

IF YOU ATTENDED ONE OF THE Robbie Burns Day celebrations in Calgary this January and thrilled to bagpipes, there's a chance one was a set of authentic Northumbrian pipes played "badly" by Steve Larter. They're more sophisticated than Scottish pipes, he explains. "These aren't highland pipes, you don't blow into them; you pump them under your arm."

This unassuming and well-spoken innovator has never been one to blow his own horn. His long list of accomplishments speaks for itself. Larter holds the Canada Research Chair in Petroleum Geology as well as a full professorship in geology at the University of Calgary. Impressive enough, but those are just a couple of his hats. He's also CEO of Gushor Inc., an entrepreneurial company he co-started in 2006 to commercialize cutting-edge processes researched and developed by him and others at the university. And in December 2009 he was selected to lead the federal government's Carbon Management Canada (CMC) Network — which will develop technologies and policy advice for de-carbonizing fossil fuel production and utilization.

Ever curious, his research interests lie primarily in studying micro-organisms, making the production of energy more efficient and these days trying to tackle massive carbon emission reduction strategies. He's been researching novel uses of petroleum reservoirs as in-situ refineries, and how natural microorganisms can speed normal processes of heavy oil and gas formation to recover energy as methane or hydrogen rather than heavy oil.

They're far-reaching and radical concepts, and that's one reason Larter was elected a fellow of Britain's prestigious Royal Society last year, capping a long list of international awards and medals: member of the Norwegian Academy of Sciences and Letters in 2004, a Top 10 U.K. Geologist in 2003, the Friendship Medal of the Peoples Republic of China in 2000 and the William Smith Medal of the Geological Society in 1998. And here in Alberta, the 2009 Alberta Science and Technology award for outstanding commercial achievement with Gushor.

He's earned these through research-driven thinking. "Our institutions and structures — business and academia — force tradition and conservatism," he says. "Indirectly or directly



Photo courtesy of University of Calgary

## OILSANDS SAGE

*Heavy oil researcher predicts the demise of SAGD*

*Text: Graham Chandler | Photograph: Ewan Nicholson*

you're encouraged not to think out of the box."

Larter's "thinking" started, he says, as a boy growing up under a schoolteacher father in rural East Anglia near Cambridge, England. "As a child I loved astronomy and telescopes. I collected spiders and butterflies and ran off catching newts. And I liked to build things. We made telescopes, smells and bangs — that kind of stuff." When he was 12 the family moved to Kent where he attended Sir Joseph Williamson's Mathematical School. His mathematics teacher there, Eric Jones, inspired him; the effect continues to this day. "He was very inspirational," recalls Larter. "He ran the astronomy club, and was into any interesting stuff."

Astronomy was Larter's first love but he says despite "being pretty good at math in school," it just wasn't good enough for astronomy at Cambridge. "So I thought I'd do the next best thing: geology, natural sciences and chemistry." After Cambridge he researched coal geology at Newcastle, became interested in organic matter in sediments and did his PhD in organic geochemistry building analytical systems to study kerogen.

"Then I was offered a job at Unocal's research centre in California. It was in the 1980s when the industry did real upstream R&D," he says. "Unocal had a big research centre and I got involved researching heavy oil, oil shale, oil and gas."

Larter's research has helped revolutionize how oil viscosity is measured in oilsands and heavy oil reservoirs, and how best to characterize and recovery-process engineer these complex systems. He says viscosity can vary considerably over even 50 metres. "Knowing viscosity patterns enables sophisticated reservoir engineering and optimum well spacing," he says.

Through Gushor, the technique is getting to market, but it's been frustrating and a harbinger of launching advanced production methods. To help understand economics and marketing, Larter reads theory extensively — and doesn't like the way it works.

"I'm interested in why it's such a complete balls-up," he says. "Although there are many

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people that worship this market — it's done some good things, people are generally living comfortable lives, in Canada at least — in general it simply hasn't delivered. If you look at energy security, supply, carbon management and climate change, the market has not delivered solutions, it has delivered problems.”

It's short-term economics that drives how most companies operate, Larter says, and that's why it's tough convincing big operators to do large pilot programs. “There just doesn't seem to be a big appetite for serious long-term R&D investment or to try new processes. So we've been looking outside the industry. R&D levels in resource-based industries like oil and gas do not compare at all with spending in the chemical or pharmaceutical industries and that's one reason why we have so few recovery process options currently.” He worries that business as usual will trump common sense.

But this visionary is forever optimistic. “The oilsands will still be producing energy in 30 years but we think it will be very different,” he says. “We will be producing power, electricity, natural gas and feedstock chemicals directly. I don't think we will just be pumping black fluids all across North America to upgraders and refineries to the extent envisaged.” He says he doesn't see the mining side surviving. “The future is in-situ [processes] but with radically new technologies.”

Larter predicts the demise of steam-assisted gravity drainage (SAGD). “We've been looking at the energy efficiency of cookie-cutter SAGD and while it's very clever and often billed as the ideal process for the ideal reservoir,” he says, “Alberta reservoirs are geologically very complex.” There are billions of barrels just outside the cold recovery window with no functional recovery technology yet, “and that's where we have to put lots of effort.”

So where does that leave the oilsands as a powerhouse of world energy? Larter notes that 60-80% of greenhouse gases come from burning fuels, not from recovering them. Even if we reduced energy recovery emissions to zero, those would remain. “The only way you solve that is to centralize energy generation, capturing the CO<sub>2</sub> and storing it and if we do move fuels around it should be natural gas.” So he thinks the future is natural gas in the short term, then electric cars and electric trains.

“There will be massive resistance to the concept,” he adds, “because it's a fundamental change to the nature of the business. But that's what has to be done.” •