scale projects.

Mr. Foerter asked if the goal of the group was CO₂ reduction through technology improvements for power. Is the goal CO₂ reductions or is it through technology changes? Mr. Boggs responded that it is not technology for technology sake. It is aimed at reducing CO₂. Ms. Pablo said the utility industry is looking at doubling its asset value between now and 2020 and they would like to know where to put their money so they make the right kind of investment. They are standing on the verge of huge investments and a responsibility to meet demand. They would like direction on what technologies to invest in to do business. Mr. Foerter said he understands the wave that is coming for new power generation, but is wondering if they are looking at the transformation of carbon capture and storage at existing power plants. Ms. Pablo clarified that this is not all about new technology. There are more coal plants on the ground than will be built in the next 5 years, so this will be addressed. Mr. Roy added that the goal is to reduce emissions to minimize the effect on the climate through technology transformation. About 25% of US greenhouse gas emissions are from coal-fired power plants; however, there are responsibilities for almost every aspect of society. This massive challenge will take massive effort across the board.

Recent Events Related to the Work of the Advanced Coal Technology Work Group

Anna Wood, EPA, said this was the time for people to mention things that Work Group members are working or know about that are relevant to the Advanced Coal Technology Work Group.

Dean Metcalf, Xcel Energy, said his company has started some clean air energy efforts, which will be especially important in the Western United States.

John McManus, AEP, said that AEP recently announced that it would initiate demonstration projects on chilled ammonia to verify its applications. This would include scaling up efforts at a power plant in West Virginia. The next step is to do a full-scale project in Oklahoma that will be operational by 2011. However, there are significant capital investments associated with the scrubbers, which is important to think about. AEP is also working on an oxy-coal demonstration on a small scale to test its applications. The schedules for these demonstrations are aggressive and there are a lot of questions still being raised about permitting.

Ben Henneke, Clean Air Action Corporation, mentioned that Sierra Club and Kansas City Power and Light came to an agreement to build a facility that was a previous unit shut-down with additional wind efforts that have no net greenhouse gas emissions. Ms. Wood added that there would be an energy efficiency focus and demand side management to offset the CO₂ emissions.

A Work Group member requested the opportunity to briefly describe a draft white paper. He noted that any statements he makes are on background and should not be attributed to him or the organization he represents. The paper is a concept for jump-starting the accelerated commercialization of carbon sequestration technology. He noted first that there are two barriers to this commercialization. The first is the lack of funding from the Bush administration. The second is the lack of a timely flow of allowances.

The Work Group member continued to describe that concept that first came up at a meeting with a large coal company. There would be a small fee or tax imposed on the gross delivered sale price on coal in the U.S. A fee of 3% would generate approximately \$1 billion annually while a fee of 5% would generate \$1.7 billion annually. A small fee between 3-5% would help to accelerate commercial carbon sequestration. The fee would be in the form of a sales tax remitted to the government and channeled to a research corporation that would serve as a funding conduit for grants to those on the ground who are making cutting-edge progress now. The Work Group member said that if we do not push these programs now, imported LNG or nuclear power will take ACT's place at the table. He added that they looked into other funding mechanisms that could serve as alternatives to the small fee. For example, a wires charge was rejected because of the diversity of portfolios. Also, a carbon tax on the coal itself was rejected because of the difference between eastern and western coal prices. The Work Group member offered to pass along copies of the draft white paper to anyone interested.

Sandra Ely, New Mexico Environment Department, talked about regional initiatives related to ACT. She said that Governor Richardson signed a MOU to create the Western Climate Initiative with a series of western states. Another regional initiative is the Multi-State Climate Registry, which includes states and tribes. She mentioned also that in New Mexico, the Climate Change Research group has finalized some recommendations for its Advanced Energy Bill. The bill, which is expected to be signed by the Governor, has a tax credit and a potential for rate recovery. There is also a carbon sequestration group initiated by the Governor that has started to meet recently. The goal is develop draft rules and regulations on carbon sequestration by the end of the year.

Dan Cunningham, PSEG, talked about his company's research on offsets. PSEG has joined with about 400 interested parties to solicit offsets for contract in different areas. They will address the legality of contract offsets related to a national program.

Paul Bollinger, U.S. Air Force, said the Air Force had an Energy Forum two weeks ago to address infrastructure, vehicles, and aircraft. There were positive comments received, which shows that the momentum has been building. Also, the certification of synthetic fuels for B52s should come out soon. The Air Force is moving ahead on the acquisition of synthetic fuels. He also mentioned that they are looking into building energy forces on the bases, but they are not

interested in investing in the plant. The goal is to have 50% of domestic fuels usage supplied by domestic companies producing alternative fuels.

Bob Wyman, Latham & Watkins, said that they are working with the State of California on behalf of the California Air Resources Board to look at many issues discussed earlier, including mechanisms for early credit generation. They hope to have the California Air Resources Board issue some protocols for pre-certification soon.

Mr. Henneke mentioned the TXU event and asked if there were any final comments from the group on recent events.

Discussion of Draft Matrix of Issues, Actors, Barriers and Opportunities

Before beginning the discussion, Anna Wood, EPA, introduced a few new members and alternates. These included: Danielle Prendergast who was an alternate for Lisa Gomez, Sempra Energy; Mark Fesmire, Chairman of New Mexico Oil and Gas Commission; Bill Stevens, alternate for EPA; and Mike Sewell, alternate for EPA.

Mark MacLeod, Environmental Defense, described the impetus for the development of the matrix. He said that in previous meetings there was broad territory covered and a lot of different problems that needed to be addressed which involved different avenues and actors. Charts and tables seemed to be a good way to bring some clarity to the issues. He said he added no original writing, but instead took the list of barriers and opportunities created by the group. He essentially created a framework in which to store all of the barriers and opportunities. He noted that the red font represented the barriers and the green font represented the opportunities. He added that this was just a first draft and welcomed suggestions.

Ms. Wood added that the recap from the last meeting may fold into the matrix.

Lessons Learned from Demonstration/First Mover Projects

Ben Henneke, Clean Air Action Corporation, introduced Douglas Topping, a Senior Vice President at EPCOR, which is a utilities generation company in Alberta, Canada.

Mr. Topping first gave a legal disclaimer. EPCOR is an operator and owner in facilities across Canada and the U.S., with investments in Raleigh, Indianapolis, and Denver. EPCOR is responsible for operating power generation with gross capacity of more than 3,400 MW. EPCOR is an integrated utility company with water and power operations.

EPCOR's generation portfolio includes Genesee 3, which is Canada's most advanced coal-fired generator and features supercritical combustion technology. It is the first supercritical plant in Canada and began commercial operation in March 2005. Their portfolio also includes Kingsbridge 1, which has 22 turbines and adds 40 MW of electricity to the Ontario power grid. EPCOR also operates facilities that generate power from renewable sources.

Mr. Topping next showed an image of the supercritical combustion at Genesee 3. He explained Alberta's generation capacity; Alberta's installed generating capacity at the end of September 2006 was 11,497 MW, which included 5,840 MW of coal-fired power, 4,278 MW of gas-fired generation, 869 MW of hydroelectric power, and 510 MW of wind and other sources. Nevertheless, Alberta's power use has increased approximately 3,500 MW since 1998. In the last four years, power demand has grown at a rate equal to adding two cities the size of Red Deer (about 80,000 people) every year. If growth continues as predicted, AESO projects 3,800 MW of new generation capacity may be needed by 2016. New capacity is also required to replace the older units like Wabamun 4 and Battle River 3 and 4. Some of the power produced by the retired units will be replaced by Keephills 3.

Mr. Topping next described how EPCOR has been looking at the power of capital stock turnover, which shows the impact on cleaner air if you proceed with Keephills 3. The units that are retiring have a huge drop in emissions. Four Wabamun units will retire by 2010. Emissions of SO₂, NO_x and mercury for Keephills 3 will be reduced by 60 to 80 percent in comparison to the four Wabamun units. The construction on Keephills 3 should be complete by the end of the first quarter 2011. TransAlta will be the plant operator.

Mr. Topping went through a timeline that describes the development of cleaner-coal based electricity generation. From 1970s to 1990s, there was subcritical pulverized coal. Now in 2005 Canada has supercritical pulverized coal, which is reducing emissions by 18% compared to average Alberta coal generation. By 2012-15, IGCC will be the best technology at the site.

He next showed a comparison of the step-change improvements in emissions, including SO_x, NO_x, and particulates, that are associated with clean coal technology. He then showed how supercritical technology and offsets have reduced Canada's greenhouse gas emissions. For example, supercritical technology such as that in use at Genesee 3 reduces CO₂ emissions 18% compared to the average Alberta coal plant.

Mr. Topping next showed the Genesee 3 license which highlights what the regulators are doing in Alberta. He showed a series of slides with information on the regulations, licensing, and the proposed Climate Change and Emissions Management Act of 2007. He next provided information on the Canadian Clean Power Coalition (CCPC). It is a coalition of companies and government agencies that aim to secure a future for coal-fired electricity generation in Canada.

He next showed the coal gasification process schematic. He said that EPCOR is looking at how gasification technology can be commercialized. The issue is that the technology is known, but has not yet been proven at a utility-sized facility or with Alberta's low sulphur mid-rank coal. To develop this facility, engineering and design work is required, focused on adapting the technology to work with the type of coal found in Alberta. This involves a \$33 million dollar study that would provide for three phases.

Mr. Topping next talked about GHG Reduction Initiatives in Alberta. Alberta is looking into investing several hundred million dollars in a carbon dioxide pipeline. This shows that things are starting to happen very quickly.

After this presentation, Mr. Topping asked for any questions.

Paul Bollinger, U.S. Air Force, asked where the pipeline went. Mr. Topping responded that the pipeline went from northern to southern Alberta.

Dan Cunningham, PSEG, asked about the limitation on offsets to Alberta. Did you mean geographic limitations to the use of offsets to Alberta? Mr. Topping responded that provinces are looked at regionally, so we want to improve the environmental footprint for Alberta. It is meant to be an incentive.

Vicky Sullivan, Southern Company, asked what kind of offsets are being used for the Genesee plant. Mr. Topping responded that they are generating MW by capturing landfill gas, which is bringing some good offsets. They have small hydro and wind as well. Furthermore, they are purchasing offsets on the global market.

Gene Trisko, United Mine Workers, asked for an update on the status of mercury control regulation in Canada. Mr. Topping said that in Alberta, they are required by the end of March to submit their plan for mercury removal systems on a site basis to remove 70% of the mercury emissions. There is a step up to 80% in 2015.

Tony DeLucia, Eastern Tennessee State University, asked if there has been a regulatory impact analysis conducted for the 12% reduction as an intensity target. Mr. Topping said that he did not know if there has been one conducted. However, he said that Alberta is a deregulated electricity market.

David Foerter, Institute of Clean Air Companies, asked about the plans for capture and storage on EPCOR's units. Mr. Topping said that they have looked at the technologies and IGCC is seen as a lot easier way to capture the CO₂. When they retrofit an existing plant, it will depend entirely on the technology.

Sandra Ely, New Mexico Environment Department, asked if there have been any geological assessments performed. Mr. Topping responded that assessments for EOR have been conducted in the Genesee plant area.

Patrice Sims, Natural Resources Defense Council, asked if there is a move towards looking at the geologic situation as part of the regulatory process. Mr. Topping responded that with respect to siting for sequestration, it seems that the rules that are developing will promote that more. It is not part of the process now. It is up to the developers to pick the fuel source, the market, the type of technology.

Al Linero, Florida Department of Environmental Quality, asked if the new unit have a mercury emission limit. Mr. Topping responded that they have done studies on the existing emissions and what would be required to get the emissions down to 70%.

Continued Discussion of Barriers, Opportunities and Tools

Anna Wood, EPA, provided a recap of the last Work Group meeting. She reviewed the areas that were discussed during the last meeting and pointed out Attachment A, the product generated from the barriers and opportunities exercise during the last meeting.

During the last meeting, the Work Group tried to reach a common understanding of the definition of Advanced Coal Technology (ACT). There were four common aspects identified through the small group ACT definition discussions: 1) reduces or eliminates the environmental impact of emissions, including CO₂, from coal-based production processes; 2) reduces CO₂ through efficiency improvements; 3) reduces CO₂ through capture and sequestration; and 4) meets dynamic, technology forcing performance parameters.

Also during the last meeting, the Work Group broke into six groups and each group identified their top 3 barriers and opportunities. Ms. Wood reviewed the first tier priority items, the second tier priority items, and the third tier priority items. She then showed the highest priorities based on total votes received. Attachment A lists the specific measures recommended by each group to advance each priority that they identified. These measures can serve as a reference point for a key set of actions.

David Berg, Department of Energy (DOE), suggested converging the 1st, 4th, 5th, and 6th bullets on the priorities that only received one vote because they all address the high cost, financial risk, and methods to address the financial risk. Mr. Berg suggested considering these as a cumulative vote of four.

Ben Henneke, Clean Air Action Corporation, next began a discussion about creating a common time scale that they use in their discussions. He suggested choosing a year to serve as a benchmark for conversations. In other words, by x number of years, we expect x, y, and z to have happened. This time scale will be helpful in answering questions such as: how many carbon capture and sequestration (CCS) plants do you imagine will be built between now and this date? There was a suggestion to use 2020-2025 as a range of benchmarks because Integrated Gasification Combined Cycle (IGCC) plants will not begin to be built until 2015.

Bob Wyman, Latham and Watkins, suggested using different time frames for different actions. For example, there would be an early time frame for financial guarantees, protocols, insurance, liability, and entitlement process. 2010 is a good timeframe for accelerated signals. 2020-2025 would be the timeframe for early plants. Sequestration and associated infrastructure will take longer. Mr. Henneke agreed that there needed to be earlier time frames; however, he was focusing on the back end.

Patrice Simms, Natural Resources Defense Council, said he thinks there is reason to be aggressive and identify early time frames. He said they should identify early dates for steps along the way.

Mr. Henneke said he would develop a ballot, so everyone could vote. He said the goal was to develop a timeline to lay out the steps along the path. Right now, however, he wanted to choose a date that represents the overall goal.

Robert Hilton, ALSTOM, said there are going to be plants of some kind built. The question is when they have to do something. Things will get done by whatever date they are mandated to get done.

Ms. Wood commented that the question for advanced coal technology is what does the vision look like for the path forward, what is possible now and what do they want to advance and by when, and what is the best approach in the interim. What is the timeframe to focus on and then what do we want to have accomplished in terms of the accelerated pace of the technology? Next, they are going to fold in the measures, actions, and recommendations that accelerate the process. Mr. Hilton said if there is not a target, nothing will be done.

Mr. Wyman said a lot of this depends on what is being optimizing. If optimizing to maximize CO₂ reductions, the time frame will be fast. If optimizing to minimum cost, the time period will be longer to learn from earlier actions and ensure that certain financial mechanisms and insurance is in place. He hopes the Work Group is optimizing both.

Vicky Sullivan, Southern Company, asked about the purpose of creating the time line. She thinks the purpose is to know when the technologies will be available and next identify the actions needing to take place to ensure that they are available. Mr. Henneke said 2020 would serve as a tentative date and they would change this year later if needed.

The Work Group next identified the types of coal-fired power plants with different control parameters, the bottom of the scale representing power plants without controls and the most advanced representing power plants with zero emissions. The Work Group broke into groups into goals and timeframes for power plants, measured by what comes out of the plant - efficiency and pollution footprint. A compilation of the individual groups' products include:

Tier 1A: Today

- By 2020, 6-15 plants with 90% CCS and LAER
- 40% efficiency; LAER for criteria = now/floor
- 40% efficiency; state of art for criteria; R&D aspect re: CCS and geologic assessment
- 35-45% efficiency (pre-controls); reduces criteria and Hg 70-90%; 60% CCS capable
- Efficiency; without CCS but with geological assessment
 - Criteria – BACT; MACT
 - Reduce water use & discharge
 - Reduce solid waste
- SOA technology

Tier 1B: More advanced tier

- Greater or equal to 45% efficiency with increased controls
 - 90-95% criteria on all coal types control + Hg control

- 60-75% CCS capable of removing, capturing, and storing CO₂ through any combination of technology; will store it if acceptable storage opportunity
- SOA for criteria pollutants
- Working CCS, 60% located where storage is possible
- CCS capable unit with technology to remove CO₂ from process; integrates storage and reservoir into economics of plant
- 90-95% control for criteria and HG
- CO₂ equals NGCC
- LAER
- 95% Hg
- Decreased water and waste use and discharge

Mr. Henneke said he would create a ballot to capture the Work Group's ideas about the future of 500MW equivalent plants by 2020 and the Work Group member's willingness to break down barriers and create incentives for the different types of power plant tiers that were previously identified by certain dates.

Work Group member comments, suggestions, and questions following the discussion of the future types of power plants include:

- The length of time to develop policies promoting advanced coal technology. Ms. Wood said perhaps the group may recommend integrated, accelerated permitting that looks at not only the carbon capture and storage, but also the siting of the facility. All options need to be looked at.
- Answers to the number of plants by 2020 with the characteristics laid out by the Work Group will depend upon the regulatory and legislative drivers in place. In the absence of specifications, it is not possible to develop estimates.
- People are headed towards projects that are economically viable and environmentally improved. These projects will not all be identical by 2020. Constraints will affect this.
- Voting would be better done as a scenario that has a baseline of business as usual.
- Assuming the most aggressive policy approach is taken, how far are we capable of getting in the timeframe identified?
- It would be beneficial to hear about the limits in the construction world, the financing from the financing world, and cost recovery from the utility commissions. These are barriers and the Work Group needs to make judgments about them.
- Combine the interim steps and base the vote on these under a business as usual scenario and a carbon constrained world.

Presentation on Efforts of the Coal Utilization Research Council (CURC)

Doug Carter, Coal Utilization Research Council (CURC) began by showing the members of the CURC. Over 50 companies are part of the association. CURC is an association of coal suppliers, users, technology vendors, and academics.

Mr. Carter began with an explanation of why we should care about coal technology and its advances. Looking at energy use in the United States, coal ranks 2nd in consumption. Also, 90% of coal use in the U.S. is for electricity. Mr. Carter shows a chart prepared with EIA modeling, which assumes that regulations stay the same. He added that half of our electricity is from coal, while nuclear and natural gas provide most of the rest. The U.S. uses so much coal for electricity because it is really cheap and because we own so much of it in the U.S, including bituminous coal in the Eastern U.S. and sub-bituminous in the Western U.S. A lot of the growth in the coal is projected to be in the Western U.S. because it is low in sulfur.

Emissions from coal use continue to decline, despite a 60% increase in coal use since 1980. However, there are now new challenges associated with coal use due to global climate change. U.S. technology development may be vital to others, especially since over time the projected emissions from North America and China increase significantly. This means that the technology to deal with these emissions must be affordable.

CUCR and EPRI have developed a roadmap for improvements in coal using technology. The roadmap was a collaborative effort that identifies a family of technologies needed to achieve the goal of near-zero emission coal-based technology by 2025. Several messages come out of the roadmap. First, a successful commercialization program should be based on R&D, demonstration projects, and commercial financial incentives. Second, with successful R&D, sequestered coal-based generation in 2025 will cost about the same as unsequestered coal-based generation. With technology development, future PC and IGCC will be highly competitive, and both will cost less than either technology costs today. The bad news is that R&D funding is significantly inadequate today, especially for demonstration funding.

The analysis for the roadmap was conducted on a disaggregated level. This included differing power systems, two base coals, and three locations. However, the results are presented in aggregate. The team found that you can get an order of magnitude reduction for traditional pollutants by 2025. Mr. Carter next showed a slide on cost performance for PC and IGCC systems. He gave a summary of technical needs, such as the need for turbines that can burn hydrogen and the need for lower costs of capture systems and pulverized coal systems. He added that there is also a lot of concern about long term liability issues.

He next showed a slide with a chart on the technology progress without CO₂ capture. It encompasses the roadmap and includes a list of necessary technologies for both IGCC and PC. With PCs, there are improvements in efficiency, which is primarily a temperature issue. The other part of the PC equation is the advanced sorbent. With the IGCC system, there is a need for hydrogen turbines and demonstrated carbon storage. When you think about incentives, you should consider what type of storage you are supporting. There will eventually be a need for saline reservoirs, so there should be incentives here. Unfortunately, there is no money in the saline reservoirs (like there is with EOR). By 2020 or 2025, we can have more efficient systems at lower cost.

Mr. Carter next explained the summary of federal and private sector costs of the roadmap. The total cost for research for the roadmap is \$11 billion. CURC goes to Congress and encourages

them to give money to DOE to do the research. Nonetheless, technology requires time to develop. Mr. Carter gave the example of the mercury control systems that took 20 years to commercialize.

The bottom line is that technology is the solution. Improved technology is the key to continuing to receive the economic and energy security benefits of coal. The roadmap presents a coherent set of goals and a pathway to achieve them. Adequate funding is essential to achieve these goals. The budget CURC is requesting is less than a percent of Congressional budget and this money would lend to improving energy security. With this conclusion, Mr. Carter asked if there were any questions.

John McManus, AEP, referred to charts 15 and 16 and asked why there are different objectives for different years. What do the numbers associated with the years mean? Mr. Carter responded that it means the years when a plant would start up as a functional, commercial, economically viable plant. This is different than how others look at their R&D timelines. For example, DOE looks at timelines based on demonstrations. Also, these slides involve 90% capture, on top of the efficiency improvements that have been achieved.

Mr. McManus then asked with reduction in cost of electricity, are the plants being built at a lower cost, or is the reduction due to efficiency improvement? Mr. Carter responded both. He said that the presumption though is that they could build the plants for substantially less money. Mr. McManus then said thinking about a technology performance objective, it seems like these types of roadmaps are important for us to consider.

Bob Wyman, Latham and Watkins, asked where can we get more information on the analysis? Mr. Carter responded that the website has some materials, but that you should call with any questions.

Jeff Hopkins, Rio Tinto, asked if 2025 predictions are cost dependent on the 2005 cost? Mr. Carter responded that you cannot jump from 2005 to 2025 technology. There are intermediate technologies you have to encounter. There is certainly learning by doing.

Discussion re: the Framework for the Six Month Interim Report

Ben Henneke, Clean Air Action Corporation, clarified the Work Group's charge: to review the barriers and opportunities in the Clean Air Act and also look beyond the Clean Air Act and EPA's capabilities. He said he wants the Work Group to first reach agreement on the contents of the interim report. He suggested that it be less than 10 pages and include the charge, a little history, and focus mostly on the recommendations reached by the Work Group. It needs to briefly explain advanced coal technology. He does not think the interim report should include all the issues discussed and cover all the variance and details that exist. This could be included in the final report. The interim report will focus on what is obvious from the Work Group's discussions to encourage the utilization of advanced coal technology.

John McManus, AEP, said he did not think the Work Group would be far enough along to suggest recommendations as opposed to issues identification for the interim report. Mr. Henneke said he wanted to strive for as many useful recommendations for the interim report as possible.

Rick Bolton, CTECH, asked if the interim report would discuss the process that the Work Group took to arrive at the contents of the report (i.e., discuss how the Work Group dealt with issues and how they made decisions). Mr. Henneke said this would briefly be covered.

Tony DeLucia, East Tennessee State University, thought Mr. Bolton's question was important. It might be possible to lose the richness of some of the discussion between interim report and final report if this process is not discussed. Keeping the process moving is very important.

Bob Gruenig, National Tribal Environmental Council, asked how Mr. Henneke planned to frame some of the opportunities and barriers. Mr. Henneke said this is what the main part of the conversation is supposed to be about. Over the next 6-8 weeks the Work Group will frame language then modify the language to make sure it represents consensus.

Anna Wood, EPA, asked if keeping the interim report simple and less than 10 pages was agreeable to group. The Work Group confirmed that it was. The interim report will discuss the background of the Work Group, the charge, the overview of what the Work Group has done to date and how they have arrived at where they are, discuss the barriers and opportunities in terms of how the Work Group viewed them as a group, and lastly discuss the recommendations. Understanding this will be helpful when writing a draft report which will be sent to the group before the May meeting.

Mark MacLeod, Environmental Defense, asked if there was one more working meeting to finalize the interim report. Mr. Henneke responded that there were two more meetings. Mr. MacLeod asked if the consensus interim report should be done by the end of the June 5th meeting. Ms. Wood said yes. Mr. MacLeod said that if the Work Group does not have consensus recommendations in the next two meetings, he would suggest that the interim report describe the ground that they have covered, the issue map before them, and identify the four or five recommendation issues they are going to spend the most time on, and identify the issues they are not going to spend time on.

Bob Wyman, Latham and Watkins, said at some point the Work Group needs to set the context for the discussion. There are many objectives that are implicit in this exercise (e.g., energy security, greenhouse gas reductions, and cost optimization) that need to be stated. He is not sure, however, if this needs to be fine tuned for interim report. Mr. Henneke agreed and thought these implicit objections should be mentioned in the interim report.

Ms. Wood next showed a slide showing the highest priorities based on the total votes received: 1) regulatory driver for CO₂; 2) liability and NUMBY on CCS; 3) education and outreach for public/regulators; 4) streamline/accelerate permitting for ACTs; and 5) commercial and financial risks associated with ACT. These priorities may serve as the "guts" of the report, so the Work Group should strive to reach a common understanding with regard to these issues. Attachment A already lists several recommendations with regard to these issues. Perhaps Work Group

members would like to focus on a particular issue, using Appendix A as a starting point. Ms. Wood asked the Work Group if these priorities were the areas that the interim report should focus on.

Mr. Henneke said a first movers fast track was missing from the list. Mr. Berg suggested that the last bullet be reworded to “incentives for technology adoption.” This addresses the first mover issue. Ms. Wood said it seemed that all the listed priorities were incentives for early adoption. She asked if he was referring to commercial or financial incentives. Mr. Berg said the regulatory driver creates a market because externalities that are not addressed right now are internalized. Once this is done, there are a number of issues and risks that must be addressed before moving forward. Regulators and the public must be educated so that everyone understands the problem, the potential solutions to the problem, and their individual roles. Liability and NUMBY need to be addressed because this stands in the way of individual projects taking place that involve sequestration. The permitting issue is important because this is EPA’s hook. The business risks associated with projects and incentives come into play here. He thinks the Work Group has developed a list of the main issues that must be addressed in order to achieve the charge.

Patrice Simms, NRDC, said he would edit the first bullet to put an “s” at end of driver.

Mr. McManus said in the first bullet, he thinks they need to be careful not to write legislation. The Work Group needs to identify issues that could be addressed through legislation. When they discuss ACT, he has been under the assumption that this is coupled with sequestration and storage.

Vicky Sullivan, Southern Company, said she would echo Mr. McManus thoughts about not writing legislation. She also sees liability and NUMBY as cutting across the last two bullets. There are permitting issues associated with the injection and there are financial risks associated with the liability of that injection.

Priority Discussion Exercise

During this break Ben Henneke, Clean Air Action Corporation, and Anna Wood, EPA, further refined the financial risk priority into two bullets to reflect commercial-related risks and what is needed on the R&D side to reflect technical risks. Ms. Wood assigned each table a priority action area and asked each group to develop no more than 3 specific actions related to their assigned priority to put into their matrix. Each group would then report these actions which will be included in Mark MacLeod’s, Environmental Defense, revised matrix. The groups reported the following priority items: (Note that the names listed next to the priorities are the names of people who were at each table for the purpose of identifying which table was assigned which priority)

Priority 1: Create Market Drivers (Michael Ling) *Table 4*

- CO₂ cap and trade for Congress
- Establish power plant performance standards (EPA)

- Transition strategies

Priority 2: Create Incentives (Tony DeLucia) *Table 3*

- Develop new depreciation rules for ACT including AMT
- Liability transference rules for CO₂ (Congress)
- Broad based energy tax guaranteeing incentives for investment for first movers

Priority 3: Education and Outreach (Mark MacLeod) *Table 5*

- Educate people on why, what, and path forward
- Integrate all issues with respective and appropriate experts
- Public needs one-stop shopping clearinghouse for information

Priority 4: Liability and NUMBY (John McManus) *Table 2*

- Property rights issue underground
 - Address a shared limited liability provision (Congress)
- EPA establishing standards for the underground injection process
- Provide insurance vehicles to mitigate risk

Priority 5: Streamline/Accelerate Permitting for ACTs (Lisa Stolzenhaller) *Table 6*

- Federal model rule for both ACT as well as CCS (states)
- Carbon management plan in lieu of a piece of certain permitting processes
- Minimum thresholds based on energy efficiency, environmental impacts, and a phased approach to carbon management to accelerate permitting

Priority 6: Advance technology (Vicky Sullivan) *Table 1*

- Create self-funded R&D fund that is not subject to appropriations process
- Require matching funding from organizations receiving R&D funding
- Advocate priority be given to projects with near term potential for commercialization

Alvaro Linero, Florida Department of Environmental Protection, asked if we need to do justice to some of those incentives.

Michael Ling, EPA, said that some of the tables we did not feel like they could represent other tables' recommendations very well, which means that all should be able to take a shot at some of these at some point.

John Campbell, Caterpillar, suggested adding the word "guaranteed" to the incentives section.

David Berg, DOE, said that incentives can fall into taxes and other financial incentives. Financial incentives generally create incentives for investment, and these sorts of incentives usually include tax credits and loan guarantees.

Bob Wyman, Latham and Watkins, said that in the context of incentives, there is nothing that says that early actors would be able to count on credits. There are other types of markets where you might be able to generate credits. We are talking in California about discreet markets.

Greg Schafer, Arch Coal, said that sometimes the barriers seem like opportunities and vice versa.

Patrice Simms, Natural Resources Defense Council, said that they have thought about the question of the role of efficiency improvements and demands side management options. This is an issue that is key to easing transition burdens in early years. Jumping in early with strong programs for energy efficiency is really important.

John McManus, AEP, said that if we create the right market drivers, the other issues can be resolved. Also, the suggestion that we set efficiency standards can be refuted.

Ben Henneke, Clean Air Action Corporation, said that a lot of it seems to come down to issues of timing. Do you put a moratorium on any new plants because the market drivers are not there, or do you have interim steps?

Mr. Simms responded that he thought there are specific things that can happen at the PUC and state level in the relative immediate future.

David Foerter, Institute of Clean Air Companies, said that the thermal efficiency part of this is missing here; there should be some sort of payback for any CO₂ energy efficiency improvements. He said this is a near term issue and he does not see it listed in the set of actions.

Tony DeLucia, East Tennessee University, said we need to think about what the prize is for switching to coal in different regions. There are going to be different favorable approaches according to region. There is no panacea that is going to solve our energy problems.

Vicky Sullivan, Southern Company, said that efficiency and improvements seem like they can go in priority 5. This sounds like NSR and permitting accelerations should fit into this bullet point.

Mr. Foerter added that they were trying to do both new and existing plants.

Mr. Ling added that he also read the efficiency part into number 1. He said it seems like our performance standards should have some efficiency related to them.

Discussion of Additional Information Needed for the Six Month Report and Discussion of Areas of Substantial Agreement Identified by Work Group

The group decided to make some decisions about whether there should be facilitators and press at the next meeting. Ben Henneke, Clean Air Action Corporation, also asked if there was any substantial information that the Work Group wanted to understand and that has not been covered up until now.

Bob Wyman, Latham and Watkins, said he would like to hear from the lending community, the insurance industry, and the construction and resource limitation (i.e. engineer and raw material liability).

David Berg, DOE, said that a lot of time the lenders do not want to talk because they are in the process of doing deals. You could instead get the raters to come.

Vicky Sullivan, AEP, said that EPRI has recently done a prism analysis which looks at the potential for deployment of technologies and the R& D needs to get that done.

Sandra Ely, New Mexico Department of Environmental Quality, mentioned that Julio Freedman talked to the group before about the regulatory efforts related to CCS management.

Mr. Berg said that the DOE Carbon Capture and Sequestration team could come talk to the Work Group.

David Foerter, Institute of Clean Air Companies, said that we have heard about how projects are under-funded, and it would be nice to hear more about funding for these projects.

Bruce Rising, Siemens, said that maybe we should bring someone in from EIA who can tell us something more about modeling.

Robert Hilton, ALSTOM, asked about what authority EPA thinks it has? He said we need to think about that part of the liability issue could be getting the authority if it is not already there.

Anna Wood, EPA, said that some people from EPA would be available to come and talk to the Work Group about EPA's authority to address carbon storage.

Mr. Simms said that he would like more information on the potentials for energy efficiency savings and renewable resources, at a national or regional level.

Mr. Henneke described a document from McKinsey Quarterly on the cost-curve for reductions in GHG and their associated costs. He said that they wanted to send it to you but we could not because it is copyrighted. He asked if everyone wanted some of these things just to read, or actually presenters?

Mr. Wyman said that the McKinsey information is on the website.

Mr. Simms said it would be good to send emails, but suggested trying to include everything in just one email.

Sandra Ely, New Mexico Department of Environmental Quality, said that it would be good to have someone address the proper market signals we need to bring out advanced coal on the forecast of power plants.

Mr. Henneke responded that there are lots of people who could answer that question.

Mr. Rising said that you may be looking for a forecasting model that no one in the room has ready access to. He mentioned that there had been a study done that took several days just to run the model. In this case, you would probably need someone to come in and run those models.

At the conclusion of this discussion, the following items were identified as additional information needed for the six month interim report:

- Perspective from the lending community
- Insurance availability
- Perspective from the construction industry about construction related constraints
- EPRI Prism Analysis
- DOE CCS partnerships
- R&D deficiencies (funding)
- EIA modeling and forecasts of power plants
- Discussion of market signals
- EPA's authority to regulate CO₂
- Discussion on potential for energy efficiency savings & renewable resources
- McKinsey Report on GHG reductions

Discussion re: Process to Create first Draft of Interim Report

The following processes were identified as needed to create the first interim report:

- conference calls – get some calls scheduled for informational purposes
- draft six month interim report framework to share with Work Group
 - detailed outline
 - conference call
 - small group breakout to follow up on certain aspects

There were several follow-up questions and comments following the process identification.

Vicky Sullivan, Southern Company, said the Work Group needs to work through technical issues before writing the interim report. Mr. Wyman agreed. He does not want to be off base with basic assumptions.

Anna Wood, EPA, thought they could develop a draft key outline that will list key concepts that will give the Work Group a framework to work from. This could be used as a tool to help refine thinking as they move forward. The goal is to get the draft to the subcommittee in June.

Ben Henneke, Clean Air Action Corporation, said they will be giving a presentation about the Work Group's progress at the May 10th Clean Air Act Advisory Committee (FACA) meeting. At the present time, they will not present to the Economic Incentives and Regulatory Innovation subcommittee on the 9th. Mr. Henneke reviewed the plan to identify presenters to discuss some of the "additional information needed" topics via conference call as soon as possible.

John Campbell, Caterpillar, said he thinks all the additional information needs could be dealt with by a conference call except for how to compile the portfolio.

Mr. Henneke said they would: 1) identify someone who can answer the listed information needs; 2) identify a date when the person can speak about the issue over the phone; and 3) notify everyone of the date.

Ms. Wood clarified that these additional information topics would be addressed in April and May. Mr. Campbell said it is easier to have the conference calls in two-hour increments. Mr. Wyman said it might be helpful to use the web to see visuals when applicable. Mr. Henneke agreed and said the presentations would be emailed before hand or posted online.

Ms. Wood said the conference calls would be no longer than two hours. She will send a more detailed outline to the group. The outline will consist of what the group has generated and include the identified action items. This will be further refined and built upon. Mr. Henneke said the Work Group members who best understand the items on the priority list should assist with drafting the interim report. Ms. Wood suggested that the Work Group spend more time discussing the interim draft during the May meeting and less time on presentations.

Meeting Wrap-up and Adjournment

Ben Henneke, Clean Air Action Corporation, ended the meeting by reading the results of the facilitator and press vote on which the Work Group previously voted.

F/P	Yes	No	No Opinion
Facilitator	9	13	1
Press	19	4	0

Ms. Wood said that frequently observers will ask for Work Group handouts. She asked if the Work Group should keep these documents internal. Mr. Berg said if the press is present, he thinks it is important that they agree that this is on a not for attribution basis. Mr. Wyman suggested that at the beginning of each Work Group meeting, the Agency could announce that the default assumption is that no one is speaking for attribution unless they so specify. Ms. Wood said they will approach this in the not for attribution context and they will make this announcement at the beginning of future Work Group meetings.

Ms. Wood wrapped up the Work Group meeting by reviewing important dates:

- Next Work Group meeting – May 8th
- Subcommittee meetings and the full CAAAC meeting – May 9th and 10th
- Clean Air Excellence Awards ceremony at the National Museum of the American Indian – May 9th

Ms. Henneke and Pat Childers, EPA, encouraged the Work Group members to attend the Clean Air Excellence Awards. Ms. Wood thanked everyone and the meeting was adjourned.

**Advanced Coal Technology Work Group Meeting
Double Tree Hotel (Crystal City)
300 Army Navy Drive, Arlington, VA 22202
March 29, 2007**

List of Attendees

Name	Affiliation
Rick Bolton	Center for Toxicology and Environmental Health (CTECH)
Dan Chartier	EPA
Jim Welch	KY PSC
Robert Hilton	ALSTOM
Gene Trisko	United Mine Workers
Vicky Sullivan	Southern Company
John McManus	AEP
Anna Marie Wood	EPA
David Foerter	Institute of Clean Air Companies (ICAC)
Bob Wyman	Latham and Watkins
Mike Sewell	EPA
William Stevens	EPA
Mark Fesmire	New Mexico Oil Conservation Division
Chris Romaine	Illinois EPA
Bob Wayland	EPA/OAQPS
Bob Gruenig	National Tribal Environmental Council
Michael Ling	EPA/OAQPS
Mark MacLeod	Environmental Defense
Barbara Bankoff	Siemens Power Generation
Daniel Cunningham	Public Service Enterprise Group (PSEG)
David Berg	Department of Energy (DOE)
Ben Henneke	Clean Air Action Corporation
Patrice Simms	Natural Resources Defense Council (NRDC)
John Campbell	Caterpillar
Alvaro Linero	Florida Department of Environmental Protection
Greg Schaefer	Arch Coal
James Burns	Shell
Lisa Stolzenhaler	General Electric (GE)
Bruce Rising	Siemens Power
Jeff Hopkins	Rio Tinto Energy
Tony DeLucia	East Tennessee State University
Danielle Prendergast	SEMPRA
Dean Metcalf	Xcel Energy
Paul Bollinger	US Air Force
Sandra Ely	New Mexico Environmental Department