

Summary Report: Chewonki Carbon Capture and Storage Seminar

October 24, 2007

Carbon Capture and Storage (CCS) technologies have emerged as a solution to meet projected energy demands and make reductions in CO₂ emissions that contribute to climate change at the same time. Because the proposed Twin River Energy Center in Wiscasset, Maine included consideration of CCS technologies and because CCS is a new technology, The Chewonki Foundation met the need for information-sharing and education regarding the potential and limitations of CCS by hosting a one day educational seminar on the technology.

During the seminar, participants were given information to guide them in decision-making regarding the proposed plant through learning about the CCS technology from national experts in the field. The goal of this event was to provide key stakeholders and decision-makers with information regarding CCS technologies to enable informed decisions regarding the future of CCS technology in the Northeast.

This report is based on a summary of the day, which was presented to the public during an evening forum held on the day of the seminar. It was prepared by Potomac-Hudson Engineering with input from the panel of experts who participated in the evening forum: Jay Braitsch from the U.S. Department of Energy Headquarters, Grant Bromhal of the National Energy Technology Laboratory, Jeff Bielicki from Harvard, and Jennie Stephens from Clark University.

The opening presentation of the day was given by the Maine Commissioner of the Department of Environmental Protection, **David Littell**. During his talk, David highlighted the importance of climate change, including already observed ecological impacts resulting from climate change. David also reviewed the Regional Greenhouse Gas Initiative (RGGI) and Maine's RGGI implementation plan. RGGI will apply to all new plants with more than 5% fossil fuel in their feedstock starting in 2005. The RGGI states current rough estimate of allowance pricing is \$2-5 per allowance and will be used to help fund energy efficiency programs. David mentioned that CCS will be a topic in the Maine legislature this year and highlighted the need for further exploration of storage options.

Joe Chaisson from the Clean Air Task Force (CATF) also highlighted the importance of the climate change issue with an emphasis on the rapid rates of change in atmospheric CO₂ concentrations. Joe highlighted some of the CATF's work in China and India and noted that in China one 1,000 MW coal plant is being built each week. Joe addressed the importance of all options of addressing climate change, including increased energy efficiency and use of renewable energy and acknowledged that CCS is needed to make the needed reductions in CO₂ concentrations. The CATF has publicly supported a

proposed IGCC plant in Indiana, and Joe concluded his talk by reviewing the criteria needed for a proposed facility to earn CATF support.

Eric Larson from Princeton University gave a technology-focused presentation on producing low-greenhouse gas liquid fuels from biomass and coal. Eric's presentation highlighted that when coal alone is used to produce liquid fuels, the CO₂ footprint is almost double that of conventional petroleum fuels. With capture and storage of the by-product CO₂ produced at a coal-to-liquid plant, the CO₂ footprint can be equivalent to petroleum at best. However, when coal and some biomass are processed together into liquid fuels and by-product CO₂ is captured and stored, it is possible (with about 40% biomass and 60% coal input) to produce liquid fuels with zero associated lifecycle CO₂ emissions. With this co-processing, the amount of biomass required per unit of liquid fuel energy produced is much less than the amount of biomass required to produce a "pure" biofuel such as cellulosic ethanol. Eric's presentation concluded with an economic case study for a facility co-processing coal and biomass in Illinois.

Howard Herzog from MIT reviewed the key findings of the MIT *Future of Coal* study, which was released in March 2007 and addressed the role of coal in a greenhouse-gas constrained world. Howard began his presentation by emphasizing the importance of coal in electricity generation. Correlating electricity prices with the percentage of coal in the generation mix shows that states using more coal have lower electricity prices. Acknowledging the importance of addressing coal-derived CO₂ emissions to tackling climate change, his presentation reviewed how to reduce CO₂ emissions on a Gigaton scale. CCS was defined as a critical, enabling technology. MIT has recommended several large scale demonstrations of CCS technology as a next step to move the technology forward.

Jennie Stephens from Clark University addressed the environmental and social implications of advancing CCS technologies. She emphasized that technology development of this character cannot happen without CO₂ policies. She also discussed the difference between existing technologies that can be deployed now and revolutionary technologies that need further technological advancement, explaining how CCS spans that spectrum. Public awareness of CCS was described as low with mistrust of industry and government affecting public support of a proposed project. Jennie raised the question of whether we should build new coal plants without CCS as well as the unresolved issue of long-term liability for stored CO₂. Jennie also described the regulatory uncertainty associated with CCS as well as the risk of leakage from the injection formation.

Like many of the speakers, **Jay Braitsch** from the U.S. Department of Energy, Office of Fossil Energy Headquarters, began by discussing climate change. Jay highlighted that with current greenhouse gas emission trends, atmospheric concentrations of CO₂ could reach 450 ppm, a level some believe will lead to unacceptable consequences, in a few decades. He described the U. S. as being rich in geologic sinks for storing CO₂ based on the considerable geologic information available for most areas. However, it is generally believed that geology in the New England is not as promising, although this area has not been as well-studied as most others. Jay described DOE R&D programs for carbon

capture and storage, noting that the U.S. has the most comprehensive program in the world. He also discussed the DOE Regional Carbon Sequestration Partnership program, which includes seven partnerships encompassing 41 States, and recommended that Maine consider joining a partnership if it wants to explore the carbon capture and storage option more thoroughly.

Ken Hnottavange-Telleen of Schlumberger Carbon Services described how monitoring and site characterization can help manage the risks and performance of a carbon capture and storage project. Ken described both site characterization and modeling as iterative processes that occur throughout a CCS project. Information on suitable reservoirs is often based on data from past oil and gas exploration. Ken's conclusion was that we have the technology to do CCS now, that we can learn to do CCS even better, and that it's essential to manage the risks and performance throughout a CCS effort.

Sarah Forbes of Potomac-Hudson Engineering presented the results of an independent mine-to-wheels analysis of the projected CO₂ emissions from the proposed Twin River Energy Center. The analysis concluded that the emissions from the stack at the Twin River Energy Center would range from 3.5 to 1.9 million metric tons of CO₂ each year, depending on how much biomass is included in the feedstock and whether opportunities to store or reuse the 25% of CO₂ captured can be realized. The study also evaluated the emissions from the full process including mining and transport of the coal and shipment and use of the alternative liquid fuels and found that the total mine-to-wheels emissions from the facility are projected to be 4.7 to 3.2 million metric tons of CO₂ each year. An assessment of the preliminary feasibility of geologic storage opportunities was also addressed.

Twin River Energy project engineer **David Grogan**, reviewed the design of the proposed facility. Panelists were then asked to respond to the technology chosen for the Twin River Energy Center based on their perspective. Unfortunately a transcript of that session is not available, however, written comments from two of the panelists are provided below:

"Given the scale of the carbon dioxide reductions required to mitigate climate change and the associated urgent need for a transformation in society's energy system, new coal-fired power plants in the United States should not be considered unless the carbon dioxide from the plant can be safely and securely captured and stored to prevent further carbon emissions into the atmosphere.

While the Twin River Energy Center proposal in Wiscasset, Maine mentions some capacity for carbon dioxide capture, the proposal does not include analysis or identification of potential storage locations. The New England region's minimal potential for carbon storage undermines justifications for siting this proposed power-plant in Maine.

The current lack of a carbon dioxide regulation to provide incentive to systematically include carbon dioxide emissions in society's energy technology decisions has enabled proposals, like the Twin River Energy Center project, to advance despite the proposed

projects' contribution to increasing rather than decreasing carbon dioxide emissions."
-Jennie Stephens, Clark University

"The Twin River Energy facility sits at the intersection of global/national interests with local community concerns. From a global and national perspective, we need to limit the amount of carbon dioxide (CO₂) being emitted into the atmosphere while simultaneously addressing growing needs for energy without a significant increase in its cost. If coal is to be the primary source of energy, we need to deploy gasification technologies, such as that proposed for the Twin River Energy facility, which must be coupled with 'carbon capture and storage.' As a society, we need to gain experience with these technologies and their commercial deployment, because gasification processes can produce a stream of CO₂ with a high partial pressure so that it is more readily captured; but gasification facilities must be deployed in locations relatively close to geologic formations where we currently believe CO₂ can be stored.

It is unclear if Maine is the proper place for a new facility at this time, even though the existing infrastructure (leftover from previously decommissioned power plants) makes the Wiscasset location attractive. While the cost of electricity in Maine is higher than the national average, in part because of Maine's lack of reliance on coal-fired electricity generating plants, we lack the knowledge of where in the region it might be possible to geologically store the CO₂ that will be produced from the facility. Such information is crucial, and a dedicated effort to perform a regional characterization could provide the initial requisite knowledge within a couple of years."

-Jeff Bielicki, Harvard University