SPE 164850 Integration of Production Facilities and Reservoir Simulation for Comparison of Subsea and Conventional Lift Technologies

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Subsea processing is a potential technology currently being tested and analysed for deep water fields to increase production. One requirement (for the field described in the paper) is to increase the pressure drawdown by reducing the system back pressure so the technology in use must integrate the reservoir production with the processing facility model. The objective for this project is to compare gaslift against subsea gas-liquid separation as the main artificial lift method.

There are already some advantages to subsea gas-liquid separation compared to gaslift; flow assurance, reduction of the primary separator in the surface facility and more efficient pumping.

The model was built using: PVTP for the fluid characterisation and creation of Black Oil data, PROSPER for the well models, GAP for the network models, IMEX for the reservoir and RESOLVE as the modelling platform.

Two scenarios were modelled to compare the effects for each artificial lift option:

1. *Homogeneous reservoir:*
   This approach was taken to focus purely on the artificial lift options without needing to account for the reservoir complexities. Assuming that there are to be 3 oil producing and 4 water injecting wells, the primary results showed that pressure maintenance will be vital to the success of this project. It was observed that the liquid production remained at a plateau for a greater amount of time with subsea gas-liquid separation than with gaslift.
2. *Heterogeneous reservoir:*
   This approach was taken to compare the two methods with realistic reservoir responses. 3 different configurations were investigated with varying numbers of injection wells. The most economical approach had 3 oil producing and 6 water injecting wells. One issue to account for was the increased drawdown due to the greater production when subsea gas-liquid separation was in use so either more injection wells may be necessary to maintain the reservoir pressure or increasing the distance between the producing wells may be necessary.

Both of the above cases showed that subsea gas-liquid separation produced more oil in the early years however gaslift could be of help as the field matures due to the increasing water cut.

CONCLUSION:

- Reservoir pressure maintenance is key to the successful production from this field.
- Subsea gas-liquid separation produced higher volumes.
- Combining gaslift with subsea gas-liquid separation increased production as the field matured.
- It was found that the same amount of oil could be produced through smaller tubing and pipeline diameters when subsea gas-liquid separation was used, making it the more economical choice.
- IPM is highly recommended for this type of model due to the complexity of the problem.