

# Wavefront Upfront

Innovative Powerwave technology keeps Wavefront Technology Solutions competitive in an increasingly sceptical energy market.

BY TOR MELING

Introducing any new technology to the oil and gas industry is difficult at the best of times. Proving a new technology's benefit to a cautious and often sceptical industry can be a long and challenging road to navigate. Wavefront Technology Solutions is succeeding at both challenges with its Powerwave technology, a fluid injecting optimisation approach that holds vast potential to expand the life cycle of reservoirs around the world.

Powerwave is an innovative technology that helps on-shore and off-shore oil producers extract more oil from oil reservoirs with only a small addition to existing

infrastructure. Once installed, Powerwave can increase production by up to 200% in less than 12 months and revive reservoirs scheduled for decommissioning and extend its lifetime by years. With offshore decommissioning costs often running into several hundred million dollars, being able to extend field life can be worth tens of millions of dollars to the operating companies for each year abandonment can be delayed, even without considering the value of the additional oil production and recovery that can be produced with Powerwave.

According to the US Department of

Energy estimates, more than 374 billion barrels of oil are stranded in the ground in the United States alone, making Powerwave's market potential very substantial. Compared to the economic and environmental cost of drilling and completing more oil wells, Powerwave significantly increases overall oil recovery with minimal investment.

### Pulsating Injection Stream

Injection optimisation alters traditional approaches to fluid injection. Powerwave's down-hole tool works with conventional surface equipment, and is installed into injection wells to transform the

normally steady rate of injection to a pulsating injection stream with typically 20 to 40 pulses per minute. Similar to the idea of kinking a garden hose, precise amounts of energy are repeatedly built up and released by the tool.

The pulses add acceleration and momentum to the injected fluid, forcing it into the reservoirs' nooks and crannies and more impermeable rock at speeds of up to 100 metres per second. This allows the injection fluid to enter pore spaces which have remained untouched over time. The result is a much better "sweep" of oil towards the surrounding producing wells.



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To be utilised in oil fields around the world, it is critical that the Powerwave tool remain accessible and flexible to producers and the reservoir where it is being deployed. The competitive advantage of Powerwave is its flexibility to be used in a wide and varied range of reservoir conditions. Each Powerwave system arrives on the oil producer's location specifically calibrated to accommodate existing infrastructure and reservoir formations. Wavefront's technical experts customise the Powerwave tool to match the conditions in each reservoir application. The

tools can be deployed to operate electronically, mechanically or a combination of both depending on the reservoir conditions.

"Powerwave's impressive track record of success in optimising waterfloods, miscible CO<sub>2</sub> floods, or chemically-aided floods in all types of reservoirs could potentially add billions of barrels of oil to the world's recoverable reserves," says Wavefront President and CEO Brett Davidson.

**Powerwave-Aided CO<sub>2</sub> Flood Project**

For example, Core Energy, an independent E&P company in Michigan, US, has implemented the Powerwave system in a carbonate pinnacle reef field for approximately 15 months. The reservoir is

naturally fractured and reservoir quality is highly variable. This ongoing Powerwave-aided CO<sub>2</sub> flood project involves four wells including one periodically shut-in well and one injector. The project intended to broaden CO<sub>2</sub> distribution through existing oil well infrastructure thus allowing for enhanced oil recovery.

With a clear objective to increase oil production, significant benefits have been realised with approximately a 46% rate of return on the project after 11 months. The average oil cut after 11 months increased to 94% compared to the previously established trend of 82%. In January 2011, Core Energy had increased its production rate from this field by 46 barrels of oil per day to 84 bopd – an overall increase of 120%.

"After 16 months of evaluation, Core engineers confirm the results," said Robert Mannes, president, Core Energy. "And [Core] will be reviewing other assets for further Powerwave deployment to replicate the production results of the pilot program."

**Waterflooding**

The longest running Powerwave project in Alberta is optimising a waterflood in a high quality sandstone with 18 API oil.

"Waterflooding viscous oil is very much like waterflooding a light oil in a fractured reservoir" said Wavefront President & CEO Brett Davidson, "The water moves through the reservoir too quickly, without effectively displacing the oil. Powerwave enables us to dis-

tribute the water better and achieve better sweep efficiency, oil production and recovery."

This project is currently undergoing another significant expansion following sustained delivery of significant production gains. Production following the last expansion saw an increase of around 30% within 8 months of installation with virtually no production decline.

**Flexible Solution**

Powerwave is also very flexible with respect to its implementation to varying reservoir conditions. In a second example, a major Canadian operator based in Calgary implemented Powerwave in a mature waterflood in a sandstone formation located in Southeast Saskatchewan. The program has been ongoing since October 2009 and consists of four Powerwave-aided water injectors influencing 20 oil producers. As of the end of March 2011 production rates had increased by 51 barrels of

**In the most recent quarter alone, Wavefront has secured four key Powerwave contracts totalling 24 tools:**

- A six-tool Powerwave contract with the largest oil production company in the Sultanate of Oman
- A Powerwave contract with Plus Petrol in Argentina
- A Powerwave contract with Clayton Williams in Texas
- An 11-tool, three-field Powerwave contract with a major Calgary-based oil producer



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oil per day – an overall increase of 56%. With a netback of \$33 per barrel project payback requires 8 barrels of incremental oil production per day; Powerave incremental production is well beyond breakeven and continuing to show increasing benefit.

A small independent Operator in Alberta implemented Powerwave with 6 tools in the relatively tight Viking formation in December 2010. This is a mature waterflood in a sandstone with average porosity of around 9% and permeability ranging from 0-50 millidarcies (mD). In this light oil project, Powerwave has increased the production from the offset producers by 69 barrels of oil per day, or 52% above the base decline trend. We are in discussions with this operator about project expansion. The continued expansion of existing Powerwave installations signals to

oil producers, big and small, that Powerwave can get more oil out of their existing infrastructure.

Powerwave was installed in a dolomite formation in Crane County, Texas in March 2010 where the reservoir has around 15% porosity and permeability of 0-50 mD. Production from the area has increased by around 30% compared to the pre existing trend and the underlying base decline has decreased from 3.8% to around 1.5% per month. "A drop in the underlying base decline is typical for Powerwave installations, and in our experience, this reduction can range from 50 – 95%, which together with a production increase makes Powerwave a very attractive option" said Wavefront President & CEO Brett Davidson.

Wavefront is currently contracted to employ Powerwave systems in Argentina in a high-quality sand-

stone reservoir with a viscous oil to improve oil recovery. Wavefront will continue to expand in the region over the next two years.

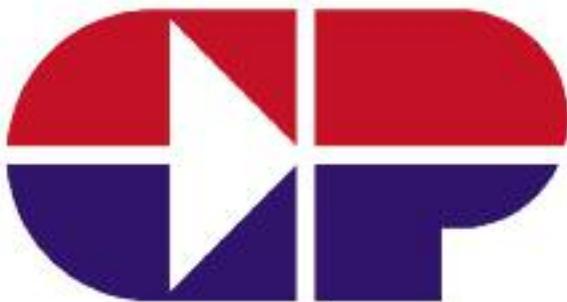
### Game Changer

Powerwave is a game-changing technology providing clients' with a demonstrated advantage to improve oil production rates, slow the rate of production decline, extend field life, and maximise asset value. Today, Powerwave systems are or will be imminently employed in major oil production operations around the world including Mexico, Argentina, Australia, the Middle East, Canada and the US. As a new technology, Wavefront has been successful in moving beyond the stage of early technology adopters and on to the early industry majority stage in the technology adoption life cycle. ■

### The Author:



Tor Meling is Wavefront's Vice President and has more than 22 years of experience in Research, Exploration, Operations, Petroleum and Reservoir Engineering, from Europe, Alaska, USA, Middle East, Latin America and Canada with his speciality in field development and optimisation. Meling, joined the Wavefront team in 2008 where he is responsible for the planning and implantation of Global 'Powerwave' Projects.



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