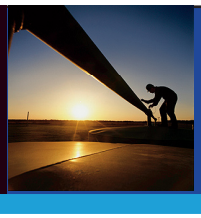
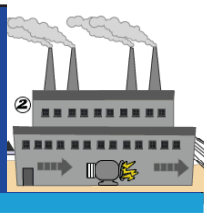
Spring 2007



Carbon Capture and Sequestration (CCS)

The University of Washington as a Case Study



UW's Power Plant

The on-campus UW Power Plant uses primarily natural gas to produce steam, chilled water, compressed air, and some electricity for the UW. The plant is a large emitter of CO2, producing more than 40% of UW's emissions (85,000 metric tons CO2 in 2006) .

The power plant is also an essential component of the UW community. It has been in continuous operation for over 30 years and if it is not functioning for more than 4 hours the UW Medical Center must be evacuated.

Although a number of alternatives to power plant production have been investigated, such as biomass fuel and co-generation, none of these are economically feasible at this time. Given that the plant is so essential to the community, and yet is a large point source emitter, carbon reduction solutions that do not alter the production cycle, but rather address tail pipe emissions are highly desirable.

Processes of CCS

Carbon capture and sequestration (CCS) involves a number of distinct phases from capture, to transport, to storage. Each stage of capturing carbon also emits carbon, making the efficiency of the CCS process essential to the success of this method in mitigating climate change.

Select Resources

UW Climate Partnership Power Plant Carbon Sequestration Report. Available: http://courses.washington.edu/emk-sp06/uwclimate/index.html

IPCC Special Report on Carbon Dioxide Capture and Storage (2005) Intergovernmental Panel on Climate Change, Cambridge University Press, New York, NY

Rao, A.B., Rubin, E.S. (2002) A Technical, Economic, and Environmental Assessment of Amine-Based CO2 Capture Technology for Power Plant Greenhouse Gas Control, Published Online: Environmental Science & Technology, Vol. 36, No. 20, Pages 4467-4475

Technology Available

Amine separation is the only CO2 capture technology available that would suit the CO2 production rate at the UW power plant. Transportation options include pipeline, truck, rail or ship. Pipeline transport is preferred as it is a mature and widely used technology that is economical over the long-term. Existing storage methods include geologic storage, ocean storage, mineral carbonation or industrial applications. Of these geologic storage is currently the most feasible option. There are a number of CCS technologies in the research and development phase that may be applicable in the future, but currently amine separation, transport via pipeline and geologic storage are the best fit for UW.

Costs and Uncertainty

Cost estimates were difficult to develop because most published information is for plants much larger and with different thermodynamic characteristics from the UW plant. Cost estimates including capture, transport, storage, and monitoring are roughly ~$60 MTCO2 stored.

Estimates are also based on a ton CO2 stored basis, rather than ton CO2 avoided. In order to understand the global warming mitigation potential of this system the carbon generation in capture, transportation and storage processes would have to be added in.

Cost uncertainty, potential disruption to plant operations, available space for additional equipment, aesthetic considerations, and additional environmental impacts including water consumption, eutrophication and are all significant concerns for CCS implementation.

However, if UW is seriously considering achieving climate neutrality, dealing with the power plant emissions will need to be part of the solution.

Next Steps

In the case of UW further research on transportation and storage are necessary to creating a more complete picture of what a CCS system for the UW power plant would entail.

The University's role in developing CCS technology should not be overlooked. The University should consider putting more effort into researching this rapidly growing and perhaps essential field of climate change mitigation. Findings by this project indicate that research focused on the carbon capture process has the potential to contribute the most advancement in CCS technology; it is the aspect of CCS that is the most technologically difficult, costly, and inefficient.

In Partnership with the City of Seattle
2006-2007 Luce Keystone Project: UW Climate Partnership Team
Environmental Management Certificate Program
Program on the Environment, University of Washington