

## Static Reservoir Modeling Using Well Log and 3-D Seismic Data in a KN Field, Offshore Niger Delta, Nigeria

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### ABSTRACT

This study focuses on the application of 3D static model using 3-D seismic and well log data for proper optimization and development of hydrocarbon potential in KN field of Niger Delta Province. 3D Seismic data were used to generate the input interpreted horizon grids and fault polygons. The horizon which cut across the six wells was used for the analysis and detailed petrophysical analysis was carried out. Structural and property modeling (net to gross, porosity, permeability, water saturation and facies) were distributed stochastically within the constructed 3D grid using Sequential Gaussian Simulation and Sequential Indicator Simulation algorithms. The reservoir structural model show system of different oriented growth faults F1 to F6. Faults 1 and Fault 4 are the major growth faults, dipping towards south-west and are quite extensive. A rollover anticline formed as a result of deformation of the sediments deposited on the downthrown block of fault F1. The other faults (2, 3, 5 and 6) are minor fault (synthetic and antithetic). The trapping mechanism is a fault assisted anticlinal closure. Results from well log analysis and petrophysical models classified sand 9 reservoir as a moderate to good reservoir in terms of facies, with good porosity, permeability, moderate net to gross and low water saturation. The volumetric calculation of modeled sand 9 horizon reveals that the (STOIIP) value at the Downthrown and Ramp segment are 15.7 MMbbl and 3.8 MMbbl respectively. This implies that the mapped horizon indicates hydrocarbon accumulation in economic quantity. This study has also demonstrated the effectiveness of 3-D static modeling technique as a tool for better understanding of spatial distribution of discrete and continuous reservoir properties, hence, has provided a framework for future prediction of reservoir performance and production behavior of sand 9 reservoir. However, more horizontal wells should be drilled to enhance optimization of the reservoir.

### KEYWORDS

Porosity; Permeability; Water Saturation; Volumetric Calculation; Facies

### 1. Introduction

The increasing demand for petroleum products has posed a change to the search of oil and gas. This search for hydrocarbon has developed increase with advances in greater computational technology to evaluate the probability of hydrocarbon proneness of the basin thereby limiting the risk factor associated with hydrocarbon. Government revenue of most oil producing countries in the world depends on these products. In Nigeria, Niger Delta province has commercial accumulation of oil and gas.

The production of oil and gas is from the accumulation in the pore spaces of reservoir rock usually sandstone, limestone or dolomite. In Niger Delta, petroleum production is produced in sandstone and unconsolidated sand of Agbada formation. This formation is characterized by alternating sandstones and shale with rock units varying in thickness from 100 ft to 15000 ft [1]. The sand in this formation is mainly hydrocarbon reservoir with shale providing lateral and vertical seals [2]. The Niger Delta is situated in the Gulf of Guinea between the longitude 5°E - 8°E and Latitude 3°N - 6°N. The Niger Delta lo-

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