

ABSTRAK

***FACIES-GUIDED SEISMIC INVERSION* DENGAN VALIDASI CNN UNTUK PREDIKSI RESERVOIR DI LAPANGAN AMAIHA**

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Lapangan Amaiha, yang terletak di Cekungan Natuna Barat, memiliki potensi hidrokarbon yang signifikan, terutama dalam bentuk gas, yang berasosiasi dengan fasies fluvio-deltaik pada Formasi Keras, Gabus Atas, dan Barat. Tingginya heterogenitas litologi serta keterbatasan resolusi metode seismik konvensional menjadi tantangan utama dalam pemodelan reservoir. Studi ini menerapkan metode *Facies-Guided Seismic Inversion* (FGSI) berbasis Convolutional Neural Network (CNN) dan membandingkannya dengan pendekatan inversi konvensional. Model fasies dibangun dari integrasi data log empat sumur dan atribut seismik, kemudian dijadikan batasan dalam proses inversi impedansi akustik. Hasil menunjukkan bahwa CNN memberikan prediksi impedansi akustik beresolusi tinggi dengan nilai RMSE lebih rendah dan R^2 lebih tinggi dibanding metode *model based*. Zona prospektif berhasil diidentifikasi pada Formasi Keras, Gabus Atas, dan Barat, ditandai oleh anomali AI rendah ($< 6.500 \text{ m/s} \cdot \text{g/cc}$), porositas efektif $> 10\%$, volume serpih $< 50\%$, dan saturasi air $< 70\%$. AI dan model deteksi fluida menunjukkan keandalan model CNN dalam delineasi *sweet spot* dan estimasi cadangan. Pendekatan hibrid ini terbukti meningkatkan akurasi prediksi reservoir dan mendukung keputusan eksplorasi dengan ketidakpastian lebih rendah.

Kata kunci: *Facies Guided Seismic Inversion*, *Convolutional Neural Network* (CNN), Impedansi Akustik, Karakterisasi Reservoir, Cekungan Natuna Barat.

ABSTRACT

FACIES-GUIDED SEISMIC INVERSION WITH CNN VALIDATION TO PREDICT RESERVOIR IN “AMAIHA” FIELD

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The Amaiha Field, located in the West Natuna Basin, has significant hydrocarbon potential, particularly in the form of gas, associated with fluvio-deltaic facies in the Keras, Gabus Atas, and Barat Formations. The high lithological heterogeneity and limited resolution of conventional seismic methods pose major challenges in reservoir modeling. This study applies the Facies-Guided Seismic Inversion (FGSI) method based on Convolutional Neural Network (CNN) and compares it with conventional inversion approaches. The facies model is constructed from the integration of four well log data and seismic attributes, then used as constraints in the acoustic impedance inversion process. The results show that CNN provides high-resolution acoustic impedance predictions with lower RMSE values and higher R^2 compared to model-based methods. Prospective zones were successfully identified in the Keras, Gabus Atas, and Barat formations, characterized by low AI anomalies ($< 6,500$ m/s·g/cc), effective porosity $>10\%$, shale volume $<50\%$, and water saturation $<70\%$. AI and fluid detection models demonstrate the reliability of the CNN model in delineating sweet spots and estimating reserves. This hybrid approach has proven to improve reservoir prediction accuracy and support exploration decisions with lower uncertainty.

Keywords: Facies-Guided Seismic Inversion, Convolutional Neural Network (CNN), Acoustic Impedance, Reservoir Characterization, West Natuna Basin.