ABSTRAK

Pentingnya prediksi beban transformator daya dalam sistem tenaga listrik, khususnya pada kondisi beban rendah yang dapat berpotensi menyebabkan *overvoltage* dan menurunkan keandalan peralatan, menjadi dasar dalam penelitian ini. Penelitian ini bertujuan untuk mengembangkan sistem prediksi beban transformator daya jangka pendek (1–24 jam) berbasis *ensemble machine learning* dengan pendekatan *hybrid feature selection* pada Transformator Unit 2 PLTP Kamojang. Dataset yang digunakan berupa data historis operasional sebanyak 2111 data dengan interval pencatatan 1 jam, yang terdiri dari 9 variabel utama. Data dibagi menjadi 80% data latih dan 20% data uji, serta divalidasi menggunakan metode *10-fold cross-validation*. Model yang digunakan meliputi Random Forest (RF), XGBoost (XGB), dan Extra Trees (ET), dengan evaluasi menggunakan metrik *Mean Absolute Error* (MAE) dan *Root Mean Squared Error* (RMSE). Hasil penelitian menunjukkan bahwa model Extra Trees memiliki performa terbaik dengan nilai MAE sebesar 0.320 dan RMSE sebesar 0.833, dibandingkan dengan Random Forest (MAE 0.331; RMSE 0.926) dan XGBoost (MAE 0.310; RMSE 0.905). Sistem kemudian diimplementasikan dalam bentuk *dashboard* interaktif berbasis Streamlit sebagai visualisasi dan simulasi prediksi beban secara langsung. Berdasarkan hasil dan analisis, diperoleh kesimpulan bahwa metode *ensemble machine learning* dengan *hybrid feature selection* mampu meningkatkan akurasi dan kestabilan prediksi beban transformator daya serta dapat digunakan sebagai langkah pengambilan keputusan operasional dalam sistem tenaga listrik.

Kata kunci: Prediksi Beban Jangka Pendek, Transformator Daya, *Ensemble Machine Learning, Hybrid Feature Selection,* Extra Trees *Regression*, Sistem Tenaga Listrik.

ABSTRACT

The importance of power transformer load forecasting in electrical power systems, particularly under low-load conditions that may potentially cause overvoltage and reduce equipment reliability, serves as the basis of this study. This research aims to develop a short-term (1–24 hours) power transformer load prediction system based on ensemble machine learning with a hybrid feature selection approach for Unit 2 Transformer at the Kamojang Geothermal Power Plant. The dataset used consists of 2,111 historical operational records with a 1-hour sampling interval, comprising 9 main variables. The data were divided into 80% training data and 20% testing data and validated using the 10-fold cross-validation method. The models employed include Random Forest (RF), XGBoost (XGB), and Extra Trees (ET), evaluated using Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) metrics. The results indicate that the Extra Trees model achieved the best performance with an MAE value of 0.320 and an RMSE value of 0.833, compared to Random Forest (MAE 0.331; RMSE 0.926) and XGBoost (MAE 0.310; RMSE 0.905). The system was then implemented in the form of an interactive Streamlit-based dashboard for visualization and direct load prediction simulation. Based on the results and analysis, it can be concluded that the ensemble machine learning method with hybrid feature selection is capable of improving the accuracy and stability of power transformer load forecasting and can be utilized as a supporting tool for operational decision-making in electrical power systems.

***Keywords**: Short-Term Load Forecasting, Power Transformer, Ensemble Machine Learning, Hybrid Feature Selection, Extra Trees, Power System Operation.*