

ABSTRAK

Ketidakseimbangan beban pada sistem tiga fasa dapat menimbulkan arus netral dan meningkatkan rugi-rugi daya. Penelitian ini bertujuan menganalisis pengaruh ketidakseimbangan beban terhadap arus netral dan rugi-rugi daya pada Transformator TD1 di PT PLN (Persero) Gardu Induk Arun. Analisis dilakukan secara kuantitatif melalui perhitungan manual terhadap 30 titik pengamatan tanggal 20 Mei 2026 dan simulasi *Unbalanced Load Flow* menggunakan DIgSILENT PowerFactory 2024 pada empat kondisi pembebanan. Hasil perhitungan menunjukkan ketidakseimbangan beban sebesar 0,39–4,13%. Pada kondisi ketidakseimbangan maksimum pukul 10.00 WIB, diperoleh arus netral 48,12 A, rugi beban transformator 11,38 kW, daya pada NGR 92,64 kW, dan total rugi-rugi daya yang dianalisis 104,02 kW. Simulasi menghasilkan ketidakseimbangan 4,21%, arus netral 48,90 A, dan total rugi-rugi daya 107,05 kW. Hasil penelitian menunjukkan bahwa ketidakmerataan arus antar fasa meningkatkan arus netral dan daya yang terdisipasi pada NGR.

Kata Kunci: *Arus netral, DIgSILENT PowerFactory, ketidakseimbangan beban, NGR, rugi-rugi daya.*

ABSTRACT

Load imbalance in a three-phase system can generate neutral current and increase power losses. This study aims to analyze the effect of load imbalance on neutral current and power losses in the TD1 Power Transformer at PT PLN (Persero) Arun Substation. The analysis was conducted quantitatively through manual calculations using 30 observation points recorded on May 20, 2026, and an Unbalanced Load Flow simulation using DIgSILENT PowerFactory 2024 under four loading conditions. The results showed that the load imbalance ranged from 0.39% to 4.13%. At the maximum imbalance condition at 10:00 a.m., the neutral current was 48.12 A, the transformer load loss was 11.38 kW, the power dissipated in the NGR was 92.64 kW, and the total analyzed power losses were 104.02 kW. The simulation produced a load imbalance of 4.21%, a neutral current of 48.90 A, and total analyzed power losses of 107.05 kW. The results indicate that unequal current distribution among phases increases neutral current and power dissipation in the NGR.

Keywords: *DIgSILENT PowerFactory, load imbalance, neutral current, NGR, power losses.*