Everybody out to build a better CO2 trap; Industry, universities, government working on carbon-dioxide capture and storage solutions for greenhouse gas emissions

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The same things that make Alberta a major producer of carbon-based energy are making it a leader in managing the byproducts blamed for climate change.

The geological formations that trapped oil and natural gas for eons before industry drilled into them can hold CO2 for just as long into the future.

And the clever minds who developed technologies to produce energy are now pushing back the frontiers on carbon capture and storage (CCS) in those reservoirs.

Alberta has a rapidly growing roster of CCS pilot projects driven by industry and research organizations, often working together and often in concert with the provincial or federal government, or both, because of the costs.

"This whole area of carbon dioxide capture and storage is not brand new (but) in the last couple of years it has really risen in prominence," says Brent Lakeman, manager of carbon and energy management for the Alberta Research Council and head of its recently announced carbon-management project.

ARC is the Alberta government's arm's-length natural resources research organization.

"There's no silver bullet, but capturing and storing carbon dioxide could achieve maybe 30 or 40 per cent of the reductions needed, not just in Canada but globally," Lakeman said in an interview with The Journal.

CCS holds particular promise for managing the greenhouse gases emitted in the course of growing oilsands production because it's early enough to design CO2 capture technology into up to eight bitumen upgraders on the drawing boards for the Industrial Heartland northwest of Edmonton.

One of the pioneers of CCS is Bill Gunter, world-renowned principal scientist for CCS at ARC.

In June, he was awarded the entire 2008 Emerald Award for environmental excellence in the category of Research and Innovation, in contrast to the one molecule of the 2007 Nobel Peace Prize he jokes was his for his contribution to the Intergovernmental Panel on Climate Change report that won along with climate change crusader former U.S. vice-president Al Gore.

Gunter has been working on CCS for 15 years, and although he's retiring this month, he is involved in the Heartland Area Redwater Project (HARP), ARC's partnership with ARC Energy Trust (no relation) to inject CO2 to repressurize the Redwater Leduc reef to mobilize the remaining oil.

"We've looked at the geology across the province, and we feel this area has ideal attributes for a CO2 capture and storage project," said Gunter in announcing the project.

"This reef is directly underneath Alberta's Industrial Heartland, which translates into less transportation infrastructure and the least-cost method of carbon storage for industries in that area."

The research council is keen to evaluate CO2 storage opportunities throughout the entire reef.

Lakeman says HARP could potentially store one gigaton of CO2. That's one thousand megatons, or one billion tonnes, more than 20 years' worth of Heartland emissions.

Overall in Canada there's approximately 800 megatons of CO2 emitted per year from all sectors, including residential, he says.

The Heartland has also been the site for a research project evaluating various representative CO2 sources to learn what is required to aggregate different quality types of the gas.

Considerations included CO2 purification, dehydration and compression requirements, and the merits of a single compression site to satisfy pipeline requirements to users.

The engineering division of SNC-LAVALIN managed the project on behalf of a 17-member consortium brought together by Petroleum Technology Alliance Canada.

PTAC is an industry organization formed to apply the leverage of collaborative industry and government R&D and financing while improving the environmental, economic, social and safety performance of the hydrocarbon industry.

The evaluation project included suppliers of industrial gases and pipeline companies, as well as energy producers and research organizations.

Two levels of government contributed $500,000 in funding, a tiny fraction of the hundreds of millions of dollars both governments have committed to reducing Alberta's emissions.

The first phase of the study covered CO2 collection and delivery to a depot. The next step is to choose a destination and cost out long-distance delivery.

The sense of urgency and the enormous costs of establishing a carbon capture, transportation and storage system mean some of the biggest players are involved in more than one project.

Oil and gas distributor Enbridge Inc., for instance, is in the PTAC consortium, plus this spring Enbridge announced it is leading a 19-member group of energy industry collaborators in the Alberta Saline Aquifer Project.

ASAP is to collect, purify and dehydrate CO2, compress it into a liquid, and inject it under pressure into carefully chosen and prepared underground reservoirs of salt water.

Project lead Chuck Szmurlo, Enbridge vice-president for energy technology and power generation, explains: "The carbon dioxide is absorbed in the same way sugar water absorbs CO2 to create tonic water, (but) it's more complicated at those (subterranean) pressures. It goes down as a liquid, is contained as a liquid and interstitially in rock pores.

"Eventually as that interfaces with briny water, it would go into solution," Szmurlo says.

Enbridge has compression and liquids storage experience, pipelines and rights-of-way to big emitters, and believes "ultimately the transportation and sequestration of carbon dioxide could become a really big commercial enterprise," Szmurlo says.

TransAlta Corp. signed a deal in April with Switzerland-based Alstom Power Systems, a global leader in power generation technology, to retrofit a coal-fired power plant west of Edmonton for CCS using a patented "chilled ammonia process."

The research, assisted by the University of Calgary, starts this year, and testing is to begin in 2012.

TransAlta expects to reduce its CO2 emissions by one million tonnes per year.

TransAlta is also part of the Integrated CO2 Network (ICO2N), a cross-section of 18 CO2 producers, transporters and users that took the lead some years ago to start designing a collection, transportation and storage system for Canada.

Working together on business planning and rational system design, ICO2N is calling for strong policy to encourage CCS across Canada.

And finally, TransAlta and ARC Energy Trust are both on the funding side of an $850,000 study being co-ordinated by the Institute for Sustainable Energy, Environment and Economy at the U of C to quantify CO2 sequestration potential in the Wabamun area.

Although the area was chosen partly because of its proximity to four coal-fired power plants that each emit three to six megatonnes of greenhouse gas per year, the Wabamun Area CO2 Sequestration Project (WASP) is focusing purely on assessing the geology for CCS.

To be completed by 2009, WASP has attracted government funding through the Alberta Energy Research Institute and the federal Natural Sciences and Engineering Research Council. Other energy-sector partners include TransCanada Corporation and Penn West Energy Trust.

In April, Alberta Energy announced Jim Carter, former president of Syncrude Canada Ltd., would be chair of its new Carbon Capture and Storage Development Council, tasked with moving demonstration pilots into a full-scale system.

Again, there is considerable overlap, because members of the council are drawn from industry and the universities of Alberta and Calgary, as well as the federal and provincial governments.

At the western premiers' annual meeting at the end of May, Alberta and Saskatchewan agreed to lead the drive in the West towards CCS. They'll be touting the idea when Canada's 13 premiers meet in Quebec City in July.

The two provinces developed their early expertise at the $80-million Weyburn-Midale CO2 Monitoring Project in Saskatchewan, which launched in 2001.