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Greenhouse gas storage capacity not a problem

Study shows huge amount of Alberta's emissions can be stored underground

It is technologically feasible to store a huge amount of the global warming gas carbon dioxide deep underground in central Alberta, says a University of Calgary-led study coordinated by the Institute for Sustainable Energy, Environment and Economy (ISEEE).

The government and industry-funded study, called the Wabamun Area CO_2 Sequestration Project (WASP), is the most comprehensive study of large-scale carbon dioxide (CO_2) storage to have all of its findings made fully available to the public.

"It's important that studies of geologic storage be publicly available so that people can make independent judgments of the potential long-term risks of this technology," says study leader David Keith, director of ISEEE's Energy and Environmental Systems Group, and a professor in the Schulich School of Engineering.

The WASP team found that more research—including drilling test wells onsite—is required before starting a commercial-scale operation to store CO_2 in rock formations deep beneath the Wabamun area where most of Alberta's coal-fired power plants are located.

"Before a commercial-scale CCS operation can begin, there needs to be an array of geological and engineering studies done on the proposed CO_2 storage reservoirs, to assess risk and facilitate safe and effective storage," says Keith, one of the world's leading experts on CCS.

The Alberta government has committed $2 billion to help kick-start four commercial-scale CCS projects as a key way of reducing greenhouse gas emissions, especially from coal-fired power plants.

Sixteen U of C researchers and industry consultants conducted the WASP study over 16 months. They examined the feasibility, cost and potential risk of permanently storing underground (called "sequestration") 20 million tonnes annually of CO_2 over 50 years (amounting to one billion tonnes) in a 5,000-square-kilometre area.

The study found that about half of the targeted storage capacity—or some 500 million tonnes of CO_2—can be accomplished without managing the pressure of the geologic formation into which the CO_2 would be injected. This is a gigantic volume of storage, roughly equivalent to half the emissions for 30 years from all of Alberta's centrally located coal-fired power plants.

“This result shows that storage capacity is not likely to be an important constraint on implementing carbon capture and storage technology,” Keith says.

“The results from WASP fill a gap between the province-wide estimates of CO_2 storage capacity and the detailed commercial studies now being done by companies for individual CO_2 storage projects,” Keith adds. WASP also included site-specific studies of geology, reservoir fluids flow and geomechanics, which the province-wide estimates don’t include.

The WASP researchers found that the costs of injecting CO_2 and storing it in geologic formations are relatively low—about $3 per tonne of carbon dioxide. However, for a full carbon capture and storage (CCS) project, the additional costs required to capture the CO_2 at an industrial facility, pressurize the gas and transport it to an injection site would be at least 10 times more than just the costs of storage.

Results from WASP will be used by TransAlta Corporation, one of WASP’s several industry sponsors, in implementing the company’s Project Pioneer—which will receive $770 million in provincial and federal funding. Beginning in 2015, TransAlta plans to capture one million tonnes of CO_2 at its Keephills 3 coal-fired power plant in the Wabamun area.

“The WASP study has provided our Pioneer CCS project with a great head start in understanding the sequestration characteristics and opportunities in the region. WASP has been a very good example of coordinated development work between government, industry and academia,” says Don Wharton, Vice-President, Sustainable Development at TransAlta.

The WASP study used existing geological, seismic and other data to examine the Nisku geologic formation as the primary target for CO_2 storage. The ‘brines’ or fluids that occur naturally in this formation contain significant concentrations of dissolved hydrogen sulphide, a poisonous gas that could potentially mix with the leading edge of the plume of pure CO_2 injected into the formation.

“This is an important and unique finding by WASP that underscores the importance of open-ended risk assessment, and highlights the need to characterize the geochemistry of fluids in the formation prior to starting a CO_2 storage project,” Keith says.

WASP was funded by the Natural Science and Engineering Research Council and the Alberta Energy Research Institute, with additional funding and support from a dozen industry partners.

The full study results are available at: www.ucalgary.ca/wasp

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