



AGR Petroleum Services helps a small independent operator achieve what two supermajors were unable to do.

## OVERVIEW

AGR Petroleum Services drilled, logged and drill stem tested the 9/3b-5 appraisal well on the Bentley field for Xcite Energy Resources. The project was executed between December 2007 and February 2008 using the Byford Dolphin semi-submersible rig, mid-way through a highly successful multi-client campaign. Reservoir fluid samples were obtained, and the Bentley heavy crude flowed to the surface for the first time.

## CHALLENGE

Xcite Energy Resources Limited (XER) is an oil exploration and development company focused on the exploration and development of heavy oil resources in the North Sea on the UKCS. In 2003, XER was awarded 100% of the working interest in the heavy-oil Bentley field in Block 9/3b of the UK North Sea after the previous operators, Amoco and Conoco, had both been unsuccessful in flowing oil to the surface and proving the commercial potential of the field. XER required a rig and an operations team to drill and test its first-ever operated well. The field was technically demanding – all previous wells on the prospect had failed to flow the heavy crude to the surface. It was very important for XER to get this project right the first time.

## APPROACH

XER contracted AGR as its drilling management contractor to develop and submit all statutory applications to the UK authorities and thereafter to assist in the design of the well and the production test, and to manage operations.

At a time of rising oil prices and limited rig availability, AGR was able to offer XER a slot on one of its multi-client rig campaigns thus satisfying XER's licence obligations within the applicable time frame. By joining the Byford Dolphin campaign, XER not only acquired rig capacity but also obtained access to AGR's drilling and well test engineering capability, and to its operations management and supply chain management expertise, including its logistics, contracting and accounting services.

AGR's team of engineers and third-party contractors applied their considerable North Sea experience and, with the offset data available, optimised the well design using the slimmest, most cost-effective casing scheme to enable XER to achieve the desired data and sample acquisition requirements.

The primary concern with drilling the 9/3b-5 appraisal well was the previous history of the offset wells, none of which had achieved a flow to the surface. One factor thought to be involved was the precipitation of organic scales and asphaltenes in the near wellbore caused by the circulation of cold mud/brine during the drilling/testing phase. Taking XER's lead, AGR developed a unique drilling fluid management programme designed to enable the reservoir section to be drilled with minimal damage to the Bentley reservoir.

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## KEY DATA PANEL

Province	Northern North Sea		
Total depth	4105 ft MDBRT	Wellhead pressure	N/A
Directional profile	Vertical	Hydrocarbon type	Heavy oil
Reservoir temp.	103°F	Operations	Q1 2008

### RESULT

- AGR Petroleum Services successfully obtained representative reservoir fluid samples through a drill stem test.
- AGR successfully proved the mobility of heavy Bentley crude.

*"The outstanding success of the 9/3b-5 appraisal well takes us past another of our key milestones for the Xcite energy business and for the Bentley field - one of the largest undeveloped heavy oil fields in the North Sea."*

Richard Smith,  
CEO of Xcite Energy Resources

### TECHNICAL NOTES

In order to fully appraise the Bentley prospect, it was vital that representative reservoir fluid samples were obtained and that the well flowed by means of a DST to prove the producibility of the Bentley reservoir.

One of the offset wells on the prospect had been tested during winter and, due to weather effects, cold brine was taken from a supply boat at ambient conditions (possible as low as 5°C) and pumped directly into the well, cooling down the formation. After the brine change-out, a DST assembly was run with a thermometer. The data showed the temperature at the reservoir had dropped by 40°F as a result of pumping in the cold brine. Subsequently the well did not produce, and several temperature-related factors were thought to have been involved.

Heavy oil is viscous and the viscosity is strongly related to temperature. The thermal shock to the near wellbore reservoir caused an increase in viscosity leading to a reduced flow and an increased probability of sand failure during the well test.

Temperature is also a key factor in the formation and stability of water/oil emulsions. Stable emulsions in the near wellbore environment can dramatically reduce productivity.

In conjunction with XER, AGR's engineering team developed a programme that involved the heating of the drilling mud and completion brine on the surface prior to pumping downhole. The intention was to manage the drilling fluid temperature so that the downhole temperature of the near-bore

oil was maintained close to the in situ reservoir temperature, thus reducing any deleterious effect on the mobility of the Bentley crude.

Temperature modelling was carried out to determine what temperature the mud pumped into the well had to be in order to give a downhole temperature equal to the reservoir temperature. The fluids were then heated in the surface pits using a diesel-powered boiler and heat exchanger on a closed-loop system before being pumped downhole.

The end result of the extensive planning and diligent operation of this system was a successful well for Xcite Energy Resources in which the first representative samples of the Bentley crude were obtained and the well successfully flowed during the DST to prove productivity.

### KEY ENABLERS

- Access to an integrated team of technical professionals including drilling, subsea, completions and well-test engineers.
- Access to established expert third-party contractor specialists through AGR's extensive supply chain network.
- Integration with the XER project team and various specialists.
- An innovative approach to avoiding the precipitation of organic scales and asphaltenes in the near wellbore.

### KEYWORDS

Bentley, Xcite, heavy oil, Byford Dolphin, heated mud, DST.



Heavy crude on a test string

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