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Operator Eliminates Allocation Uncertainties for Three Offshore Oil Wells Sharing Single Pipeline to Platform

FloWatcher flow rate, fluid density, and PT monitoring system accurately tracks production allocation in subsea environment

CHALLENGE

Improve production allocation in three remote subsea oil wells with shared pipeline.

SOLUTION

Use FloWatcher* flow rate, fluid density, and PT monitoring system to obtain continuous downhole measurements in real time from three wells.

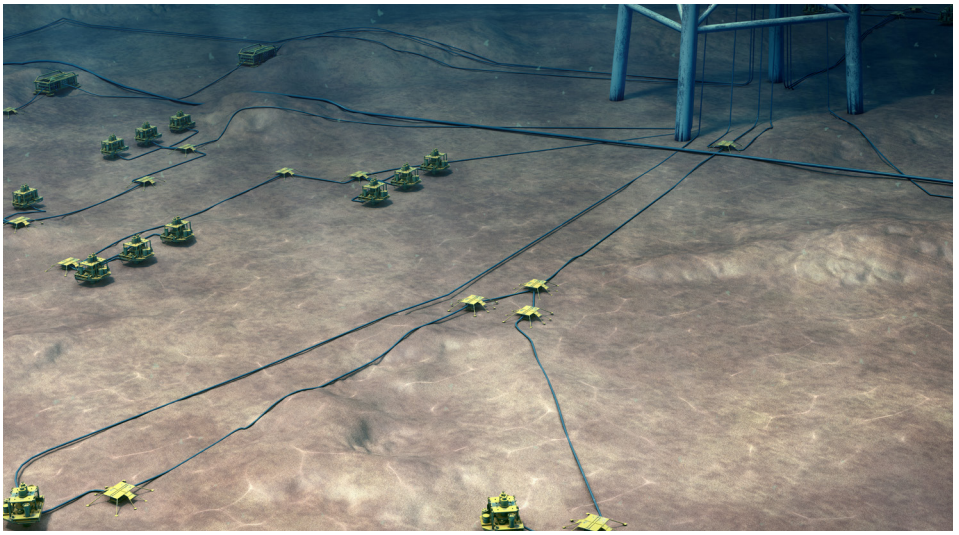
RESULTS

Optimized production allocation tracking of individual wells and reservoir modeling workflows.

Individual well production allocation is difficult in wells with shared pipeline

Remote offshore fields often have several subsea wells tied in to adjacent fields that are developed together with several gathering points and a shared pipeline. This scenario typically occurs in small or marginal fields, where profitability depends on capital and operational expenditures. Flow monitoring is usually performed at gathering points on the seabed using a multiphase flowmeter rather than at individual wellheads. Because well interventions to test individual wells are expensive and not always possible—individual well production allocation cannot be achieved without disrupting the total production from all the wells—it is necessary to have a reliable and cost-effective permanent downhole monitoring system that provides the continuous real-time data necessary to track production and improve field development strategies.

An operator and its partner were developing just such an area in the North Sea that includes a group of remote offshore fields spread out over a wide area. Three oil wells—two in one field and the third in a second field—shared a common pipeline. The two companies had different allocation workflows but lacked adequate information about the performance of the individual wells, including flow rate and water-cut measurements, for the calibration of calculated surface flow rates. In fact, their existing production allocation schemes and workflows generated alternative interpretations of the same data. They needed a way to obtain consistent data and to develop separate but consistent reservoir models.



The oil field in the North Sea includes a group of fields spread out over a wide area. Three wells—two in one field and the third in a second field—shared a common pipeline to a single platform.

FloWatcher system reveals allocation from individual wells

Schlumberger recommended use of the FloWatcher monitoring system to enable the wells to be monitored individually. The system consists of a venturi nozzle and a gradiomanometer density measurement system, a retrievable venturi gauge, and two high-precision quartz gauges that measure the temperature and pressure drop across the venturi nozzle. The data enable early identification of production and reservoir anomalies, such as water or gas breakthrough, helping reduce the cost of remediation and optimize production planning and recovery. Two-phase total flow rate and gas or water cut can also be determined.

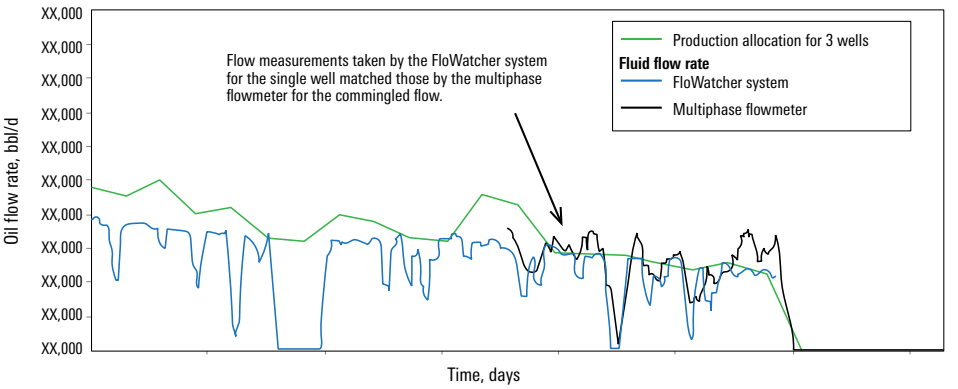
The FloWatcher system was installed in one of the wells, and total production from all three wells was monitored at the gathering point. The continuous pressure and temperature data and application of specific workflows transformed the downhole data into fluid flow rates and allowed that well's performance to be accurately evaluated.

Improved allocation tracking enhances recovery strategies

Results from the FloWatcher monitoring system—independently validated by multiphase flowmeter calculations—showed that one of the three subsea wells was producing at a much higher rate than initially allocated and that no water had been produced for the first 2.5 years. Because the wells were tied in together at the gathering point, the data automatically implied that the remaining two wells had produced less than initially thought.

Because the performance of the one well affected the performance of the other wells, the operator was able to avoid the time, expense, and added risks of testing the wells individually. The data allowed the operator and its partner to improve their allocation workflows, better understand reservoir performance, identify opportunities to improve the field development plan, and manage all three wells' performance and the consequent field performance.

The success of this FloWatcher system application showed that performance evaluations and reservoir management strategies of multiple wells can be improved simultaneously in subsea environments, where risks are high and expenditures are tight. Additional benefits that can be gained from using the FloWatcher system include the reduction of capital expenditures through the elimination of subsea test flow lines, detection of early water breakthrough, pressure transient analysis capabilities, and real-time, simultaneous production allocation for multiple wells.



When the well containing the FloWatcher system was the only well allowed to produce to the commingled station, the results of the multiphase flowmeter (black) correlated very closely with those of the FloWatcher system (blue,) attesting to the reliability of the single-well downhole measurements. Compared with the estimated allocation for the three wells (green), the well with the FloWatcher system was found to be producing above expectation, with no water production, and the other two contributing wells were underperforming.

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