

Development Strategy Planning for a Shale Reservoir

Hafiz Muhammad Bilal Younus¹, Fatima Kazmi², Afrah Khalid², Waqas Ali¹, and Muhammad Noman Khan¹

¹Pakistan Petroleum Limited

²NED University of Engineering & Technology, Karachi

Abstract

As the demand of natural gas is increasing along with decline in conventional gas resources, the exploitation of unconventional resources has become essential to meet the increasing demand. Shale being unconventional hydrocarbon resource; is very complex in terms of fluid flow and storage mechanisms and require advanced techniques to be modeled correctly. As high investments are involved to develop the resource, therefore representative model is required to decide whether to exploit a shale resource or not, and optimize the development strategy in order to maximize the recovery and profitability.

Mostly shale resources are modeled using analytical methods in which best fit model on one well is applied on all other wells of the field to simulate their behavior. However this may not be the case in actual due to heterogeneities in the reservoir. One way to simulate the performance of shale is to use a numerical simulation model in which one can predict the effect of various scenarios on production such as horizontal length, number of stages of frac, etc. In addition it allows to optimize various parameters for the development of field which may not be done through analytical models.

In this paper a numerical simulation model is developed for a shale resource. This model is used as a tool for planning and optimizing the development strategy of the resource. The model contains horizontal wells with multi stage fracturing and is validated using well production data of a shale resource. Vertical Lift Performance (VLP) curves are generated from a well modeling software and are incorporated in the simulation model. Horizontal development wells are incorporated to maintain a specific plateau rate. Sensitivity of various parameters such as number of wells, timing of the wells and plateau rate is carried out to study various cases.

The results of these cases including plateau rate and period and gas recoveries are presented and the optimum case is selected based on the profitability and maximum recovery. The adopted approach can be used efficiently to evaluate a shale gas prospect to establish its development and appraisal strategy.