“Condensate optimization in Bongkot – successful integration of an in-house empirical correlation”

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**Innovation feature**

The objective of this document is to share the challenges and successes on the CGR optimization method in Bongkot field. Bongkot is one of the largest gas fields in the gulf of Thailand producing from large number of stacked sands (>1000 reservoirs) and wells. Each reservoir has different fluid and rock properties which, hence, making it not physically possible to characterize or sample each of them individually. Gas production is constrained by the DCQ (900 MMSCFD). The field also produces significant amount of associated condensate (30000 BPD). Field optimization philosophy is to focus on meeting the gas nomination, and then maximizing condensate production by preferentially producing high CGR wells. Unfortunately, existing well test result gives condensate volume at wellhead conditions, not sales conditions. Optimizing condensate at sales points using wellhead condition turns up to 50% error in total Bongkot field production.

After 20 years of production, this study introduces a new optimization method using an empirical correlation which essentially proxies the composition data with wellhead CO\(_2\), separator conditions and CGR at wellhead from current routine basis.

A fully compositional GAP model was initially set to evaluate the impact of the Bongkot process changes using different PVT samplings (Figure-1). It generates theoretical CGR at sales condition from full ranges of wellhead conditions. The empirical formula is derived from the simulation results which finally comprises of 82 coefficients with 4 parameters input required.

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CGR_{Sales} = F\left(WH\_CGR, Sep\_Temperature, Sep\_Pressure, WH\_CO2\right)
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A field optimization trial was then carried out in Bongkot South (GBS) where the well line-up was decided based on the Sales_CGR rather than WH_CGR. There was an immediate improvement in field CGR and allocation error confirming its validity. This method improves GBS oil allocation from up to 80% to 10% error and average gain of 700 – 1000 BPD of condensate (25-35 MM$ revenue per year). Then Bongkot North (GBN) incorporates this to production allocation with similar error reduction and another 1000-1500 BPD condensate (35-50 MM$ per year) gain from production optimization.
Figure 3 – Improvement in CGR leading to gain in condensate production (at 350 MMSCFD)

Figure 3 – Improvement in CGR leading to gain in condensate production (at 320 MMSCFD)
From complicated correlation into simplified background calculation, the formula is incorporated with Bongkot PDMS that apply to every CGR for well production allocation, production optimization, and other reservoir studies.

**Thai E&P Industry Impact and Value**

The use of CGR correlation between sales and wellhead condition lessens the discrepancy on condensate allocation by predicting allocation factors to correct condensate to gas ratio (CGR) for each well. Having an accurate back allocation to wells is important for a number of reasons. Key ones among them are decisions on future development strategy, reserves calculation, optimized depletion of condensate reservoir, and day to day optimization of wells to maximize revenue from the field. The last one is the worst affected due to this inconsistency as we lose opportunity to maximize our condensate production under any given nominated gas production.

Moreover, when applying the correlation to maximize the field’s condensate production by accurately predict the condensate potential, extra revenue is gained without any need of investment.

This strategy can and should be adapted to other gas condensate fields in Thailand to enhance their production optimization strategy.

**Essay, Why this project should win the award**

This project is unique in many aspects:

1) Gain field condensate using new optimization method without any extra investment
2) Improve well production allocation
   a. Impact to field development plan and production prediction
3) Calculate Automatically from acquired wellhead CGR by building into PDMS system
4) Will soon be applied to other assets in PTTEP

It may sound unbelievable that by only changing the condensate estimation method can create extra condensate production and additional revenue to the asset. It is the innovative idea that has been neglected in real life. Also, this project requires a great effort and a good collaboration both within Bongkot production team and cross-division with Bangkok reservoir engineering team.