

ABSTRAK

PEMETAAN RESERVOAR *SHALLOW MARINE* DAN ZONA FLUIDA HIDROKARBON MENGGUNAKAN *EXTENDED ELASTIC IMPEDANCE* DAN *PROBABILISTIC NEURAL NETWORK* MULTIATRIBUT UNTUK PENENTUAN AREA PENGEMBANGAN DI SUB-CEKUNGAN ARDJUNA

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Formasi Cibulakan Atas pada Cekungan *Offshore Northwest Java* (ONWJ) merupakan salah satu reservoir hidrokarbon utama di Indonesia. Namun, heterogenitas litologi, lingkungan pengendapan *shallow marine* serta karakteristik *low resistivity low contrast* (LRLC) menyebabkan identifikasi persebaran reservoir dan fluida hidrokarbon menjadi lebih kompleks. Penelitian ini bertujuan untuk memetakan distribusi properti fisik reservoir berupa *Acoustic Impedance* (AI), porositas efektif (PHIE), volume lempung (Vclay), Lambda Rho ($\lambda\rho$), dan saturasi air (Sw), serta mengidentifikasi persebaran fasies *shelf ridge* dan zona prospektif hidrokarbon pada Formasi Cibulakan Atas. Metode yang digunakan meliputi inversi *Extended Elastic Impedance* (EEI) untuk memperoleh parameter elastik reservoir dan analisis multiatribut *Probabilistic Neural Network* (PNN) untuk memprediksi distribusi properti petrofisika secara lateral. Hasil penelitian menunjukkan bahwa reservoir batupasir prospektif dicirikan oleh nilai AI rendah berkisar 13.500–16.000 g/cc*ft/s, PHIE tinggi lebih dari 0,10–0,13 V/V, dan Vclay rendah kurang dari 51–60%. Zona hidrokarbon teridentifikasi pada nilai Lambda Rho rendah sebesar 12–20 Gpa*g/cm³ dan Sw kurang dari 60–80%. Integrasi parameter AI, PHIE, Vclay, Lambda Rho, dan Sw memperlihatkan persebaran reservoir yang memanjang dengan orientasi Utara–Timurlaut hingga Selatan–Baratdaya, yang diinterpretasikan sebagai fasies *shelf ridge*. Interpretasi tersebut didukung oleh korelasi log Gamma Ray yang menunjukkan penipisan tubuh batupasir dari *leading edge* menuju *trailing edge*. Berdasarkan hasil integrasi seluruh parameter, zona prospektif pengembangan reservoir berada pada struktur tinggian di bagian timurlaut dan baratdaya area penelitian yang menjadi lokasi paling potensial terakumulasi hidrokarbon.

Kata kunci: ONWJ, Formasi Cibulakan Atas, *Extended Elastic Impedance*, *Probabilistic Neural Network*, Lambda Rho, *Shelf ridge*.

ABSTRACT

MAPPING OF SHALLOW MARINE RESERVOIR AND HYDROCARBON FLUID USING EXTENDED ELASTIC IMPEDANCE AND A MULTI-ATTRIBUTE PROBABILISTIC NEURAL NETWORK TO IDENTIFY DEVELOPMENT AREAS IN THE ARDJUNA SUB-BASIN

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*The Upper Cibulakan Formation in the Offshore Northwest Java (ONWJ) Basin is one of the major hydrocarbon reservoirs in Indonesia. However, lithological heterogeneity, a shallow marine depositional environment, and low-resistivity, low-contrast (LRLC) characteristics make the identification of reservoir distribution and hydrocarbon fluids more complex. This study aims to map the distribution of reservoir physical properties, including Acoustic Impedance (AI), effective porosity (PHIE), clay volume (Vclay), Lambda Rho ($\lambda\rho$), and water saturation (Sw), as well as to identify the distribution of shelf ridge facies and hydrocarbon-prospective zones within the Upper Cibulakan Formation. The methods employed include Extended Elastic Impedance (EEI) inversion to obtain reservoir elastic parameters and multi-attribute Probabilistic Neural Network (PNN) analysis to predict the lateral distribution of petrophysical properties. The results of the study indicate that prospective sandstone reservoirs are characterized by low AI values ranging from 13.5000–16.000 g/cc*ft/s, high PHIE values exceeding 10–13 V/V, and low Vclay values below 51–60%. Hydrocarbon zones were identified at low Lambda Rho values of 12–20 GPa*g/cm³ and Sw values below 60–80%. The integration of the AI, PHIE, Vclay, Lambda Rho, and Sw parameters revealed an elongated reservoir distribution oriented from North–Northeast to South–Southwest, interpreted as a shelf ridge facies. This interpretation is supported by Gamma Ray log correlations showing a thinning of the sandstone body from the leading edge toward the trailing edge. Based on the integration of all parameters, the prospective reservoir development zones are located on high-relief structures in the northeastern and southwestern parts of the study area, which are the most potential locations for hydrocarbon accumulation.*

Keywords: *ONWJ, Upper Cibulakan Formation, Extended Elastic Impedance, Probabilistic Neural Network, Lambda Rho, Shelf ridge.*