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Burning Bitumen To Produce Power, Plus CO2 For EOR

By Pat Roche

A company that tested its bitumen/water emulsion-burning technology in the oilsands is proposing a plant that would produce electricity as well as high-purity carbon dioxide for enhanced oil recovery.

Quadrise Canada Fuel Systems Inc.'s bitumen emulsion fuel -- called MSAR -- was first pitched to the western Canadian oilpatch as a cheaper alternative to natural gas to generate steam for steam-assisted gravity drainage (SAGD) projects.

MSAR -- which stands for Multiphase Superfine Atomized Residue -- is a liquid fuel consisting of extremely fine oil droplets suspended in water. MSAR can be made from cheap products such as bitumen and refinery residue. The company says MSAR is also an alternative to fuel oil, coal and straight bitumen.

The technology was first tested at the Joslyn SAGD project (now operated by **Total E&P Canada Ltd.**, a unit of **Total S.A.** of France). **Petro-Canada**, **ConocoPhillips Canada** and **Paramount Resources Ltd.** also took part in this industry test.

MSAR "actually burned better than natural gas" in the 18 mmBtu-an-hour boiler used during the March-to-October 2005 Joslyn test, said Quadrise Chief Executive **Alfred Fischer**.

The droplet size analysis showed very stable emulsion with minimal settling or agglomeration, even after a year of storage, Fischer told the **Canadian Heavy Oil Association**'s fall conference in Calgary last week.

He said a Quadrise-commissioned analysis by **Purvin & Gertz Inc.** concluded the project met all of Quadrise's demonstration test objectives, showing that the company can reliably manufacture MSAR and the fuel can be burned very easily.

In a separate project, Quadrise has been burning MSAR and injecting the flue gas into the earth in the Surmont area of northeastern Alberta.

This project -- a joint venture with Paramount Resources -- has been running for 11 months, injecting about 2.2 mmcf a day of flue gas and recovering about two mmcf a day of natural gas.

"We've been online for about 70% of the time. We have seen no breakthrough or pressure migration," said Fischer. "And we've seen a nice gradual increase in pressure in the reservoirs.... The reservoir response to the whole test has been very positive."

Quadrise and Paramount have filed a patent application for the technique, dubbed MCST, which stands for MSAR Combustion & Sequestration Technology.

In addition to burning MSAR as a cheap alternative to natural gas for SAGD steam generation, the project is also using the flue gas to enhance natural gas recovery and permanently diverting CO2 emissions from the atmosphere.

If the project succeeds, the result will be a SAGD development burning much less natural gas -- and emitting far less greenhouse gases -- than typical SAGD projects.

The flue-gas injection idea was hatched as a solution to the gas-over-bitumen dispute. Several gas reservoirs in the Surmont area overlie bitumen reservoirs, and bitumen producers -- arguing that pressure depletion would hurt bitumen recovery -- convinced the Alberta **Energy and Utilities Board** to shut in 280 bcf of Wabiskaw-McMurray gas in 2004.

But if it can be shown that flue gas injection re-pressurizes the reservoir, then gas production could resume. Also, Fischer said there are indications that flue-gas injection could improve bitumen recoveries by at least 10%. The other benefit is a greenhouse gas would be kept out of the atmosphere.

Having demonstrated the MSAR burn at Joslyn and the reservoir re-pressuring at Surmont, Fischer wants to combine both processes at a power plant demonstration pilot, which he hopes can be built as early as late 2007.

The plant would be located at or near an old oilfield, where the flue gas could be injected to recover oil that would otherwise be left in the ground.

Fischer said a number of companies are interested, "so there's some negotiating going on as to where this thing is going to be." He declined to identify the companies involved as negotiations are taking place.

"The key driver here was to create a zero-emissions project and deal with the CO2 issue," he said. "One of the problems is when you burn bitumen or MSAR is you generate about 1.4 times more CO2 than you do if you burn natural gas."

The allure of Fisher's flue gas for EOR would be its purity. The Quadrise CEO said the MSAR-burning technology produces an exhaust stream that is well over 90% CO2.

From an EOR perspective, this would give the MSAR burners a big advantage over conventional coal-fired power plants. CO2 typically makes up less than 20% of those emissions; the rest is nitrogen and other compounds. And the technology needed to separate out the CO2 is too costly for EOR.

However, the MSAR exhaust stream still has to be cleaned. It has to be de-particulated and de-hydrated. And because the bitumen contains sulphur, flue gas treatment is needed if the stream is vented to atmosphere.

But Fischer said the capital cost of injecting MSAR flue gas into the reservoir is actually less than the cost of installing a flue gas treatment facility to meet sulphur dioxide emissions standards.

"The beauty (of flue-gas injection) is you eliminate all your emissions," he said.

Corrosion has been a problem at the Quadrise/Paramount CO2 re-pressuring project, which just demonstrates the need to completely dehydrate the flue gas and scavenge the oxygen -- things that are currently being done, said Fischer.

The other upside of dehydration is the recovery of water, an increasingly scarce commodity.

For example, if a 30,000-bbl-a-day SAGD project burns about 6,000 bbls a day of eight degree-API bitumen as fuel, dehydrating that flue-gas would recover about 5,600 bbls a day of water. Recovering the water from the combusted MSAR would add another 2,600 bbls, for total recovery of about 8,200 bbls a day of clean water, Fischer said.

Even a SAGD project that meets 90% of its water requirements by recycling produced water would still need about 9,000 bbls a day of new water to make up the other 10%, he said.

Fischer said an affiliated company has been incorporated to pursue the power plant/EOR objective. Though the first step would be a five-megawatt pilot, he said designs have been completed for 50- to 250-megawatt power plants.

While locating the MSAR-fuelled power plant near a SAGD project would provide a ready supply of bitumen, the hydrocarbon component of the MSAR fuel can be any cheap product such as residue, or bottom-of-the-barrel material, from a refinery.

Regular "fuel grade" MSAR could be pipelined at least 50 kilometres, but Fischer said "transportation grade" MSAR could also be produced for long-distance shipping. This means refineries and upgraders could send their low-value streams back to the field to generate steam for SAGD projects.

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