BP Optimizes Drainage of More Than 100 Million Barrels of Secondary Oil from Reservoir Offshore Azerbaijan

Permanently installed WellWatcher BriteBlue DTS fiber reveals flow rate changes in real time

**CHALLENGE**
Find a faster, more efficient way to monitor reservoir performance in highly deviated wells and minimize risk of poor drainage.

**SOLUTION**
Install permanent WellWatcher BriteBlue multimode DTS fiber outside the gravel-pack sand screens over the reservoir interval.

**RESULTS**
Optimized reservoir management and improved drainage without requiring an intervention to run production logging tools.

**Develop strategy to optimize drainage**
BP was developing a portion of the Azeri-Chirag-Gunashli (ACG) oil field in the Caspian Sea offshore Azerbaijan. The main producing formations consisted of layers of sandstone interbedded with shale. More than 100 million barrels of secondary production were at risk of being bypassed because of the reservoir’s characteristics. The development and management strategies required a good understanding of the conformance between the producer and injector wells both by geography and by formation. The use of conventional monitoring technologies, such as production logging, would have shut down production while the tool was being run inhole, increasing rig time and costs. The operator needed a faster, more efficient way to manage reservoir performance.

**Use DTS fiber to identify reservoir properties and calculate flow rate**
BP chose to install Schlumberger WellWatcher BriteBlue multimode DTS fiber. The optical fiber provides distributed temperature profiles that can be monitored at the surface in real time, and—unlike production logging tools—it requires no intervention after installation. The fiber was installed on the outside of the fiber-optic-compatible gravel-pack sand screens over the reservoir interval. Placing it there enabled the fiber to react to the temperature changes of each flowing layer.

Fluid flows from a reservoir into a wellbore because of a pressure drop. This fluid movement and subsequent Joule-Thomson effect cause the fluid to change temperature from its normal geothermal value. When the reservoir fluid passes through the sand screen to the wellbore, it mixes with the flow coming up the basepipe from layers below, and the temperature again changes. These two effects are used to create a thermal well model for the three reservoir zones (pink, blue, and green) and to calculate the flow distribution model.
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temperatures—Joule-Thomson and axial mixture, along with reservoir properties and well test data form the basis of a thermal well model, which is calculated using THERMA* thermal modeling and analysis DTS software.

Matching the thermal well model and the actual measured DTS profile produces an initial flow profile. As the temperature profile changes over time, the model can be recalibrated by history-matching the gauge information and adjusting the rest of the parameters to enhance water injection and reservoir management.

**Improved reservoir management strategy and optimized drainage of secondary oil**

The continuous temperature profiles of individual reservoir zones, made possible by the WellWatcher BriteBlue DTS fiber, enabled the effects of differential depletion to be monitored over time. As a result, BP improved its reservoir management strategy for water injection and oil drainage—optimizing the drainage of more than 100 million barrels of secondary oil. The lessons learned from this project contributed to well placement decisions for future wells and led BP to deploy the WellWatcher BriteBlue DTS fiber in its subsequent ACG operations. See [SPE 110064](http://example.com) for more details.

![Diagram of temperature and depth profiles](image)

Reductions in the temperature profile from August to October revealed the layer (pink) where depletion had occurred. From this information, a new flow distribution model was created, and changes to the reservoir management strategy were put in place.