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Modelling the Economic Impact of Spacing Uncertainty in Unconventional Long Laterals Due to Common Survey Practices

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Abstract

Finding an optimal lateral spacing is crucial to maximizing the return on investment for unconventional assets. The estimates regarding these lateral spacings were made for various plays; however, in a general sense, they assumed that the wellbores were precisely drilled and surveyed (Bharali et. al., 2014; Lalehrokh & Bouma, 2014). Wellbore positions have potentially large uncertainties and recent studies demonstrate that these uncertainties are even larger than previously assumed (Love, et. al, 2020).This study combines the previous work completed on spacing uncertainty with a reservoir simulation model to better quantify the losses caused by positional uncertainty, while exploring the sensitivity of said losses in relation to the changing lateral length, well spacing and survey accuracy allowing for future optimal field development.

A previous method of simulating reservoir losses due to survey uncertainty, proposed by Maus & DeVerse (2016) and the major basins reservoir simulation using empirically derived positional uncertainty models generated by analyzing survey data from thousands of wells by Love et. Al., (2020) provided the framework for this study. The estimations for typical production losses due to survey uncertainty were produced from simulations and compared to similar simulations using industry standard error models. In all cases, a baseline simulation was run, estimating production losses observed on historical wells alongside additional simulations to determine the sensitivity of losses on future wells against lateral length (5,000 - 15,000 ft), lateral spacing (220 - 880 ft) and employed survey management techniques. The effect of estimated losses and deviations from expectations using standard error models were explored, including an analysis of average production losses, extreme events (such as maximum modeled production loss and number of lateral crossings), and the impact of uncertainty reduction techniques commonly employed through survey management.

After performing simulations using empirically derived well paths and uncertainty models, it was found that simulations using standard error models may have greatly underestimated recovery losses due to survey uncertainty. The empirical error-model simulations suggest that realized losses for common drilling scenarios may be up to 5% or more of expected production, a much higher value than the previously estimated value of 0.5 - 2% using standard error models by Maus and DeVerse. Simulations suggest that these losses can be reduced up to 80% using survey management techniques to improve the accuracy in wellbore positioning.

Up to present times, there has not been a quantitative look at how real drilling and survey practices employed in unconventionals impact field economics. This work synthesizes prior efforts to estimate the true surveying uncertainty and links it to an ultimate asset value.