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Static Modeling Approach in the Presence of Uncertain Data; a Case Study of Bobi and Satellite Fields in Lower Indus Basin–Pakistan

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Abstract

The Bobi Field is located in the Lower Indus Basin. Eleven (11) wells in all have been drilled in the Bobi Field. 1 well in Dhamrakhi 2 wells in Chak 5 Dim South and 1 well in Mithrao. The primary target horizon in Bobi Field and satellite fields is the basal sands zones 5A, 5B & C and Middle Sand zones 4B and C. The depositional sequence constitutes of clasticprogradational sands with some transgressive events. The objective of the geological modeling study is to create a 3D-static model on which dynamic modeling can be performed to generate field development plan.

For the structural modeling required for model construction, it was decided to create a fine geological grid using consistent cell increment. The increment is considered to be sufficient to capture the horizontal heterogeneity of the reservoir under study and to produce a reasonable number of cells that can be handled by reservoir simulation for dynamic modeling purposes. Special high intensity layering was adopted to capture the heterogeneities associated with occasional fluvial channels in the Lower Goru. Facies modeling is a means of distributing discrete facies throughout the model grid. Capturing the facies architecture is fundamental for the reservoir description, heterogeneity and connectivity as all properties later will be populated conditioned to facies. It is very important to mention that core data was available for the development of facies for the Bobi and Satellite fields. Continuous variables, which have spatial correlation, such as Porosity, Volume of Shale and permeability were populated stochastically using Sequential Indicator Simulation (SIS) algorithm conditioned to the facies model. Data analysis and transformation was performed as it is the main prerequisite to run the petrophysical modeling. The petrophysical interpreted logs were quality checked, edited and depth matched before integration. Core data and DST results were integrated in the final petrophysical interpretation. There have been many different approaches to quantify cutoffs, with no single method emerging as definitive basis for delineating net pay. Yet each of these approaches yields a different reservoir model, so it is imperative that cutoff be fit for purpose.

In this study we follow a comprehensive methodology which takes into account reservoir parameters such as porosity, volume of clay and water saturation.

The methodology adopted for the property cut off's like Vclay, Sw and Phie has been on the basis of generating a pay flags which match with the movable gas saturation profiles. The input for the water saturation model was derived from petrophysical interpretation. If cores are preserved, the water saturation information can be obtained directly. However, cores are often subject to changes from the original state before brought to the laboratories. Therefore, capillary pressure (Pc) curves measured on different core samples are usually correlated to porosity, permeability, and/or rock type using various techniques to generate the field wide saturation height function. Unfortunately we did not have the saturation information neither from the cores nor did we have any capillary pressure information. Therefore we tried to find pseudo-

function. Water saturation was then modeled using PhieVsSw functions after which above contact property was integrated to model Sw as a function of height.

The water saturation Sw was not modeled as a function of capillary pressure Pc because no relationship could be found between Pc from Log Bulk Volume Water (BVW) vs height and the absence of significant transition zones. Since there was no Pc curves available from the core hence a Pc from log i.e. BVW Vs Height plots were generated for Middle and Basal Sands i.e. Zones 4B, C, 5A, B and C. In this approach, inverse relationships between Sw and Phie were used to model Sw for the different zones; which was later on modeled as a function of height.

The Bobi Field has been divided into at least 3 segments i.e. Northern, Central and Southern on the basis of integrating several cross discipline information i.e. Petrophysics, Seismic, Static and Reservoir Engineering. It is important to mention here that the Central Bobi segment is having least uncertainty whereas the Northern and Southern segments have the highest uncertainty.