October 2012

Personality Profile

Previous Article
Next Article
Printer format
Issue Contents
Issue Archive

Bitumen frequency: Researchers Bruce Rout and Jim Van Wert believe ultrasonics could be the next big thing for in situ oilsands recovery

By Melanie Collison

What do you get when you cross a guy who likes physically playing with stuff to learn how it works, with a guy who likes doing it all in his head?

Images in this article
(Click thumbnail to enlarge)

Jim Van Wert and Bruce Rout at their northeast Calgary office, where they are testing ultrasonic equipment's viability for bitumen production. Photo by: Charles Hope.

Maybe, just maybe, a better mousetrap of the sort of oilpatch innovators have been looking for since steam assisted gravity drainage (SAGD) and horizontal drilling cracked the code to Alberta's in situ oilsands vaults.

Jim Van Wert, the hands-on guy, and Bruce Rout, the cogitator, think they have a dandy concept for producing bitumen that would cost only $1 per barrel while slashing environmental impacts.

The technology uses no water and upgrades in situ. It's particularly suited for deposits too shallow for SAGD because it uses no steam or pressure.

Unfortunately, at this point one has to take their word for it—at least until they find $1 million and someone with a well they can use to prove their processes, or their patent is finalized—whichever comes first.

Rout is a mathematician and computer consultant who has been mulling this idea for a bitumen production technique since he did mathematical modelling of steam penetration into a bitumen formation for the Alberta Oil Sands Technology and Research Authority 30 years ago.

Van Wert is an ultrasonics entrepreneur who has used sound waves too high to be heard by the human ear to clean everything from flower vases to computers to Caterpillar heavy equipment. He started by buying one ultrasonic cleaning bath and experimenting with it to learn what it could do. He edged into customizing cleaning tools for awkward oilfield equipment like heat exchangers and pumps, and has built a 35-employee company, Western Ultrasonic Calgary Inc.

Ultrasonic cleaning involves bombarding a liquid with high-frequency sound waves, which creates microscopic bubbles, a process called cavitation. When the bubbles collapse, they produce a burst of heat and energy at a molecular level. The burst works like suction to separate the bonds between dirt and whatever is submerged in the bath.

Following that same principle—and sustaining Rout's interest for three decades—ultrasonics can be used to separate oil from sand. The effectiveness is documented in scientific papers by the U.S. Department of Energy and others.

Rout and Van Wert proved it for themselves in a series of garage experiments. They submerged chunks of sand-laden bitumen ore into various solvent baths, agitated the solvents with sound energy and ended up with bitumen that's fluid enough to pump.

"You can use a liquid hydrocarbon [as a solvent] for the sound to travel through," says Rout, who has also worked as a science teacher. "It works like a chain reaction to reduce bitumen viscosity and start to mobilize oil. Sound does not go through oil sand; heat and electricity don't go through it well. If the oil sand is dissolved, sound goes through it really well. Sonic-activated solvent chews through oilsands quickly. We have raised solubility by three orders of magnitude."

Trouble is, the environmental impacts of digging up bitumen ore and treating it in a bath above ground are a known industry headache, plus most bitumen is too deep for surface mining. Therefore, to be a better mousetrap, any process must work in situ.

And that's what Rout and Van Wert say they have figured out. Marrying Rout's idea with Van Wert's ultrasonics expertise, they believe they can combine ultrasonics with a solvent, to liquefy and upgrade bitumen downhole.

Rout says he had to bide his time because when he first thought of it, "they hadn't invented transducers that could go down the hole." A transducer is a device that converts one form of energy to another.

In their case, using a piezoelectric crystal, he says, "If you have an electric current crossing the

crystal it will shrink or expand. It vibrates with the electricity, 25 kilohertz of alternating current within the tool." The vibration causes the solvent to penetrate the ore without either high pressure or heat.

"We're creating a chemical chain reaction with the bitumen—cold cracking," Van Wert says. "It's cold boiling, which causes upgrading in situ. It changes the viscosity. The minute scale transforms into a large scale very quickly. Picture a 1,500-watt heater in a two-by-two box, continually going, then add high-frequency sound vibration to it."

Rout says the transducer activates the surrounding solvent, which starts dissolving the bitumen, upgrading about five per cent by volume into something liquid enough to act as solvent in addition to the solvent they inject.

"There is a volume change between bitumen and solvent separate from each other, and some in solution together," he says. "That part shrinks, so you have a reduction in pressure and it dissolves its way through as it naturally diffuses through the formation. This dissolving process will cause the solution to shrink so it soaks itself quite rapidly through the bed. In roughly five days, because of mass balance and so on, from what we've seen in the lab, it penetrates about 15 metres [from the well]. The calculations are all related to the square root of time. In a month we could get 30 metres from the wellhead."

With the U.S. patent on their process not finalized until next year, the partners won't identify their solvent or reveal how they power 500–600 volts worth of transducers downhole without using a huge cable.

They have required non-disclosure agreements with the in situ oilsands company (which they won't name) whose well they did a pilot test in earlier this year and with all the companies they're negotiating with for the next step.

Rout says, "We want to try it in a cold heavy oil well and see the increase in production. We could use parallel wells, all sorts of different designs. We're seeing it as a treatment—take the pump out, treat it for a month, then put the pump back in to produce again."

Van Wert adds, "We're looking at repeating some of what we have done and going a couple of steps further in an oilsands environment or a cold flow heavy oil environment. We want to prove up chemical reaction, time, viscosity change and upgrading capabilities.

"We are looking for a player who wants to develop it further; we'll work with an investor to find that. We're kind of open as to how to advance the technology. We know the concept works, but we need to figure out ways to get it into the field on a larger scale.

"We keep getting a little bit stonewalled, especially with the larger companies not wanting to sign non-disclosure agreements. We haven't found the right fit yet."

Three years into their project, the partners don't want to be in a position where, to attain funding, they have to give away their company, Green NABR (Non-Aqueous Bitumen Recovery) Research Ltd. They're particularly concerned that a company would express interest, buy them up and just put the idea on the shelf.

While other researchers have combined ultrasonics and hydrocarbon liquids to mobilize bitumen, Rout and Van Wert are confident they're the only ones who have done it downhole and that nothing will beat their process for economics or environmental efficiency.

Van Wert says, "People are trying electricity, lighting [the bitumen] on fire. Nothing shows the promise that this does."

Top of Page

Home | Contact Us | Subscribe | Advertise | Site Map | Help