

Developing



answers

Carbon Management Canada pushes for radical innovation in oilsands research

By Ruth Klinkhammer

Game-changing. Radical. Innovative. These ideals are easy to say, but difficult to actually achieve. For one new organization, however, the catchphrases are being taken to heart. In fact, the very survival of the group depends on whether it can deliver on its promise to change the way fossil fuels are extracted and processed.

Carbon Management Canada Inc. (CMC), a national network of over 20 universities headquartered at the University of Calgary (U of C), has established for itself dual tasks. First, it funds research to provide the technologies, the human capacity and the policy and regulations that will allow for major reductions in carbon emissions within the upstream fossil fuel industry. Second, the fledgling network wants to change the way energy companies, university researchers and government regulators collaborate and share information. CMC wants nothing short of a paradigm shift in the culture of fossil fuel technology development.

“That’s why Carbon Management Canada is important,” says Dr. Steve Larter, the organization’s scientific director, and Canada research chair in petroleum geology at the U of C. “It’s not just about the carbon. It’s about changing the way we do things. We need to think big. You don’t want incremental change, you want game-changing work.”

HUMBLE BEGINNINGS

Carbon management was identified as a research focus for the U of C almost a decade ago, but championing and hosting a national research network engaged in world-altering research was a more recent concept. In fact, 10 years ago research interest in managing carbon was only just beginning, says Wayne Patton, a Haskayne School of Business employee and interim managing director of CMC during its first few months of operation.

Patton led a collaborative initiative to establish an energy centre on the Calgary campus that eventually served as a base for the launch of the Institute for Sustainable Energy, Environment and Economy (ISEEE)—which continues to place a priority on research to reduce carbon emissions. When Patton started his efforts, few people on campus were involved in carbon management work. But slowly, research in carbon management issues and technologies increased, reinforced by growing political interest in the field.

In 2009, when the federal Network of Centres of Excellence (NCE) issued a call for new network applications, a team comprised of David Layzell, ISEEE’s executive director; Bruce Carson, chair of CMC’s board and executive director of the Canada School of Energy and Environment; Larter and Patton developed a winning proposal.

In December 2009, the NCE announced it was awarding CMC \$25 million for a five-year period and the Government of Alberta, through Alberta Environment, kicked in matching funds. CMC is actively recruiting industry partners and, at the time of writing, had seven on board—ATCO Power, Canadian Natural Resources, Capital Power, Cenovus Energy, ConocoPhillips Canada, Spectra Energy and Suncor Energy.

Industry involvement in CMC is critical, points out managing director Richard Adamson, because the network can only be regarded as successful if research results are implemented at a large scale by industry and regulators.

“Our mandate is to make a difference in real emissions in the upstream fossil fuel industry. We aren’t just about doing research,” says Adamson. “In order to bring it up to scale, we need to engage practitioners in government and industry at all levels and stages of development.”

The focus on industry involvement and real results is one of the reasons it was key to headquarter the NCE in Alberta, where the majority of energy industry operations exist.

“There’s a carbon issue in Nova Scotia. There’s one in Newfoundland. There are carbon issues across the country, but I think the main test field for what we come up with will be in Alberta,” says Carson. “That’s why it’s crucial that we be located here.” ►

THE RESEARCH: FROM TECHNOLOGY TO POLICY

According to Environment Canada, 21 per cent of the country's greenhouse gas emissions (GHGs) are generated by the oil and gas sector. Another 17 per cent come from the electricity sector—primarily through its high-emission coal-fired generating plants. In its 2007 climate change action plan, *Turning the Corner*, the federal government set GHG emissions reduction levels to 65 per cent below 2006 levels by 2050. CMC's goal is to help Canada achieve a full 40 per cent of that target through the widespread implementation of advances in fossil fuel recovery and processing.



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To achieve that goal, CMC funds research in four strategic areas it calls themes. In Theme A: Recovery, Processing and Capture, researchers focus on reducing CO₂ emissions in resource extraction and processing as well as the effective and economic capture of carbon in power and material process plants. Some of the work in this theme, which is lead by Dr. John Grace, Canada research chair in clean energy processes at the University of British Columbia, involves improving efficiencies in already proven technologies.

For instance, a collaborative group of eight researchers at six universities and Natural Resources Canada is looking at ways to reduce the energy needed to gasify

petroleum coke and low-grade coals. The reason is straightforward—processes that require less energy produce less CO₂.

In Theme B: Emerging and Enabling Technologies, research takes a twist, says theme lead Dr. John Shaw, NSERC/Alberta Innovates industrial research chair in thermodynamics at the University of Alberta. Shaw believes out-of-the-box breakthroughs will take place within his theme.

"The way I view Theme B is [that] successful projects from it will provide a strong case for our renewal," he says, referring to CMC's opportunity to apply for renewed funding at the end of years five and 10.

He could be right. Currently, work in themes A and C, is in fields with technologies that have been in use for years. Gasification, for instance, has been used commercially for decades. Ditto the sequestration of CO₂ in enhanced oil recovery (EOR). It's not that these technologies and areas of research are not crucial to reducing CO₂ emissions in fossil energy processes—but groundbreaking breakthroughs will come in novel areas and at the level of basic, fundamental science. Researchers in Shaw's group come from disciplines not traditionally associated with the energy industry such as nanotechnology, genomics and robotics.

"We are working on crazy ideas like putting refining in the reservoirs. If you

run fires underground or have bacteria chomping away or [oil] separation underground, you only produce what you want and the CO₂ never leaves the reservoir. But in order to have this vision, you need detailed understanding of reservoirs," says Shaw.

Initial projects are related to basic science and engineering. One project, for example, aims for a detailed understanding of the impact of CO₂ storage on subsurface micro-organisms.

This level of knowledge will be particularly important to developments in Theme C: Secure Carbon Storage. Headed by Canadian Society of Exploration Geophysicists' chair in exploration geophysics Dr. Don Lawton, work in this area covers a broad spectrum of issues surrounding carbon capture and storage. Although CO₂ has been stored underground for many years through EOR, there is just one site in the world (in the North Sea) in which carbon is being deliberately stored for climate change reasons. In Canada, the only site where CO₂ is sequestered at a commercial scale is Weyburn, Sask., where CO₂ is used for EOR. There are, however, four carbon capture and storage (CCS) test sites in the planning stage in Alberta.

CMC research in this area is broad and ranges from investigating secure geological storage to finding novel methods for the technology of capture and storage. One project involves testing seismic equipment, another examines the seismic behaviour of carbon-saturated sandstone and still another looks at geochemical techniques for monitoring sequestered CO₂. Scientists are also studying the possibility of capturing CO₂ in mine waste and tailings.

Key to research in all three of these themes is uptake of new technologies and knowledge by government and industry, both in Canada and abroad. Dr. James Meadowcroft, Canada research chair in governance for sustainable development at Carleton University, heads the theme critical to the success of new technologies.

"The other three themes are focused around a particular scientific or engineering problem. We are everything about the

way those technologies connect to human society,” says Meadowcroft, who heads Theme D: Accelerating Appropriate Deployment. “We deal with the barriers, problems and issues to doing it at scale.”

Take CCS, for instance. Risk assessment protocols need to be developed; publics need to be informed and consulted; and tools need to be developed that will help government, industry, environmentalists and industry compare CCS to other mitigation options. All of these topics are fair game for researchers working in Theme D.

THE FUTURE

The real challenge for CMC will be creating a culture of innovation that is based on close engagement across government, industry, academia and the nonprofit sector. CMC management and theme leaders in all four sectors believe that this needs to change in order for major steps to be made.

Some fields, such as biotechnology and medical technology, are very innovative. Others, like the fossil fuel sector, have not been known for their innovation. “What encourages innovation? There are conditions that frame innovation and make it more likely,” says Meadowcroft. The trick is to discover these and help them take root in the fossil energy sector.

To help foster conditions for innovation and research breakthroughs, the network favours proposals that bring together researchers from multiple universities and disciplines. The network is encouraging international collaboration between experts abroad and Canadian-led research teams. Industry partners are being sought out as well. The purpose, says Larter, is to bring together people who do not normally work with each other and to bring in people from outside traditional disciplines who can look at issues with fresh eyes.

Larter acknowledges that some academic researchers might look at CMC as a cash cow. That would be wrong. The mission of the company, to reduce levels of carbon in the atmosphere, is one CMC leaders take seriously.

“It would be a big mistake seeing this [CMC] as a funding opportunity. It’s a way of getting an answer,” says Larter. ■



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