LONG-TERM LOAD PREDICTION USING SIMPLE, MULTIPLE, AND TIME SERIES LINEAR REGRESSION ON THE WONOSARI ULP ELECTRICITY DISTRIBUTION NETWORK

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ABSTRACT

Long-term electricity load planning is a crucial aspect of maintaining the reliability and efficiency of the electricity distribution system. This study aims to forecast electrical energy demand in the Wonosari ULP region for the 2025–2030 period, utilizing regional planning data obtained from BAPPEDA Gunungkidul. The analytical methods employed include simple linear regression, multiple linear regression, and time series analysis. The research variables consist of the number of customers and sales power across household, business, industrial, general, and social sectors. Prior to modeling, the data underwent normality, validity, and reliability tests, which confirmed that the data met statistical assumptions and exhibited strong, significant relationships, making it suitable for predictive analysis. The results of simple linear regression indicate a consistent increase in both customer numbers and sales power across all sectors during the study period, with a relatively high accuracy as measured by the MAPE. However, sales power predictions required assumptions for the 2020–2022 period to address anomalies caused by the pandemic-related decline. Multiple linear regression performs best, with very high accuracy, a correlation coefficient close to 1, and strong explanatory power. Therefore, it is considered the most representative method for predicting electrical energy demand. Meanwhile, the time series method reveals a consistent upward trend with a smoother pattern that aligns with historical data once assumptions are established. Overall, all three methods indicate a strong, linear relationship between the number of customers and power sales. Multiple linear regression is the primary method, while simple linear regression and time series analysis serve as complementary approaches to describe long-term trends in electricity load growth at ULP Wonosari.

Keywords: Number of Customers, Sales Power, Simple Linear Regression, Multiple Linear Regression, Time Series