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July 24, 2007 [News Synopsis](#)

## Gasification Technology Poised To Compete With Natural Gas Combustion For Oilsands

*By Maurice Smith*

As the search for alternative fuels to power oilsands production picks up steam amid rising and volatile natural gas prices, promoters of gasification technologies are flocking to the province to offer up their expertise.

A heavy oil and oilsands conference in Calgary last week drew a handful of such companies which maintain their technology is not only proven, but competitive at today's natural gas prices.

As the predominant fuel for steam assisted gravity drainage (SAGD) bitumen production, natural gas has become one of the highest cost and least predictable input costs as prices have risen to new levels in the last five years. Alternatives from coal to geothermal to nuclear power are being investigated as bitumen production is anticipated to continue to grow in a declining natural gas supply environment.

A number of factors have made gasification and combustion of bitumen and refinery residues cost competitive with burning natural gas, say its backers. While natural gas prices have risen, companies have been able to build on experience gained with fuels similar to bitumen and residues, such as heavy fuel oil and Orimulsion, which have proven to be economic. And unlike that of natural gas, the supply of bitumen feedstock is plentiful, predictable and relatively low-cost.

**Dennis Finn**, business development manager for **Wartsila North America, Inc.**, made the comparison of Alberta bitumen with Venezuela Orimulsion, a bitumen-based fuel produced by mixing with about 30% water and small quantities of surfactant.

Emulsified bitumens have been shown to be excellent fuels for electricity and steam production, he said, and tests conducted by Helsinki, Finland-based Wartsila show emulsified bitumen from Alberta -- using **Quadrise Canada Fuel Systems Inc.**'s patented MSAR process -- presents a similar opportunity. MSAR (Multiphase Superfine Atomized Residue) is a liquid fuel consisting of extremely fine oil droplets suspended in water. The first commercial use of this technology in the oilsands is expected to come on stream next year.

Wartsila, which conducted combustion testing on Orimulsion prior to its commercialization a decade ago, has now conducted similar tests with the same reciprocating engine using Alberta bitumen, Finn said. The company also compared the chemical and physical characteristics of the two fuels, and has considered possible clean-up scenarios for meeting stringent air emissions requirements.

While the use of the fuel would put control of costs in the hands of producers, Finn said, he conceded it might only be economically justifiable at natural gas prices of \$7 per mcf or higher. "In a lower cost natural gas scenario, there is no advantage for this."

**William Rosenquist**, project manager and technology consultant for Chicago-based **Sargent & Lundy LLC**, said the company is conducting test burns of bitumen-based fuels at test facilities in Windsor, Ontario. The company is investigating the properties of various types of bitumen-based fuels and trying to determine the burner and boiler design parameters needed to best combust such fuels.

Sargent & Lundy is looking at new conventional drum-type boilers, new once through steam generators (OTSG) and retrofitted existing OTSG that are currently burning natural gas. Its paper presented at the conference considered the equipment design needs for burning neat bitumen, emulsified bitumen and dual fuel capability of firing natural gas.

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A common misconception, according to Sargent & Lundy, is that if bitumen is heated enough, it will handle and burn like heavy oil fuels, and that conventional boiler design practices could therefore be used. That was not found to be the case, according to Rosenquist. Sargent & Lundy's work determined that bitumen would need to be heated to above the flash point -- creating a possible safety issue -- to meet viscosity requirements, steam atomization would be needed and a problematic "sticky-carbonaceous" ash would be present.

Rosenquist said burning emulsified bitumen has a number of advantages over straight bitumen combustion. Based on its own estimates, estimates from vendors and data from CANMET tests performed for Quadrise, it was found that nitrogen oxide (NOx) emissions from emulsified bitumen were about half that from burning neat bitumen (85-103 g/GJ compared to 172 to 189 g/GJ). While Alberta has not established a limit on NOx, Rosenquist noted the limit in New Brunswick for firing Orimulsion is 90 g/GJ, a value that was therefore considered the initial target value.

For emulsion fuels, existing NOx control techniques -- such as use of low NOx burners, overfire air and reburn technology -- could bring about operation below target limits. However, this is not the case with neat bitumen due in part to the presence of "sticky ash" in the flue gas which makes the use of some post combustion technologies impractical.

As for boiler designs, manufacturers say they would change furnace material selection slightly in order to burn bitumen-based fuels, so that would not be a large issue, Rosenquist said. It is also feasible to retrofit existing OTSGs, though the cost to do so is highly dependent on the original equipment manufacturing design.

The company concludes that while combustion of neat bitumen presents significant drawbacks, which affect both capital and operating costs and NOx emission concerns, burning of emulsion fuels represents a viable alternative to natural gas.

**Christiane Schmid** of **Siemens Fuel Gasification Technology GmbH** in Freiberg, Germany, said that company is also investigating oilsands feedstocks. Its gasifiers can use a wide range of inputs, from lignite, anthracite and petrol coke to low rank fuels, such as sewage sludge and biomass.

Now in the midst of a research and development program to produce larger reactor sizes (beyond 500 megawatts) and higher gasifier competitiveness, Siemens operates a five-megawatt pilot plant in Germany to test prototype designs and determine process conditions for various feed streams.

One of the things that distinguishes its technology is its unique cooling screen technology, she said, which lowers maintenance costs, improves gasifier availability and shortens start-up and shut-down times. Its entrained flow gasification process also incorporates alternative refractory lining and a dense flow feeding system, Schmid said.

The company's focus on bitumen gasification for hydrogen, steam and power production is investigating different potential feedstocks, correlation between quality and process characteristics, and equipment needed for the design of commercial gasifier systems.

Italy's **Snamprogetti S.p.A**, an **Eni SpA** subsidiary, also presented gasification technology with a paper describing lessons learned from 10 years experience involving five integrated gasification combined cycle (IGCC) projects. Though the market has long considered otherwise promising gasification technology as entailing unfavourable and potentially risky economics, and associated it with cost overruns, operating problems and equipment failures, the company said its experience has not only proven the technology, but given it the confidence to apply it to new situations, including residues from oilsands.

Snamprogetti, which has particular experience in refinery settings for bottom-of-the-bbl upgrading and employing two leading gasification technologies, said the expertise gained at its plants shows the capital costs of gasification are now competitive with other clean technologies and even dropping.

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