1. Objectives/Scope

Development of rich gas condensate reservoirs presents a number of specific challenges. One of the main difficulties in producing from such reservoirs is the well productivity impairment due to condensate drop-out in the reservoir, particularly in the near wellbore region, once pressure goes below the dew point. The velocity-dependent relative permeability (VDRP) thought to play a counterpart favourable effect that may alleviate the detrimental impact of condensate banking. Fine-scale compositional reservoir simulation modelling used to study and to determine the effect of velocity stripping associated with velocity-dependent relative permeability behaviour near the wellbore in rich gas condensate reservoirs.

2. Methods, Procedures, Process

This paper describes the critical parameters and procedure used to accurately captures the production performance of gas condensate reservoirs, including; high-resolution 3D sector modelling, detailed Equation-of-State (EOS) fluids characterization, generalized pseudo-pressure, velocity-dependent relative permeability (VDRP) and non-Darcy flow physics. The study leverages on the modelling capabilities using our in-house reservoir simulator and wealthy Steady-state relative permeability experiments conducted on selected core samples. The observed relative permeability dependence on velocity has been modeled using advanced relative permeability model, which includes the effect of capillary number (Nc = vgug/σ), interfacial tension (IFT) and condensate stripping within the near wellbore region to rigorously quantify the overall impact of velocity-dependent relative permeability (VDRP) on wells deliverability.

3. Results, Observations, Conclusions

Results from application of this modelling technique on some synthetic simulation models showed that, capturing the dependency of relative permeability (Kr) on interfacial tension (IFT) and flow velocity in gas condensate reservoirs below dew-point pressure could greatly affect the simulated well productivity. It was also shown that the well productivity impairment due to condensate banking under VDRP conditions was not as severe as in the case where the conventional relative permeability curves were used. The results showed that the, Velocity-dependent relative permeability has greater favorable impact in low permeability reservoirs, on the other hand, no tangible positive effect was observed at moderate and high permeability reservoirs.

4. Novelty/Significance/Additive Information
The presented methodology provides a systematic approach for modelling gas condensate reservoirs while accounting for the capillary number coupling effect and its favourable impact on condensate phase recovery and wells productivity forecasting.

validating the unique near wellbore complex behaviour arising due to dependency of relative permeability (Kr) on IFT and velocity. This study will provide an understanding on how to improve the forecast of gas and condensate production for condensate gas reservoirs.