Multiply Your Coverage

Maximizing well economics with multi-lateral well completions

To maximize oil and gas recovery, and improve the capital efficiency of reservoir stimulation, operators have the option to drill multiple horizontal wells from a single vertical well to target multiple reservoirs.

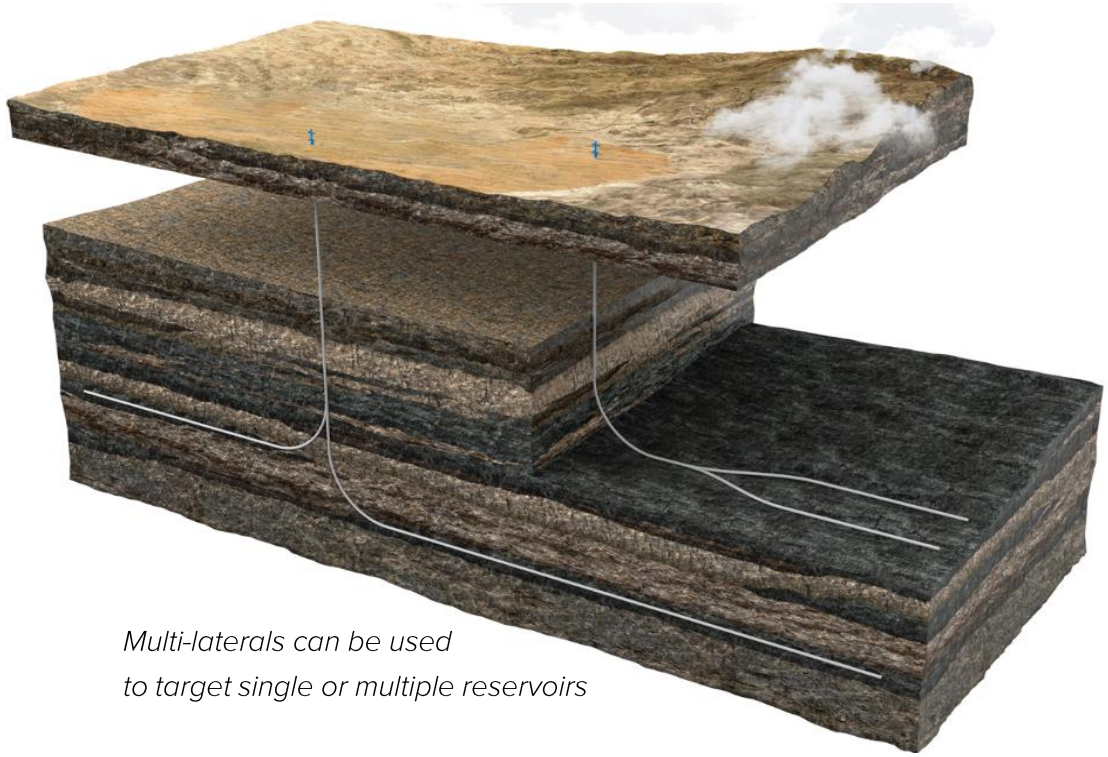
Drilling multiple wells from a single surface location reduces surface footprint, as well as the cost of drilling multiple single lateral wells. This provides an opportunity for operators to economically improve production. The capital cost saved from deploying multi-laterals includes:

- Eliminating need to drill the vertical and build section for multiple laterals
- Reducing intermediate casing costs by having one mainbore for multiple laterals
- Smaller surface footprint and less surface equipment: wellhead, pump, pipeline
- Single set up for frac operations in some cases

Packers Plus has a long history of onshore multi-lateral completions using Technology Advancement of Multi-Laterals (TAML) Level 1 and 2 junctions in various onshore formations in North America, and these are now also being applied in offshore wells.

Multi-lateral Development

Multi-lateral wells can be developed to effectively increase reservoir coverage for a single formation or accessing hydrocarbons from multiple formations by drilling multiple laterals from the mainbore at different vertical depths.



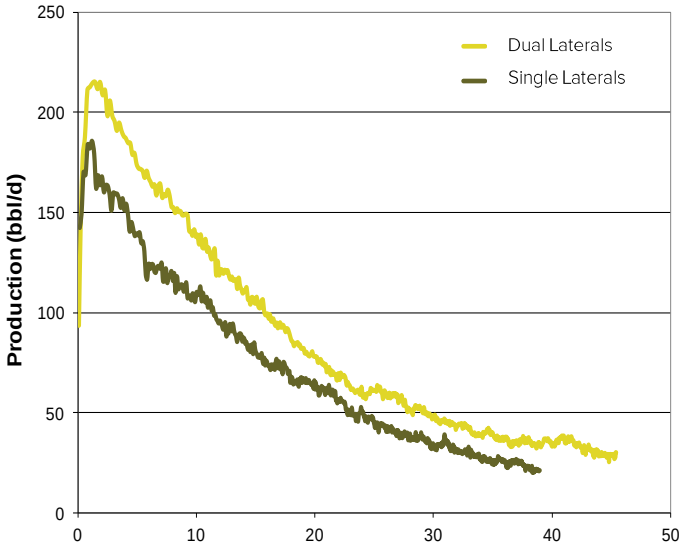
Multi-laterals can be used to target single or multiple reservoirs

Multi-lateral operations require directional drilling techniques and junction control at the point where multiple wells branch out to ensure that completion and production operations can be carried out smoothly. Onshore completions are typically simpler and use open hole multi-lateral junctions, whereas offshore completions or reservoirs with formation stability concerns are more complex and expensive, requiring mechanical junction control and sometimes hydraulic isolation.

Multi-Lateral Drivers

Production from a multi-lateral well typically exceeds that from a single lateral, with the potential to provide the same or higher payback for a lower capital cost. The example below compares the average daily production of 140 dual lateral wells and 140 offset single lateral wells in the Saskatchewan Bakken for the first 750 days of production[1].

The estimated payback for the life of the wells are quite similar for both cases; 1.3 years for two single laterals versus 0.8 years for a dual lateral (based on an estimated $90/bbl), with a total capital cost of $3.96 million for two single laterals versus $2.58 million for one dual lateral.



Average production from 140 dual lateral and 140 offsetting single lateral wells in the Bakken

In a market where the price of oil and gas can fluctuate significantly, it is important to consider cost saving approaches to hydrocarbon production such as multi-lateral development.

[1] Petrobakken, *Corporate Presentation*, November 2011

Multi-lateral Challenges

Complexity

Drilling more than one lateral off a single vertical section adds complexity to operations. A whipstock and directional drilling techniques are required to drill multiple laterals. This is more challenging for offshore applications. Most onshore well applications utilize open hole or uncased junctions.

A careful, planned approach is more critical for multi-lateral applications, where there can be potential limits to access the laterals for workover operations. Multi-lateral wells can be designed with re-entry capabilities for workover or re-stimulation programs, but require complex designs that offer selective through-tubing re-entry into all producing laterals[2].

Formation Stability

Most onshore completions have typically used open hole junctions for multi-lateral development due to application in carbonate reservoirs that generally have very stable rock properties. Development in clastic reservoirs that are generally less stable require mechanical support and possibly also hydraulic isolation to mitigate the risk of junction failures such as wellbore collapse later in the life of the well.

[2] Hogg, C. 1997. Comparison of Multilateral Completion Scenarios and Their Application. Presented at Offshore Europe Conference, Aberdeen, Scotland, 9-12 September. SPE-38493-MS.https://doi.org/10.2118/38493-MS

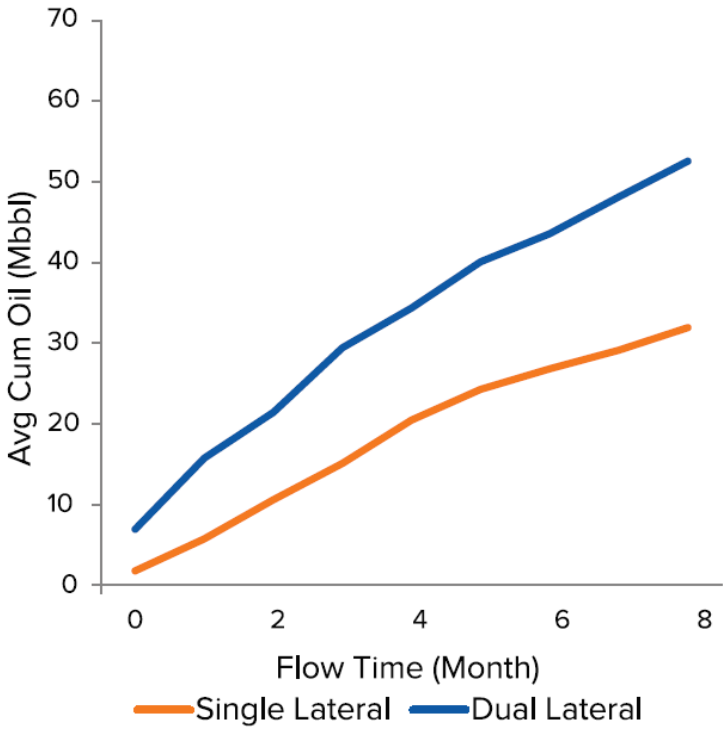
Success Stories

Packers Plus has completed over 1,000 multi-lateral dual and triple legs using TAML Level 1 and 2 open hole junctions. in the Bakken, Cadomin, Slave Point and Beaverhill Lake formations in Canada, and the Cleveland Sand and Bakken formations in the United States.

With the onshore success, Packers Plus has also begun similar operations for offshore well completions with wells completed in offshore Romania and the United Kingdom.

Improved Economic Margins and Ultimate Recovery with Dual Laterals

An operator looking to improve margins and recovery in the Slave Point formation first transitioned from cemented liners to open hole multi-stage completion systems, resulting in a 32% reduction in average cost per stage and 9% improvement in completion efficiency, but margins remained low with a high capital structure. Increasing the stage density of the single laterals resulted in improved production but a reduction in the economic gains per stage.

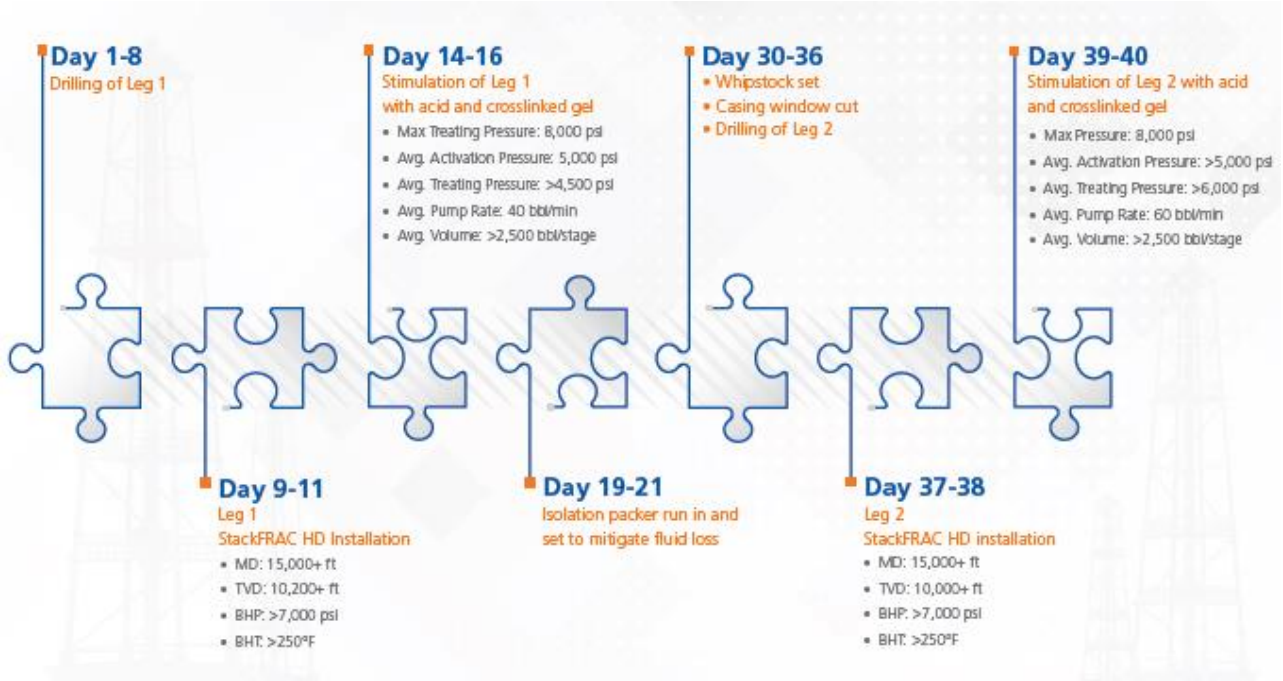


Comparison of average cumulative oil production from single and dual lateral StackFRAC completed wells

In transitioning to dual laterals, cost savings of approximately 13% were realized on a per stage basis for completion and 19% for drilling operations. Initial production rates of dual laterals with an average of 36 stages demonstrated an 85% improvement over single lateral wells with 20 stages, and a 65% improvement in cumulative production after six months.

Offshore Dual Lateral Multi-Stage Completion

An operator in the North Sea in the United Kingdom was looking for a completion solution for offshore development to maximize stimulation effectiveness and minimize cost in an area with multiple target reservoirs. Designing for simplicity, Packers Plus proposed a straightforward and proven 5.5-in. StackFRAC HD system for each leg of a dual lateral targeting two different reservoirs using a TAML Level 2 multi-lateral junction with 14 stages for each leg.



Dual lateral multi-stage well drilling and completion timeline

To mitigate risk with millout operations and to allow for workover operations later in the life of the well if needed, degradable balls were used and the system was designed with the largest possible ball seat sizes to allow 2-in. coiled tubing access to the toe. The second leg was planned to be drilled far enough from the first to avoid inter-wellbore communication.

Over a year of extensive planning and coordination resulted in the successful completion of the multi-stage multi-lateral well. Both laterals were treated with acid and operations for the well were completed as planned, within a total of 12 non-consecutive days and higher than expected initial production.

Conclusion

Multi-lateral well development enables operators to reduce surface footprint while providing the opportunity for higher returns than drilling multiple single laterals. As these operations can be more complex, well development requires careful consideration of formation stability, depending on the type of junction required.

Packers Plus has successfully completed a number of onshore multi-lateral wells with TAML Level 1 and 2 junctions where formation stability concerns were not an issue, and has recently begun similar operations in offshore wells.

Packers Plus is a completion technology company dedicated to providing high quality solutions that work the first time. To this end, Packers Plus offers systems for a variety of applications, including cemented liner, open hole, and high pressure and high temperature applications.

Explore more solutions, case studies, and news at packersplus.com.