Carbon Capture and Storage Background Document
Illinois Climate Change Advisory Group

Compiled by the World Resources Institute
May 2. 2007

The best estimates of when carbon capture and storage (CCS) could be ready at commercial scale

Components of the technologies needed for implementing carbon capture and storage (CCS) largely exist today. However, greater experience is needed in implementing them together as a complete system. Additionally, cost reductions in capture technology are needed to make CCS more economically viable.

The timing of commercial deployment of carbon capture and storage technologies will depend primarily upon 1) the price of carbon and when a carbon policy in enacted, 2) successful demonstration of large scale CCS projects, 3) resolving long term liability issues, and 4) public acceptance. That said, a few commercial projects that enjoy special incentives are currently in the planning stages. BP and Edison Mission Group currently plan to construct a 500MW power plant in Carson, California with CCS. Injection is scheduled for 2011, and the CO_2 will be used for enhanced oil recovery (EOR). This project benefits from low-cost fuel (petroleum coke), tax credits under the Energy Policy Act of 2005, and a revenue stream from CO2 sales for enhanced oil recovery. AEP plans to deploy CCS at its 450MW coal-fired power plant in Oologah, Oklahoma in 2011, although the commercial drivers there are less certain at this point.

It is worth noting that to provide an economic incentive for power producers to deploy CCS, carbon prices will have to be much higher than proposed federal and state policies would initially bring about. The recent MIT study *The Future of Coal* states that a carbon price of $30/tonne of CO_2 will make CCS cost competitive with traditional pulverized coal plants. A 2006 study by the Global Energy Technology Strategy Program provides a clearer picture of carbon prices needed to spur CCS deployment. For ammonia and natural gas processing facilities near EOR opportunities, prices under $20/tonne CO_2 may be sufficient; though they estimate that most coal-fired power plants would require carbon prices around $50/tonne CO_2.

Issues to consider around siting, monitoring and liability

To carry out successful CO_2 geo-sequestration, it is important to ensure that the risks associated with the entire lifecycle of a CCS project (from capturing CO_2 to transport, storage in the geologic formation, closure of the storage site and post closure management) and associated liabilities and financial responsibilities are defined carefully and managed through a robust regulatory framework. The following four issues require proper consideration to minimize the potential risks:

Site Selection and Characterization

The first and most important step is to carefully select and characterize a site for sequestering CO_2. Improper site selection may jeopardize the integrity of CCS projects by increasing the

probability of leakage through surface or sub-surface CO_2 migration, which could have local as well as large-scale environmental and human health impacts.

For proper site selection the geology of the area needs to be studied carefully to determine reservoir specific storage criteria[1]. In Illinois, research on site selection and characterization of possible geologic reservoir candidates, which includes saline aquifers, oil wells and coal seams, is being undertaken as a part of the Midwest Geological Sequestration Consortium (MSGS)[2], one of the seven regional partnerships. The reservoir specific site characterization criteria are being developed to characterize the reservoirs with high, moderate and low CO_2 sequestration potential. The program is now in its second phase of operation (2005-2009) where small field tests are planned to validate the efficacy of carbon sequestration in three types of reservoirs. During the first phase (2003-05), CO_2 capture and transportation options were assessed. In the third phase (2009-2012) DOE plans to include a number of large volume sequestration tests. These tests will be designed to address R&D issues associated with three major steps, namely (1) site selection and characterization; (2) operations and well closure; and (3) post-closure monitoring.

Monitoring, Mitigation and verification (MMV) framework

Monitoring, Mitigation and Verification (MMV) is required to ensure the integrity of a CO_2 storage reservoir, and provide confidence to carbon crediting markets. A robust MMV framework would include a set of site specific tools to measure the amount of CO_2 stored at a sequestration site, monitor the site for leaks or other deterioration of storage integrity over time, and to verify that the CO_2 is stored in a way that is permanent and not harmful to the host ecosystem. A mitigation framework is required to ensure the capability to respond to CO_2 leakage or ecological damage in the unlikely event that it should occur.

Liability

It is crucial to clearly define liability and financial responsibilities to ensure that the potential risks of CCS are properly accounted for and that they are borne by those who share the benefits of CCS. Based on a project's risk profile at various stages of its lifecycle (capture, transport, storage, closure and post closure), potential liabilities may vary, which if not clearly defined may lead to several perverse incentives (e.g. site abandonment). Most project developers are prepared to deal with operational liability in CCS projects, but the question of long-term liability is critical. Most companies believe that transfer of ownership from private to public hands must

[1] The general criteria for selecting a storage site include CO2 storage potential, accessible pore volumes, cap-rock integrity, seismicity, potential leakage pathways but the criteria for selection and characterization may vary for different types for reservoirs.

[2] The Midwest Geological Sequestration Consortium, headed by the University of Illinois - Illinois State Geological Survey, has examined ways of storing CO2 within deep, uneconomic coal seams, numerous mature oil fields and saline reservoirs that lie beneath the 60,000 square mile Illinois Basin, which underlies most of Illinois, western Indiana and western Kentucky. http://sequestration.org/

eventually occur if investment is to take place on a commercial scale. This is currently a priority topic in policy research.

Public acceptability

How the public perceives the risks of geologic CO2 storage is another contributing factor for the success of a CCS project. To ensure public support, it is crucial to develop an effective communication strategy to educate the public about the risks, rewards and trade-offs of CCS. Transparency should be maintained in developing rules for CCS and public involvement in the process will ensure more confidence in the technology. The opposition to a recent California bill by local environmental groups clearly depicts that public support could be a crucial factor in moving forward with CCS.

Current legislative or regulatory measures under consideration in IL

The State of Illinois is contending with Texas as a potential host for FutureGen project. In July 2006, the towns of Mattoon and Tuscola, located in the east-central part of Illinois, were selected as potential sites. Two other candidate sites were announced in Texas. The final selection is expected in September of this year. The state has committed an estimated $80 million package of grants, tax breaks and low-interest loans to attract FutureGen. Specifically, state legislation and clean-coal program funding will provide:

- $17 million direct cash grants from a clean-coal technology fund
- $15 million in sales tax and property tax exemptions
- Up to $50 million in reduced-interest loans
- Public improvement funding
- Reimbursement for employee training costs

To date legislative activity around CCS in Illinois has solely targeted the promotion of FutureGen. There are no legislative proposals under consideration that begin the process of developing a full scale regulatory framework for the deployment of this technology. A discussion of the two FutureGen bills is presented below:

<u>SB 1704- Clean Coal FutureGen for Illinois Act</u>

Introduced by Senator Gary Forby along with six co-sponsors in February 2007, for the purpose of providing the FutureGen Alliance with adequate liability protection, land use rights, and permitting certainty to facilitate the siting of the FutureGen Project in Illinois. The bill contains provisions concerning the transfer of title to sequestered gas and associated liabilities to the State; insurance and indemnification by the State for the Operator for certain liabilities; permits; land use, including condemnation powers; and economic incentives. The Bill amends the Department of Commerce and Economic Opportunity Law concerning financial assistance; the Illinois Enterprise Zone Act concerning high impact businesses; the Court of Claims Act and the State Lawsuit Immunity Act concerning jurisdiction; and the Eminent Domain Act concerning condemnation authority.

The Bill was amended on March 7, noting that locations at Tuscola and Mattoon are the only locations eligible for benefits under the Act. Amendments delete the authority to acquire property by condemnation and makes conforming changes. A sunset date of December 31, 2010 was also added for these incentives unless the FutureGen Project is located at either Tuscola or Mattoon. On March 22 the bill was referred to the Rules Committee.

Similar Legislation was proposed in the House via HB 1777 by Rep. Jay C Hoffman and 6 other co-sponsors. On April 27 the third reading/final action deadline for the bill was extended to May 9.

HB 5825 'Clean-Coal Project Indemnification Act'

HB 5825 was proposed last year in August 2006. The bill would require the Attorney General to appear and defend an operator of a clean-coal project in civil proceedings commenced against the operator arising from the escape or migration of injected carbon dioxide. The bill would require the State to indemnify the operator unless the conduct or inaction that gave rise to the claim or cause of action was intentional, wilful, or wanton misconduct. As of January 2007, the status of bill is 'Sine Die'.

CCS regulatory activity at the federal level

At the federal level, two major bills have been introduced to date. They are described below:

HR 1267 & S 731, these identical bills were introduced in House and Senate by Representative Gordon of Tennessee and Senator Salazar of Colorado. The bill titled 'National Carbon Dioxide Storage Capacity Assessment Act of 2007' requires the Secretary of the Interior, acting through Director of the United States Geological Survey (USGS) to develop a methodology for and complete a national assessment of geological storage capacity for CO_2. The capacity assessment would cover all the 50 states and includes provisions to survey saline formations, unmineable coal seams, oil or gas reservoirs, the injection potential of various storage formations, the potential volumes of oil and gas recoverable by injection and storage of industrial CO2 in storage formations and the risks associated with storage formations. The money allocated to do this assessment amounts to $20,000,000 for the period beginning October 1 of the first full fiscal year after the date of enactment and ending 4 years thereafter.

S 962, was proposed in the Senate on March 23, 2007 by Senator Bingaman of New Mexico. The bill titled 'Department of Energy Carbon Capture and Storage Research, Development and Demonstration Act of 2007' amends the Energy Policy Act of 2005 to reauthorize and improve the carbon capture and storage research, development, and demonstration program coordinated by the Department of Energy. For this purpose the act includes R&D activities under cost sharing requirements of section 988 (b) of EPACT to be considered: $90,000,000 fiscal year 2007, $105,000,000 fiscal year 2008 and $120,000,000 fiscal year 2009.