

# Nuclear plants to power oil sands extraction

Energy Alberta Corp. eyes atomic energy for Alberta's oil sands

by Robert Simpson

Alberta's first nuclear power plant could be opened in the oil sands within a decade, says a Calgary-based company in talks with several oil patch players and government officials to bring the project to a reality. Nuclear power is looking more attractive amid fluctuating natural gas prices, increased public pressure over greenhouse gas emissions and dwindling conventional oil production.

**Energy Alberta Corp.**, in partnership with the Canadian crown corporation that sells reactors, **Atomic Energy of Canada Ltd.** (AECL), is proposing a \$3-billion, 750-megawatt CANDU 6 (Canadian Deuterium Uranium) reactor for completion by 2014.

This would produce enough energy to support a 100,000- to 150,000-barrel-per-day oil sands operation. The idea of nuclear power in the oil patch is quickly gaining support from Albertans, in the government and industry.

Brad Anderson, executive director of the Alberta Chamber of Resources, says, "Sustained high oil prices are removing lingering doubts about the long-term profitability of extracting oil from sand while the price of natural gas—which oil sands producers have relied on to produce the steam needed to ply the viscous oil out of the ground—has risen 60% in the past year."

Also, there is increased public pressure on oil sands producers and governments to find ways to lower CO<sub>2</sub> emissions, which contribute to global warming. Oil sands producers pump out 23 million tonnes of greenhouse gases a year and are the largest and fastest rising source of greenhouse gases in Canada. Without new technology, the oil sands will be emitting 156 million tonnes of greenhouse gases per year by 2015.

"There is increasing support because nuclear power in the oil patch makes good sense economically, politically and socially," says Wayne Henuset, director of

Energy Alberta Corp. Nuclear power is cost effective and environmentally friendly. It uses less water in steam generation, while generating no carbon dioxide and polluting emissions.

"Instead of relying on natural gas for fuel at volatile world market prices, oil sands producers could count on a reliable, steady price for nuclear power for the next 50 years," says Henuset.

The idea of nuclear power to fuel the energy-intensive requirements of oil sands production has been battled around for years. In the 1950s, several U.S. and Canadian scientists were convinced they could release the heavy oil from the sand by blasting a nine kilotonne atomic bomb under the oil sands 60 kilometres south of Fort McMurray. The idea was to vaporize the rock and create a large cavity into which heated oil would flow and later be pumped out by conventional methods. The idea was killed due to political pressure, but was resurrected briefly in the 1970s.

Nuclear power discussions appeared on the provincial government agenda several times in the 1990s, but it wasn't until 2003 that Alberta's energy minister and AECL made their discussions public.

At the time, AECL commissioned a study from the Canadian Energy Research Institute on how nuclear power compared

with the natural gas-fired plants currently used to generate the steam and electricity needed to extract bitumen from the oil sands and the hydrogen necessary to process it into usable crude oil. The study showed that nuclear power is a viable option for the oil sands and competitive at natural gas prices of US \$3.50 per million BTU or higher. Gas prices have averaged US \$7.27 per million BTU this year on the New York Mercantile Exchange.

## IT'S JUST A MATTER OF TIME

Support for the idea of nuclear power in the oil patch is coming from governments, industry and some Albertans. In January 2007, Canada's Natural Resources Minister Gary Lunn gave a big thumbs up for nuclear energy in the oil sands. He said Canada will likely use nuclear power to feed its booming Alberta oil patch.

"It's not a question of if, it's a question of when in my mind," Lunn says. "I think nuclear can play a very significant role in the oil sands. I'm very, very keen."

Lunn noted that nuclear energy is "absolutely emission free" and "CO<sub>2</sub> free" and that it can help replace natural gas and other fossil fuels currently burned to extract bitumen from the tar sands. Nuclear power fits nicely into the CO<sub>2</sub> reduction timelines of the federal government's Clean Air Act.

The government of Alberta has not been as vocally supportive, but they have stated that although there are no nuclear power plants in the province, there is no moratorium on nuclear energy either. "We don't favour one form of energy over another," says Donna McCol, Alberta Energy Ministry spokesperson. "We let the market decide." In April, outgoing Premier Ralph Klein told reporters Albertans should be prepared to look at nuclear power in the oil sands.

Individual Albertans appear to support the idea. A survey commissioned by AECL last year suggested only 40% of Albertans favored nuclear power and another 30% were neutral to the idea. The idea that 70% of Albertans aren't averse to nuclear power in their backyard has generated interest with industry. Last year, French oil giant Total SA announced it is considering a nuclear power plant to extract oil. Total would speak about its plans only in general terms.

"It's not foolish to look into nuclear options," said Yves-Louis Darricarrere, Total's director for natural gas and power. He said a nuclear power plant would help Total comply with tougher constraints on carbon dioxide and other greenhouse gas emissions.

## THE NUCLEAR ADVANTAGE

"The real driver for nuclear power in the oil patch is economics," says Henuset, adding that three companies are serious about the proposal.

Producing oil from oil sands uses unsustainable amounts of energy. The bitumen extraction process requires about 750 cubic feet of natural gas for every barrel of bitumen, according to the Pembina Institute, an independent, not-for-profit environmental policy research and education organization, report "Oil Sands Fever." The *in-situ* process that pumps super-hot steam 1,000 metres underground requires 1,500 cubic feet of natural gas to produce a single barrel of oil.

Currently, about 0.6 billion cubic feet of natural gas are used every day in the oil sands region—enough to heat 3.2 million Canadian homes. (The average household in Alberta uses 50 gigajoules of natural gas daily.)

Production estimates for 2025 show that the energy input will be between 1.6 to 2.3

billion cubic feet of natural gas per day, approximately equal to the planned maximum capacity of the proposed McKenzie Valley gas pipeline, or about one fifth of daily Canadian gas production.

"Pipeline or not, the projects planned for development already exceed the amount of natural gas usage in oil sand operations by 2015, just nine years from now," says Henuset.

The price volatility of natural gas has also been an issue for oil sands producers. Over the past year, natural gas prices have fluctuated to highs of US \$10.80/MMBtu, an increase that may be representative of future natural gas price levels as the North American supply and demand balance is expected to tighten. "Something has to give," says Henuset.

## STEAM, ELECTRICITY AND HYDROGEN

To replace natural gas dependency, Energy Alberta Corp. is suggesting that a CANDU reactor built close to the oil sands would provide the required steam and electricity. The electricity is used to produce hydrogen from water through electrolysis which is then used to upgrade the heavy oil. Currently, production of synthetic crude oil from Alberta tar sands involves two basic steps: steam heating and hydrogen enrichment. The oil and sand are heated using steam to separate the raw bitumen from the sand. This may be done by mining and processing the sand or, *in situ*, by applying heat to the sand underground.

The bitumen produced from this process is not equivalent to normal crude oil. It is much heavier and must be upgraded. The preferred way is to add hydrogen to the bitumen, forming less viscous, lighter components.

Several studies of the potential use of nuclear energy for the extraction of tar sands oil have been undertaken. The latest Canadian study, completed in 1994, considers the application of a CANDU 9 reactor could supply the steam and electricity to extract and upgrade about 600 million barrels of bitumen over a period of 30 years. The land area from which bitumen would be extracted is about 18

square miles, requiring stream distribution and bitumen recovery piping from a centrally located, 60,000-barrel-per-day plant. Smaller reactors would be suitable for smaller production rates with shorter piping distance.

## NOT EVERYONE AGREES

There are those who don't subscribe to nuclear power alternatives. In a recent interview with the Wall Street Journal, a spokesperson for Imperial Oil Ltd. of Canada, said it looked into the nuclear option in the past but didn't pursue it because of the cost of the technology.

Imperial Oil is not alone in its thinking. Groups such as the Canadian Heavy Oil Association have been skeptical in part because of the scope and the multi-billion-dollar cost of the nuclear project.

Environmental groups are also vocally opposed to the proposal. A recently released report by the Pembina Institute states "Nuclear power, like other non-renewable energy sources, is associated with severe environmental impacts." The Pembina report claims nuclear power generation still produces greenhouse gases during mining, transportation and construction, and that it relies on uranium, which is not a renewable resource. Also, the report claims, nuclear power releases hazardous pollutants into ground water and produces toxic waste that will endure for hundreds of thousands of years.

In addition to stressing environmental and health risks, Mark Winfield, director at the institute, outlines some of the financial risks to nuclear power. "Nuclear reactors are often plagued with maintenance problems, constructions delays and high capital costs, which have left significant debt."

In Ontario, nuclear energy has required massive provincial subsidies. The province still carries debt from nuclear power projects and maintenance on some of their plants. The Pickering plant in particular is costing the province between \$4- and \$5 billion.

Henuset, on the other hand, challenges those who oppose nuclear power for the oil sands. "If anyone can provide a better energy alternative, I would be happy to hear from them." ■

