

Looking for solutions to the carbon conundrum  
Canada could be losing technological race for emissions capture and storage

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At his lab in an industrial park in Edmonton, Bill Gunter is exploring how carbon dioxide reacts with the crude oil molecules that are drawn from the Leduc reef near Redwater, Alta.

The Alberta Research Council scientist is a veteran in the arcane science of CO<sub>2</sub> injection, in which carbon dioxide is shot underground to coax stubborn oil and gas molecules out of geological formations where they have been trapped for hundreds of million of years.

He is working with Calgary-based ARC Energy Trust, which is proceeding with a pilot project to boost oil and gas production from its Redwater deposit by flooding it with carbon dioxide.

But there is a new urgency to the research. Now, Dr. Gunter is just as keen to ensure the carbon dioxide remains trapped underground as he is to enhance the recovery of ARC's valuable oil and gas deposits.

The researcher is also hunting bigger game: He is studying the reef to determine the feasibility of permanently sequestering as much as one billion tonnes of CO<sub>2</sub> in its structures.

ARC's Redwater site is strategically located just a few kilometres from the vast complex of existing and planned refineries, petrochemical plants and oil sands upgraders that will make northeast Edmonton one of the country's CO<sub>2</sub> hot spots. In essence, the idea is to turn their smokestacks upside down – pumping the carbon dioxide underground rather than into the atmosphere.

“We've got the perfect conditions in Western Canada – excellent storage potential, a large source of CO<sub>2</sub> and a market for it in enhanced oil recovery,” he said in an interview in Edmonton. What's lacking at the moment, he added, is the economic incentive for companies to invest the billions of dollars needed to build an integrated carbon capture and storage network.

Carbon capture and storage technology is critical to Canada's ability to meet two seemingly contradictory goals on energy and the environment. Indeed, it may be the silver bullet that allows the world to arrest climate change even as the globe consumes growing amounts of fossil fuels to energize emerging economies like China and India.

And Canada is uniquely positioned to take a leadership role in the technology, if

it can summon the political will to do so.

Much of the debate over the economy-versus-environment conundrum here focuses on the oil sands boom and how governments should manage it. Oil companies are planning to quadruple the output from the oil sands over the next 15 years, which would propel the country into the elite ranks of the world's top petroleum producers and produce jobs and wealth for all Canadians. But at the same time, the federal government has set targets to reduce greenhouse gas emissions by 20 per cent from 2006 levels by 2020. The oil sands are expected to be the single largest source of growth in Canada's greenhouse gas emissions.

Carbon capture and storage (CCS) would have to account for nearly half of Canada's emissions reductions if the country is going to meet its 2020 targets, according to Ottawa's advisory panel, the National Round Table on the Environment and the Economy. But while the technology holds immense promise, large-scale applications remain untested and fraught with challenges. Not the least is the massive cost involved, Robert Page, the round table's deputy chairman, said in an interview.

"The economics are serious and the economics are going to be a problem," Mr. Page said. But if government imposes a significant price on CO<sub>2</sub> – either through a cap on emissions or a carbon tax – "then it begins to close the gap."

By some estimates, it would cost \$16-billion over 20 years to build and operate a system that would capture 20 megatonnes of CO<sub>2</sub> per year by 2020 – a level well short of the round table's target but considered ambitious by other experts. That figure could vary widely depending on construction costs in Alberta, and the source of fuel used to fire oil sands upgraders.

Those estimates dwarf the initial \$2-billion of government spending recommended this week by a panel commissioned jointly by the federal and Alberta governments. The ecoEnergy task force said government should allocate the funds to build four initial capture and storage projects. But it rejected suggestions government should move first to help finance a pipeline to gather carbon dioxide from sites around the province. Neither government has said to what extent it would be willing to underwrite CCS deployment.

The technology could eventually remove 600 megatonnes of CO<sub>2</sub> per year from Canada's smokestacks, equivalent to 40 per cent of projected emissions in 2050, the panel report said.

Among those leading the effort on carbon capture and storage is Dr. Gunter, who earned what he calls "one molecule" of the 2007 Nobel Peace Prize for his work with the United Nations' Intergovernmental Panel on Climate Change, which was awarded the honour along with climate change crusader Al Gore.

He suggests Canada is losing a technological race against the Americans, the Europeans and the Australians to develop and deploy the CCS technology, which could be exported to emerging markets. Abu Dhabi, an oil-rich member of

the Persian Gulf state United Arab Emirates, has entered the field with plans to capture up to 15 million tonnes of carbon dioxide and inject it into aging oil fields to enhance recovery.

“The message is that the other governments are looking at an order-of-magnitude higher investments than Canada is in order to move CCS along,” Dr. Gunter said. “So it will be interesting to see if we get in the ball game or not.”

Progress in Canada is stalled by debates over who will pay the steep cost of capturing CO<sub>2</sub> from industrial and energy sites; how the pipeline system will be financed; and who will assume liability for long-term underground storage sites.

The leading industry research and lobby group, the Integrated CO<sub>2</sub> Network, comprises 18 of Western Canada's largest emitters of greenhouse gases, including major oil sands producers like Suncor Energy Inc., Syncrude Canada Ltd., Imperial Oil Ltd. and Canadian Natural Resources Ltd. The province's large coal-dependent utilities – Epcor Power LP and TransAlta Corp. – are also members of the group and are considering plans to capture emissions from a power plant and sequester the gas.

In a report last fall, the ICO<sub>2</sub>N group warned it would cost billions to build a CCS system that would eliminate significant amounts of emissions, including a \$500-million pipeline to gather the greenhouse gas from oil sands upgraders and coal-fired power plants.

Most of those costs – up to 80 per cent – are incurred in capturing the gas from worst-offending oil sands plants and coal-fired power plants. While the figures sound daunting, proponents say carbon capture would add only \$3 to \$4 to the cost of producing a barrel of upgraded synthetic crude from the oil sands.

ICO<sub>2</sub>N spokesman Stephen Kaufman, a Suncor executive, said the industry will require governments to help finance the CCS network, comparing it to the building of the transcontinental railway or cross-country natural gas pipeline. Proponents of CCS argue that they are asking government for roughly the same level of support as provided to wind power producers, who are dominated by multinationals like General Electric, or to agrifirms that produce ethanol.

However, environmentalist John Bennett of [climateforchange.ca](http://climateforchange.ca) said taxpayers should not be subsidizing highly profitable oil firms to reduce greenhouse gas emissions, but that governments should regulate steep reductions. His arguments resonated even more loudly this week, as major oil companies posted record profits from the stunning runup in prices last year.

Faced with growing cost and environmental pressures, the oil sands producers are all investing in technology that will lower production costs by cutting energy consumption, and in the process reduce emissions. But it's not clear whether or how quickly they will embrace CCS, which offers little return on investment.

Neil Camarta, Petro-Canada's senior vice-president in charge of oil sands, said

his company aims to have the industry's lowest level of emissions per barrel of oil produced, known as emissions intensity. But he said carbon capture and storage is prohibitively expensive, though the firm is building its Edmonton-area upgrader to have the capacity to divert CO<sub>2</sub> from the emission stacks.

“There's a lot of hair on this one yet,” he said. “We're watching this space very carefully because we think in the long run there will be a solution but there isn't an economic solution out there yet.”

On the other hand, Petrocan's planned upgrader will be located about 40 kilometres northeast of Edmonton, in the neighbourhood of ARC's Redwater site. So conceivably, Petrocan could sell CO<sub>2</sub> to ARC, which would then use it to enhance oil production.

As a minority partner in a Weyburn, Sask., enhanced oil project, ARC has had a front-row seat at Canada's largest carbon capture and storage effort. Operated by Calgary-based EnCana Corp., the Weyburn plant buys its CO<sub>2</sub> from a highly subsidized North Dakota coal gasification facility and shoots it underground to boost oil recovery. It is one of the world's largest carbon capture and storage projects, and has attracted interest from around the world as researchers study it to determine whether the CO<sub>2</sub> will remain buried once it is injected.

ARC took its experience at Weyburn and applied it to central Alberta, where aging oil fields could benefit from enhanced recovery techniques and there is plenty of CO<sub>2</sub> being emitted into the atmosphere. ARC's David Carey said he is still not sure those emitters will become suppliers for the project. “At this point, government hasn't identified carbon as something that has to be captured,” he said.

Ultimately, the driver behind carbon capture in Canada is likely to be Big Oil's fear of losing its \$100-billion bet on the oil sands. There is a growing worry climate concerns – notably the growing call for climate change action in the United States – will trump economic ones, and force companies to rein in emissions, notes David Keith, a director at the Institute for Sustainable Energy, Environment and Economy at the University of Calgary, and a member of the recent federal-provincial task force on CCS.

“You're just not going to be able to grow the oil sands without managing this problem,” Dr. Keith said. “And you are not going to manage it without moving aggressively on carbon capture and storage.”