

## ABSTRAK

NUR ISNAINI. Analisis Kelayakan Teknis Dan Ekonomis Perluasan Jaringan Tegangan Rendah Dan Gardu Distribusi Untuk Melayani Perumahan Pesona Khatulistiwa Kota Balikpapan. Dibimbing oleh KARTIKA TRESYA MAURIRAYA, S.PD., M.PD.

Pertumbuhan kawasan perumahan baru di Kota Balikpapan, khususnya Perumahan Pesona Khatulistiwa, menyebabkan peningkatan kebutuhan energi listrik yang andal dan berkualitas. Dalam rangka memenuhi kebutuhan tersebut, PLN perlu melakukan perencanaan perluasan jaringan tegangan rendah dan pembangunan gardu distribusi baru. Perencanaan ini memerlukan kajian kelayakan teknis dan ekonomis agar investasi yang dilakukan dapat memberikan manfaat optimal. Penelitian ini bertujuan untuk menganalisis kebutuhan daya listrik Perumahan Pesona Khatulistiwa, menilai kelayakan teknis perluasan jaringan distribusi, serta mengevaluasi kelayakan ekonomis investasi yang diperlukan. Analisis teknis dilakukan dengan menghitung kapasitas beban, di mana dari 58 unit rumah diperoleh daya terpasang sebesar 102,4 kVA, daya beban sebesar 71,68 kVA, dan kebutuhan kapasitas total setelah penambahan faktor cadangan 20% sebesar sekitar 86 kVA. Hasil evaluasi menunjukkan transformator eksisting 100 kVA telah mengalami pembebanan hingga sekitar 102,4% sehingga melampaui batas operasi yang dianjurkan. Perencanaan teknis perluasan dilakukan melalui penambahan gardu sisip 100 kVA dan perluasan jaringan tegangan rendah sepanjang  $\pm 385$  meter (9 gawang), serta kapasitas gardu distribusi yang mampu adalah 100 kVA tetapi tidak direkomendasikan, dan kapasitas gardu dinilai paling sesuai adalah transformator dengan rating 160 kVA agar pembebanan berada di bawah 80% sesuai standar SPLN, edaran direksi dan IEC. Analisis ekonomis dilakukan dengan memperhitungkan biaya investasi pembangunan jaringan dan gardu distribusi serta membandingkannya dengan estimasi penerimaan dari pelanggan menggunakan parameter Payback Period (PP). Hasil analisis menunjukkan bahwa rencana perluasan jaringan dan penambahan gardu distribusi secara teknis mampu menurunkan tingkat pembebanan gardu, mendekatkan titik suplai ke pusat beban, serta meningkatkan keandalan penyaluran daya, dan secara ekonomis dinyatakan layak untuk direalisasikan. Penelitian ini diharapkan dapat menjadi bahan pertimbangan bagi PLN dalam pengambilan keputusan investasi serta mendukung tersedianya suplai energi listrik yang handal, efisien, dan berkesinambungan di Perumahan Pesona Khatulistiwa.

**Kata kunci** : Jaringan Tegangan Rendah, Gardu Distribusi, Kelayakan Teknis, Kelayakan Ekonomis, Perumahan.

## ABSTRACT

NUR ISNAINI. *Technical and Economic Feasibility Analysis of Low Voltage Network Expansion and Distribution Substations to Serve the Pesona Khatulistiwa Housing Complex in Balikpapan City. Supervised by KARTIKA TRESYA MAURIRAYA, S.PD., M.PD.*

*The growth of new housing areas in Balikpapan City, particularly the Pesona Khatulistiwa Housing Complex, has led to an increased need for reliable and quality electrical energy. To meet these needs, PLN needs to plan the expansion of its low-voltage network and the construction of new distribution substations. This planning requires a technical and economic feasibility study so that the investment can provide optimal benefits. This study aims to analyze the electrical power needs of the Pesona Khatulistiwa Housing Complex, assess the technical feasibility of expanding the distribution network, and evaluate the economic feasibility of the required investment. The technical analysis was carried out by calculating the load capacity, where from 58 housing units the installed power was obtained at 102.4 kVA, the load power was obtained at 71.68 kVA, and the total capacity requirement after adding a 20% reserve factor was approximately 86 kVA. The evaluation results showed that the existing 100 kVA transformer had experienced a load of approximately 102.4%, thus exceeding the recommended operating limits. The technical planning of the expansion was carried out by adding a 100 kVA insert substation and expanding the low voltage network along ±385 meters (9 gates), and the distribution substation capacity that is capable is 100 kVA but is not recommended, and the most appropriate substation capacity is a transformer with a rating of 160 kVA so that the load is below 80% according to SPL, edaran direksi and IEC standards. Economic analysis was carried out by calculating the investment costs of building the network and distribution substation and comparing it with the estimated revenue from customers using the Payback Period (PP) parameter. The results of the analysis showed that the network expansion plan and the addition of distribution substations were technically able to reduce the level of substation loading, bring the supply point closer to the load center, and increase the reliability of power distribution, and were economically declared feasible to be realized. This research is expected to be a consideration for PLN in making investment decisions and supporting the availability of a reliable, efficient, and sustainable supply of electrical energy in Pesona Khatulistiwa Housing.*

**Keywords :** *Low Voltage Network, Distribution Substation, Technical Feasibility, Economic Feasibility, Housing.*