Deepwater Reservoir Modeling for Improved Reservoir Management, Depletion Planning and Field Performance: Erha Field OML 133, Offshore Nigeria

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Streamed in 2006, Erha is a deepwater offshore Nigeria field with cumulative production of about 200 MBO. In response to available data and evolving asset life-cycle business needs related to project funding, field development and reservoir management, several phases of reservoir models have been built.

For project funding and early development planning, a less confined and more distributary basin flow geologic model containing numerous control surfaces and across channel, continuous faults was built using seismic data acquired in 2000 with global population of properties from the 4 available wells. Subsequent updates during development drilling were mostly at well location. However, this model was sub-optimal for longer-term production scale reservoir management. Refinements in interpretation of multi-cycle deepwater channel architecture, integration of reservoir surveillance and improved seismic data were critical to developing a next generation reservoir model to facilitate improved reservoir management and future infill drilling.

Utilizing a 2005 high-resolution seismic volume, 28 wells with pressure and production data, a new integrated reservoir model was constructed to reflect the observed improved connectivity using fewer control surfaces and a less continuous network of relayed faults with potential connectivity at fault tips. Significant model improvement included a pseudo-zone approach, used to mitigate the impact of "pinch-out cells" on flow across channel boundaries with significant reduction in grid-cell numbers. Refined interpretation of reservoir architecture ensured that the relationship between low net marginal reservoir facies and the main channel body were adequately captured to reflect depositional concepts and observed production.

Flow elements, including baffles and high permeability streaks, were identified through a multi-discipline integrated performance evaluation. Principal paths for gas cap advance were determined within reservoir compartments. These have been integrated in a new simulation model and have played a role in optimizing injection strategy for improved reservoir performance.

The static model displays improved lateral and vertical connectivity across channel boundaries consistent with field performance. Dynamic reservoir model initialization in EMpowerTM simulator yields an excellent match with BHP using a well-by-well comparison and will underpin an updated depletion plan and future infill drilling program