

Gamechanger –

Powerwave Helps Rescue Billions of Barrels of Stranded Oil

In the face of increasingly elusive oil reserves, producers are continually looking for new resources which are often associated with more drilling into untapped areas.

BY TOR MELING

Setting up new oil wells is also very costly and can create risks for environmentally sensitive areas. There is huge potential, however, in tapping into the small pockets of oil in existing reservoirs that cannot be accessed using traditional extraction methods. In fact, the U.S. Department of Energy estimates there are more than 374 billion barrels of oil in the United States alone that are left behind underground and untouched after the application of conventional enhanced oil recovery technology.

Canadian-based Wavefront Technology Solutions has developed an innovative technology called Powerwave that helps land and offshore producers extract more oil from existing sites with only a small addition to existing infrastructure. In fact, the technol-

ogy can help increase ultimate recovery by 20 percent, and take reservoirs scheduled for decommissioning and extend their lifetimes by 10 years or more.

Powerful Bursts

How can such a small piece of technology make such a big difference?



Wavefront President and CEO, Brett Davidson
(all photos: Scott Lennon/Wavefront)

Wavefront's Powerwave technology creates powerful bursts of fluid to sweep up underground pockets of stranded oil both on land and offshore. Wavefront's president and CEO Brett Davidson found inspiration for the technology through his team's research on oil production after earthquakes.

"It has long been established that oil production rates spike following earthquakes," says Davidson. "We wanted to look into this phenomenon more closely to understand the mechanisms involved and recover more oil from existing sites."

In 1997, Davidson managed a group headed by Dr. Maurice Dusseault called the Porous Media Research Institute at the University of Waterloo to study the flow of

fluids underground. In particular, his group examined cold heavy oil production, borehole stability and anecdotal information about how earthquakes can increase fluid flow in Alberta's and Saskatchewan's heavy oil fields.

Waterloo's research eventually connected Davidson and Dusseault with Dr. Tim Spanos at the University of Alberta who had developed his own theory on liquid flow. The trio proved in a laboratory that sending controlled bursts of fluid underground could increase the flow of oil to extraction wells. Patents were obtained and a company was formed around the technology shortly afterwards. Field trials were conducted in Alberta, Canada from November 1998 to February 1999. The trials provided very positive first-time-out results demonstrating that the technology could increase oil recovery by up to 34 percent.

"We knew right then that we had a game-changing technology that could bring significant benefits to oil operations anywhere given the high uniformity of oil well infrastructure around the world," says Davidson. "The technology could leverage existing processes to generate dramatically improved results."

Field Testing

Davidson and his partners approached oil companies and asked if they wanted to license the technology. Slowly and steadily, oil companies began adopting and employing the technology. By 2001, Wavefront decided that a public marketing vehicle would best help the company expand. It found a shell company on the Toronto venture exchange and did a reverse takeover.

By 2007, an Alberta-based company tested three units in three different production patterns. Two years later, it ordered another 50

Powerwave downhole tools. Wavefront hasn't looked back since. It now has about 240 confirmed and pending contracts for about 240 tools, with plans to expand internationally into South America, the Middle East and Indonesia.

While waterflooding has been used by oil operators for several decades, its effectiveness is limited. Water passes underground through the path of least resistance, leaving behind many barrels of "stranded" oil.

The Powerwave pulse engine can be used with existing well infrastructure. Once lowered down the injection well, Powerwave sends out powerful bursts of water every 1/10th of a second for higher permeability formations, and as fast as every 1/100th of a second for lower permeability formations. Powerwave moves the water through the oil bearing formation with greater uniformity regardless permeability or variability.

Stored Energy

Davidson compares how Powerwave works to a water hose with a kink in it. The pressure from the tap drives the water from the end of the hose at about 50 to 55 pounds per square inch. With a kink in the hose, energy builds behind the kink.

"The host acts like an accumulator," says Davidson. "People think that more pressure is being created but that's not possible. You can't create pressure when it's still coming from your house. What you're doing is storing energy."

When the kink is released, the stored energy accelerates the flow of water until it returns to the naturalised flow. Powerwave works similarly downhole as it stores and releases the energy driving water or CO₂ into a reservoir. With conventional oil injection, water finds a



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path of least resistance underground. By adding a pulse, the water moves more extensively underground and "sweeps up" more oil. Put more technically, the Powerwave pulse causes a momentary elastic flexure of the formation pore structure. The pulse moves fluid into and out of a larger number of pore networks, obtaining a more uniform front to increase oil recovery.

Optimisation Technique

What makes Powerwave a revolutionary technology is that it increases the efficiency of existing infrastructure with minimal additions. Instead of drilling more

wells, Powerwave can increase an operator's recovery factor while maintaining existing production strategies.

Powerwave has been used in numerous configurations around the world. Last year, Wavefront's new projects included a waterflood in Alaska with a major global producer, and an offshore project in California off the coast of Long Beach. The company has also been expanding internationally, most recently signing a letter of intent with Pemex in Mexico to use Powerwave in waterfloods and well stimulations.



“I have been around the globe talking to representatives from large oil companies,” says Davidson. “I tell them they really want to think of Powerwave as an optimisation technique to something they’re already doing. A lot of people want assurances that we will be able to work within their existing infrastructure and that is a key feature of Powerwave. It is designed from the outset to work with existing infrastructure. All we ask is that you put this one little device at the end of your injection string. That will enhance the whole outcome of your water-flood.”

In addition to being an effective enhancement strategy, Powerwave is very simple to use. Operators can use Powerwave literally “out of the box” by following instructions included with the equipment. Operators simply lower the Powerwave engine down the injection well and from there, pulses of high pressure fluid push the stranded oil toward the production

wells. Adjustments can be made quickly and easily to ensure maximum efficiency and effectiveness.

Powerwave can generate significant additional oil recovery for producers. Results have shown that Powerwave can help increase yield by as much as 20 percent, meaning millions of dollars of additional revenues from an existing field.

International Growth

Davidson has big plans for the future, and is looking to continue Wavefront’s international growth. It continues to field inquiries from around the globe and has added new

international sales personnel to respond to the growing interest and demand for information. Wavefront has also invested in R&D to make the tool even simpler and more efficient. Davidson reports that many companies are keen to try the technology as it becomes a more accepted and “must-have” piece of equipment.

“We see a day when Powerwave will be a widely used and accepted piece of technology in the oil business,” says Davidson. “Given how oil fields are getting depleted, and the environmental and financial costs to set up new drilling, it makes sense to maximise existing resources. There is still a great deal of potential for Powerwave in oil fields around the world and throughout North America.” ■

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