ANALISIS INDEKS KEANDALAN SISTEM JARINGAN DISTRIBUSI 20 KV MENGGUNAKAN GUI MATLAB PADA PT PLN (PERSERO) ULP GANDAPURA

ABSTRAK

Keandalan sistem distribusi tenaga listrik merupakan faktor krusial dalam menjamin kontinuitas penyaluran energi listrik kepada pelanggan. Penelitian ini dilakukan di PT PLN (Persero) Unit Layanan Pelanggan (ULP) Gandapura dengan tujuan untuk menganalisis tingkat keandalan jaringan distribusi 20 kV berdasarkan perhitungan indeks SAIDI (*System Average Interruption Duration Index*), SAIFI (*System Average Interruption Frequency Index*), dan CAIDI (*Customer Average Interruption Duration Index*). Selain itu, dikembangkan juga aplikasi berbasis GUI MATLAB sebagai alat bantu untuk mempercepat dan mempermudah proses perhitungan serta visualisasi data gangguan. Metode yang digunakan adalah pendekatan kuantitatif dengan studi kasus. Data dikumpulkan melalui wawancara teknis dan dokumentasi laporan gangguan selama satu tahun. Selanjutnya data dianalisis dan diolah menggunakan aplikasi GUI MATLAB untuk menghitung nilai SAIDI, SAIFI, dan CAIDI secara otomatis. Hasil perhitungan menunjukkan bahwa nilai SAIDI sebesar 2,494 jam/pelanggan/tahun belum memenuhi standar WCS (1,666 jam) dan sedikit melewati kriteria standar IEEE (2,30 jam). Nilai SAIFI sebesar 1,933 kali/pelanggan/tahun juga masih di bawah standar WCS (3 kali), meskipun sedikit melebihi standar IEEE (1,45 kali). Sementara itu, nilai CAIDI sebesar 18,34 jam/gangguan masih jauh di atas standar IEEE (1,58 jam/gangguan) yang mengindikasikan rendahnya efisiensi dalam pemulihan gangguan. Penyebab utama gangguan berasal dari kerusakan Kabel Sambungan Rumah (SR), Kabel Jaringan Tegangan Rendah (JTR), konduktor, serta peralatan proteksi seperti Recloser dan PMCB. Gangguan akibat pemeliharaan terencana juga memberi kontribusi signifikan terhadap total durasi padam. Perbandingan antara perhitungan manual dan hasil dari aplikasi GUI MATLAB menunjukkan tingkat akurasi sangat tinggi, dengan selisih kurang dari 0,01%. Dengan demikian, aplikasi GUI MATLAB dapat digunakan sebagai alat bantu andal dan efisien dalam menganalisis keandalan sistem distribusi listrik di lingkungan kerja PLN.

***Kata kunci** : GUI MATLAB, Evaluasi Kinerja Distribusi, Indeks Keandalan Listrik, PLN ULP Gandapura*

ANALYSIS OF THE RELIABILITY INDEX OF THE 20 KV DISTRIBUTION NETWORK SYSTEM USING MATLAB GUI AT PT PLN (PERSERO) ULP GANDAPURA

ABSTRACT

The reliability of the electric power distribution system is a crucial factor in ensuring the continuity of electricity distribution to customers. This study was conducted at PT PLN (Persero) Customer Service Unit (ULP) Gandapura with the aim of analyzing the reliability level of the 20 kV distribution network based on the calculation of the SAIDI (System Average Interruption Duration Index), SAIFI (System Average Interruption Frequency Index), and CAIDI (Customer Average Interruption Duration Index) indices. In addition, a MATLAB GUI-based application was also developed as a tool to speed up and simplify the calculation process and visualization of disturbance data. The method used is a quantitative approach with case studies. Data were collected through technical interviews and documentation of disturbance reports for one year. Furthermore, the data were analyzed and processed using the MATLAB GUI application to calculate the SAIDI, SAIFI, and CAIDI values automatically. The calculation results show that the SAIDI value of 2.494 hours/customer/year has not met the WCS standard (1.666 hours) and slightly exceeds the IEEE standard criteria (2.30 hours). The SAIFI value of 1.933 times/customer/year is also still below the WCS standard (3 times), although slightly exceeding the IEEE standard (1.45 times). Meanwhile, the CAIDI value of 18,34 hours/disruption is still far above the IEEE standard (1.58 hours/disruption), which indicates low efficiency in recovering from disruptions. The main cause of disruptions comes from damage to House Connection Cables (SR), Low Voltage Network Cables (JTR), conductors, and protection equipment such as Reclosers and PMCBs. Disturbances due to planned maintenance also contribute significantly to the total duration of the outage. The comparison between manual calculations and the results of the MATLAB GUI application shows a very high level of accuracy, with a difference of less than 0.01%. Thus, the MATLAB GUI application can be used as a reliable and efficient tool in analyzing the reliability of the electricity distribution system in the PLN work environment.

Keywords: *GUI MATLAB, Distribution Performance Evaluation, Electrical Reliability Index, PLN ULP Gandapura*