



Development of Heavy Oil Reservoirs: A Case Study of a Low API Reservoir Offshore, Nigeria

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Heavy oil fields provide a large number of challenges relating to: flow assurance, produced water separation and treatment as well as additional heat and power requirements. This paper will discuss the economics of producing a heavy oil reservoir for which the produced fluid was comingled with a lighter crude and the corresponding challenges.

The first phase of field development involved a single pilot producer which was used to determine the reservoir fluid properties, test the ability of the reservoir to deliver commercial rates and assess the long-term economics of using ESPs in an offshore environment.

The application of ESPs was such a success that five more wells were drilled. Another challenge was reservoir fluid sampling for which a number of methods were attempted and the best method which is still to be attempted is thought to be bottomhole sampling at low stable rates. Regarding the PVT analyses, a number of challenges were encountered due to SBM contamination.

Understanding the reservoir temperature was also a challenge due to the three different temperature readings provided by the different sensors for which no satisfactory explanation was achieved.

A number of criteria were defined prior to field development:

- Experience in the local environment was critical.
- Sand control methods were to be investigated for the expected solids production.
- Any artificial lift would need to apply to continuous use.
- Any artificial lift would need to handle high production rates.
- Powering source and costs would need to be accounted for when recognising the above criteria.

The main operational challenges could be split into three categories:

- Produced Water Separation
- Metering
- Marketing

Conclusion:

The cumulative production from the heavy oil field accounted for nearly 30% of the total recovery resulting in excellent economic returns. Incremental costs were faced due to operational challenges but were easily addressed due to the economic success of this system.

Managing the production challenges was alleviated by the presence of other lighter oil reservoirs for crude quality uplift as well as the excellent reservoir properties and strong aquifer support.