WellWatcher Advisor Software Optimization Helps Increase Oil Production by 15%, Ecuador

IntelliZone Compact system and forward-modeling software enable accurate calculation of back-allocation and optimum choke settings

**CHALLENGE**
Increase oil production in a mature field and allocate commingled production without intervention or production deferment.

**SOLUTION**
- Complete wells with IntelliZone Compact* modular multizonal management systems comprising a production packer, four-position flow control valve, and pressure and temperature gauges for each zone.
- Derive zonal flow allocation and optimize production from each zone with the WellWatcher Advisor* real-time intelligent completion software.

**RESULTS**
- Computed zonal back-allocation for commingled production within 10% compared to a surface well test, and 1% compared to a multiphase meter test.
- Improved oil production by 15% by selectively optimizing choke positions for each zone.

**Dual-string completions limit optimization choices**
Producing from mature oil fields in Ecuador introduces many reservoir challenges, including multizone oil production and high water-handling costs. Traditionally, operators deploy dual-string completions with sliding sleeves and dual ESPs to access the different layers and obtain back allocation with standard surface well testing.

Although these dual-completion wells are functional, they are far from ideal. Production logging is uneconomical because it requires pulling the ESP. So, to estimate oil, water, and gas production, operators schedule periodic surface well tests. From the total (commingled) production, they back-allocate oil and water rates based on oil API and water salinity. The process prevents frequent analysis, making it extremely challenging to optimize the wells for maximum production.

For a pilot project studying the value of intelligent completions, an operator wanted to monitor production parameters (flow rates, water cut, and productivity index for each reservoir layer) and then maximize oil production by optimizing downhole valve settings in three wells.

**Intelligent software adds real-time flexibility**
Schlumberger recommended using the WellWatcher Advisor software to manage an IntelliZone Compact system with multiposition flow control valves and gauges. The software analyzes downhole data from the completion system in real time to estimate flow allocation, productivity index, and average reservoir pressure of each zone. The software then uses those calculations to optimize production for system constraints, such as drawdown, bubble point, or rate limitations.

Guided by the software analysis, engineers adjust each flow control valve to manage production from each layer, and then production is commingled. The completion system enables single-string configurations, reducing the number of ESPs required for lifting. Unlike traditional dual completions, the intelligent completion is versatile and simplifies workovers, precluding the need to pull a lower completion.

An operator in Ecuador replaced conventional dual-string completions with single-string, dual-zone intelligent completions and downhole gauges. The system was then connected to software that enabled real-time monitoring and choke adjustments resulting in a 15% oil production increase.
**Optimization improves oil production and simplifies reporting**

In three new two-zone completions, each zone included annulus and tubing pressure and temperature gauges, a four-position flow control valve, and packer for isolation. In each well a single ESP was used to lift the commingled production.

WellWatcher Advisor software analyzed data from the downhole gauges and valve position sensors. This enabled automatic, real-time calculation and visualization of flow allocation by zone. To test the accuracy of the allocation calculations, the operator performed a conventional surface test.

The software-calculated total liquids production value was found to have ±10% accuracy compared with the actual well test, and ±1% accuracy compared to a multiphase test meter.

Engineers also used the software to optimize valve positions for the wells, and the operator accepted the recommendations for two of the wells, resulting in increased oil production by an average of 15%. In Well C, choking the production from the lower zone reduced the overall fluid production but increased oil production.

For additional details about the project, see SPE-185513.

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<thead>
<tr>
<th>Wells</th>
<th>Initial condition</th>
<th>Recommendation</th>
<th>Oil production rate change</th>
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<tr>
<td></td>
<td>Upper valve position, % open</td>
<td>Lower valve position, % open</td>
<td>Upper valve position, % open</td>
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