

## **ABSTRAK**

YAYAN SOPIAN. Pemodelan Rekonfigurasi Jaringan Spindle Distribusi 20 kV Berbasis SCADA untuk Meningkatkan Efisiensi Sistem Distribusi. Dibimbing oleh Dr. DHAMI JOHAR DAMIRI, M.Si.

Pertumbuhan konsumsi energi listrik nasional, khususnya di kawasan urban seperti Jakarta, menuntut sistem distribusi yang efisien dan andal. Salah satu tantangan utama adalah tingginya tingkat susut menurunkan efisiensi operasional. Penelitian ini melakukan pemodelan rekonfigurasi jaringan spindle 20 kV berbasis Supervisory Control and Data Acquisition (SCADA) terhadap efisiensi distribusi. Rekonfigurasi dilakukan dengan pengaturan posisi saklar secara otomatis melalui SCADA untuk mengoptimalkan aliran daya secara real-time. Rekonfigurasi jaringan Spindle GH272 di Jakarta Pusat dan Jakarta Barat, terdiri dari 15 penyulang dengan karakteristik beban bervariasi. Pemodelan sistem menggunakan DIgSILENT PowerFactory, dengan data beban dari sensor SCADA dan optimasi menggunakan algoritma Simulated Annealing (SA). Hasil simulasi selama 24 jam menunjukkan penurunan rugi daya dari 1,15 MWh menjadi 0,97 MWh, atau 15,65%, dengan penghematan energi 179 kWh per hari (setara Rp 258.601/hari). Hasil ini menunjukkan bahwa pemodelan rekonfigurasi jaringan dengan SCADA dan Remote Control (RC) meningkatkan efisiensi serta mendukung sistem distribusi yang adaptif. Penelitian merekomendasikan penguatan infrastruktur melalui sensor tambahan seperti ADCU dan integrasi MDMS dengan ADMS untuk mendukung pengambilan keputusan yang lebih responsif.

Kata kunci: efisiensi energi, jaringan distribusi 20 kV, losses, rekonfigurasi jaringan, SCADA, Simulated Annealing, smart grid, spindle.

## **ABSTRACT**

YAYAN SOPIAN. Modeling of SCADA-Based Spindle Network Reconfiguration in 20 kV Distribution Systems for Efficiency Improvement. Supervised by Dr. DHAMI JOHAR DAMIRI, M.Si.

The growth of national electricity consumption, particularly in urban areas such as Jakarta, demands an efficient and reliable distribution system. The main challenges is the high level of technical losses, which reduces operational efficiency. This study develops a network reconfiguration model for a 20 kV spindle distribution system based on Supervisory Control and Data Acquisition (SCADA) to improve distribution efficiency. Reconfiguration is performed by automatically adjusting switch positions through SCADA to optimize real-time power flow. The study focuses on the GH272 spindle network in Central and West Jakarta, consisting of 15 feeders with varying load characteristics. System modeling was conducted using DIgSILENT PowerFactory, utilizing load data obtained from SCADA sensors and optimization through the Simulated Annealing (SA) algorithm. Simulation results over a 24-hour period indicate a reduction in power losses from 1.15 MWh to 0.97 MWh, (decrease 15.65%), with daily energy savings of 179 kWh (equivalent to IDR 258,601 per day). These results demonstrate that SCADA enhances distribution efficiency and supports an adaptive distribution system. The study recommends strengthening infrastructure by deploying additional sensors such as ADCU and integrating the Meter Data Management System (MDMS) with the Advanced Distribution Management System (ADMS) to enable more responsive decision-making.

*Keywords: energy efficiency, 20 kV distribution network, losses, network reconfiguration, SCADA, Simulated Annealing, smart grid, spindle*