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Performance optimization of offshore production wells using pipesim simulation: A case study of the horizon oilfield

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INTRODUCTION & AIM

Petroleum production engineering aims to maximize oil and gas output while being cost-effective. Drilling and completion of producing wells transport oil and gas from reservoirs to stock tanks or sales lines. During the oil and gas production process, there may be issues that reduce the quantityof hydrocarbons produced. Implementing production optimisation measures can help address this issue. Production optimization aims to maximise hydrocarbon production rates or minimise operating costs while adhering to technical and economic constraints.

This study proposes utilizing PIPESIM, a steady-state multiphase flow simulator developed by Schlumberger, to optimise production under both natural flow and artificial lift conditions, thereby identifying strategies to enhance productivity and mitigate decline due to water cut, gas-liquid ratio (GLR) variations, and reservoir pressure depletion.

METHOD

Horizon Oilfield reservoir and production data will be used for this project, which includes ESP design data, PVT properties, reservoir characteristics such as depth, permeability, porosity, and fluid properties, as well as completion parameters such as casing sizes, perforation depths, and skin factors, as well as reservoir pressure, temperature, and production forecasts. PIPESIM (Schlumberger) was utilized in production engineering to simulate steady-state multi-phase flow, nodal analysis, and sensitivity studies on tubing sizes(3–7 inches) to identify the optimal tubing diameter for maximum flow rate, gas-liquid ratios (GLR) to assess how gas-liquid ratio variations affect well deliverability, water cuts to simulate performance at increasing water cuts up to 100%, and reservoir depletion to determine abandonment pressures and production decline trends.

Correlation models such as Inflow Performance Relationship (IPR) models for productivity estimation and Vertical Lift Performance (VLP) correlations for tube performance and pressure drop calculations will also be employed in this project.

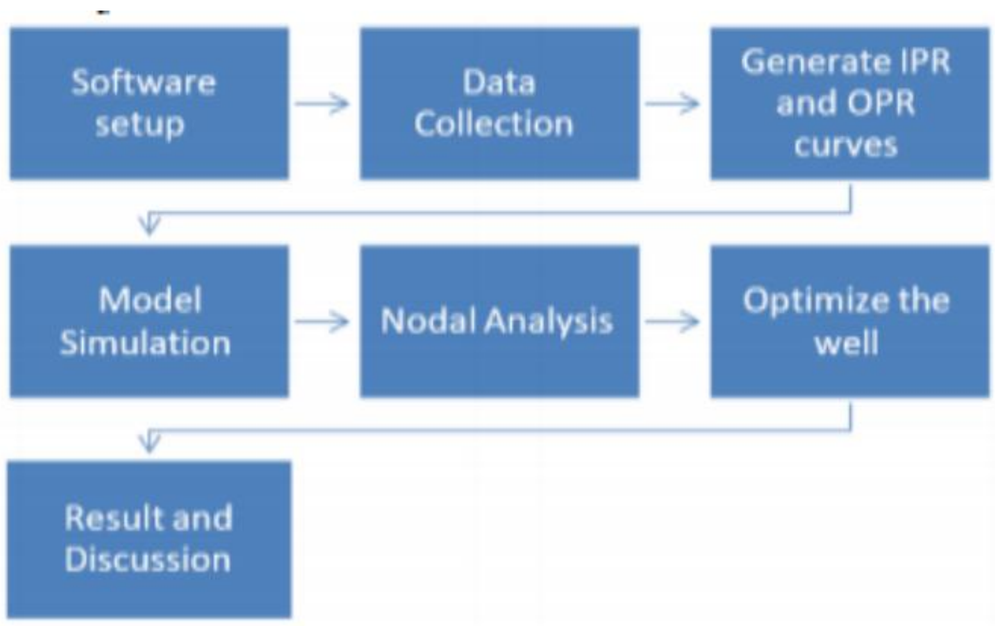

Figure 1. The Research Procedure

RESULTS & DISCUSSION

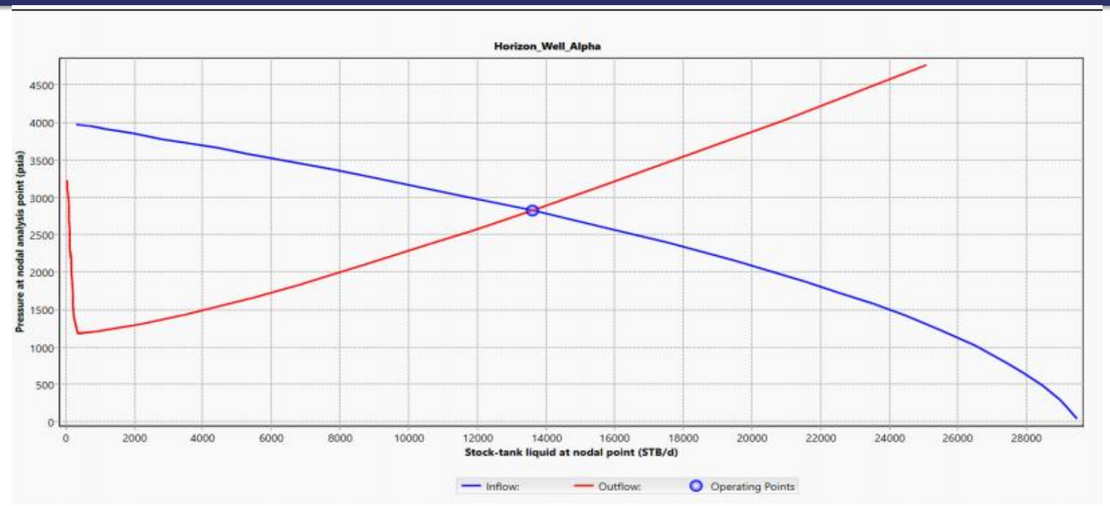

Figure 2. IRP and OPR for natural flowing well

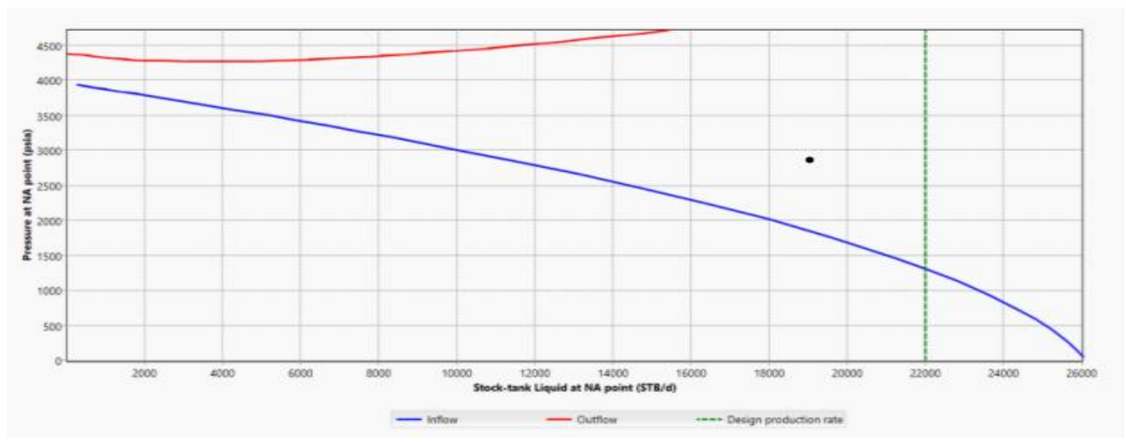

Figure 3. Producing well at 100% water cut

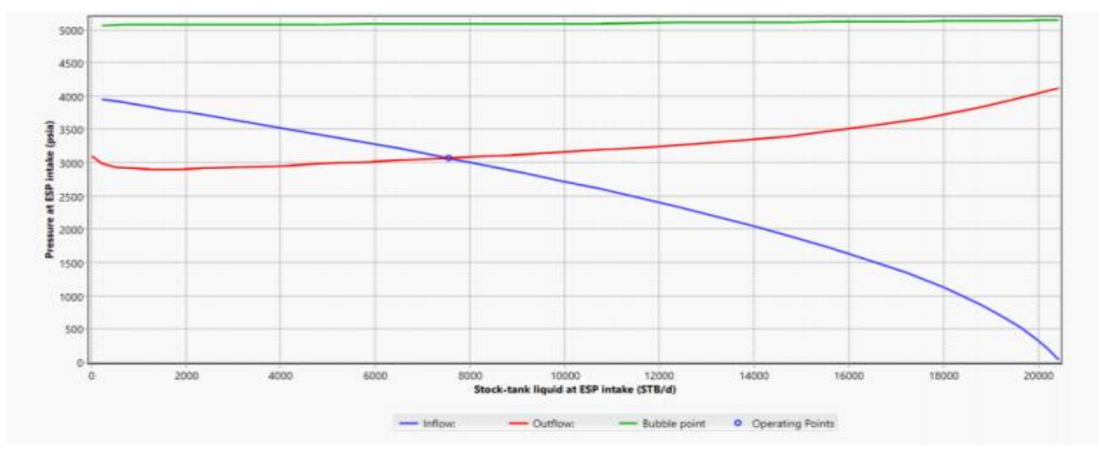

Figure 4. Production rate after ESP was installed

CONCLUSION

Overall, the results show that proactive well design,specifically optimizing tubing size, monitoring GLR and water cut trends, and using ESPs, can significantly enhance production efficiency, recovery factor, and long-term field sustainability. These findings offer a useful foundation for optimizing production in the horizon oil and gas field located in the southwest of Ghana.

FUTURE WORK / REFERENCES

[1] Efendioglu, A.E., Mendez, J., and Turkoglu, H. 2014. Numerical Analysis of the Flow and Separation Efficiency of a Twophase Horizontal Oil-Gas Separator with an Inlet Diverter and Perforated Plates. WIT Transactions on Engineering Sciences 82(1): 133-142.
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