Future of Tunu Field Development: A Breakthrough of Gas Sand Identification using Automated Seismic Assessment

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ABSTRACT

Tunu is a giant gas field located below the present-day Mahakam Delta, East Kalimantan, Indonesia. Since launched in 1990, more than 1100 development wells have been drilled and the cumulative production is >9 Tcf. The field is divided into two intervals, Tunu Shallow Zone (TSZ) with depth of 600-1500 mSS and Tunu Main Zone (TMZ) between 2500-5000 mSS. TSZ corresponds to Pliocene fluvio-deltaic series where the gas reservoirs have limited surface extensions and scattered all over the field. The first TSZ development phase was launched in 2008. Recently more attention has been given to TSZ where most of the Tunu new wells are drilled. The zone currently contributes 40% of the Tunu field production.

The first seismic survey dedicated for the TSZ was shot in 2009, and since then the development had relied on detailed interpretation of seismic anomalies. Gas sands are characterized by a methodology that comprises of analysis on angle sub-stacks, gathers, amplitude versus angle (AVA), and litho-seismic inversion. More than 150 seismic-driven wells have been drilled based on the seismic methodology with a success ratio of 82% in finding targeted reservoirs. This methodology is rigorous and proven to be reliable, but full field assessments of Tunu which covered 1350sqkm will be a lengthy process.

This triggered the need of a quicker approach that can mimic and automate the conventional seismic methodology in the most efficient manner. A geomodel was therefore built to have for the first time an exhaustive and comprehensive view of the field. The first step was an automatic screening of all potentially gas-related seismic anomalies on available 3D seismic surveys. Next was to identify gas-bearing sand reservoirs and discard coals to minimize the risk of failure since both have similar characteristic on the conventional full stack seismic cube. Final step was to properly assess the resource of each reservoir. The result was a full field inventory of all potential gas reservoirs and their estimated resources. The geomodel also allows integration of well trajectory and surface constraints, which help setting priority for the next wells.

More than 24000 seismic anomalies have been identified in the initial screening. Through evaluation of their AVA responses, half of the anomalies exhibit typical gas reservoir response. These first two steps were done automatically with a workflow in the geomodel. The potential gas reservoirs were then stacked to highlight the most interesting locations with the highest resource accumulation. Today, up to 1400 anomalies are classified as potential drilling targets. In recent downturn of gas price this geomodel is considered as a key in identifying economical wells to support the TSZ development.