

Case study: Offshore, Qatar

# Lateral Entry Guidance System doubled stimulated well length in 9-well multilateral campaign

An operator in the Persian Gulf was experiencing oil production and water injection declines in a carbonate field. All of the wells were multilateral of two or three legs. Historical coiled tubing interventions had gained access to only the natural leg (typically the last leg drilled). To improve stimulation results, access to the other legs in each well was necessary.

Baker Hughes proposed the **Lateral Entry Guidance System (LEGS)** to reliably entry all lateral branches of the wells. The system is hydraulic based and provides a 360° sweep of a wand at the end of the tool. If a lateral window is found, a pressure loss is noted and the tool remains static allowing for coiled tubing to be run into the lateral.

After yard tests and detailed operational design to confirm the optimal tool wand length, the initial openhole water injector well was chosen. Following the successful identification of the branch, both laterals were stimulated, resulting in an 84% increased injection rate, a significant improvement over the historic (single lateral) gain of 49%.

Two additional campaigns for five and four wells each followed. Lateral access was successfully obtained in 12 of 13 junctions. The attempt in the final junction was abandoned due to budget restrictions.

Between each campaign, operational reviews identified exaction improvements. To assist in gaining lateral reach, the final campaign used extended-reach tools with the LEGS tool.

The wells represented a mixture of openhole and cased-hole mechanical junctions.

The use of the LEGS tool to access each lateral provided a 161% gain in injection compared to single lateral stimulation gains of 42%. In production wells, a 49% improvement was observed, vastly exceeding historic 16% gains.

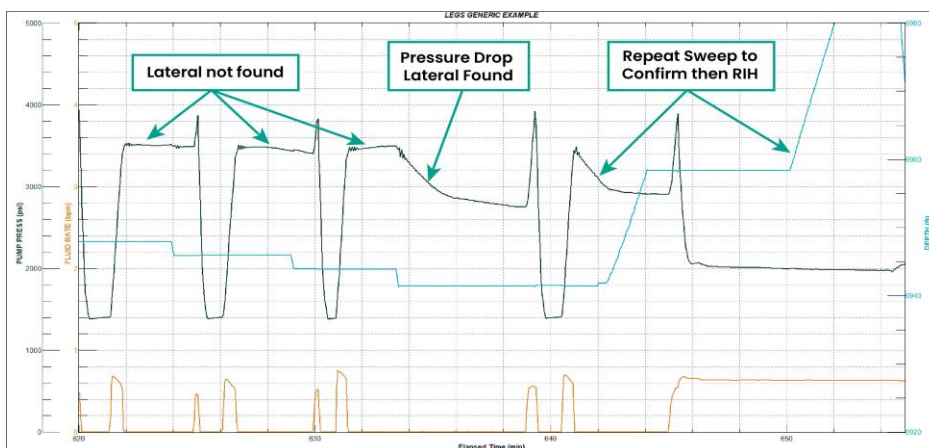
The average time to stimulate each lateral with LEGS was 3.92 days, slightly quicker than the 4.3-day average when accessing only the main lateral. Additional well length accessed from being able to enter more than one lateral per well was an average gain of 125%.

## Challenges

- Enable access to 14 laterals in 9 wells without use of workover rig
- Stimulate wells to remove formation damage
- Overcome extreme lateral lengths and the inability of coiled tubing to reach total depth

## Results

- Accessed 13 of 14 laterals using the LEGS tool
- Successfully stimulated wells
- Achieved a post-stimulation production gain of 49% compared to historic 16% gain (stimulation natural leg only)
- Reached a post-stimulation injection gain of 161% compared to historic 42% gain (natural leg only)
- Surpassed average days to stimulate each lateral with LEGS 3.92 days (historic average days per well (one lateral only) was 4.3 days)



Surface pressure illustrates finding the lateral with the LEGS tool.