Application of Moving Average for Forecasting The Amount of Electricity Distribution in The Mojokerto Region

Ah. Hasan Bashori[1], M.Irfan Hanafi[2], Nanda Dwi Nurkholifah[3], Desi Yunitasari[4]

Teknik, Universitas Islam Majapahit[1-4]

Correspondence Author: hasanargan85@gmail.com

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ABSTRACT

PT PLN Mojokerto is responsible for managing electricity distribution in the Mojokerto area. To effectively manage electricity distribution, accurate forecasting is crucial. Data plays a pivotal role in making decisions related to electricity distribution in Mojokerto. The primary objective of this research is to forecast the amount of electricity to be distributed in the area. Having an accurate forecast is essential for estimating future electricity distribution. The research utilizes the Moving Average model, a time series forecasting model. Data for the research is sourced from the Mojokerto statistical agency, covering the period from 2014 to 2020. By employing the Moving Average method, researchers can generate forecasts for the future. Additionally, the researchers calculate MSE (Mean Squared Error) and RMSE (Root Mean Squared Error) when using the Moving Average method.

1. INTRODUCTION

Electricity usage in the Mojokerto area fluctuates due to uncertainties surrounding the number of customers. According to the Statistics Agency (BPS, 2021), electricity usage in this area tends to change. To predict future information accurately, various strategies are employed by power supply officers (Rachman, 2018).

Shifting trends in electricity usage in the Mojokerto area stem from changes in the current number of clients. This significantly affects the traditional methods used to address challenges in the region. One such strategy is the Moving Average method, which uses historical data to anticipate future trends (Eris et al., 2014). While this method helps anticipate power delivery, its accuracy remains uncertain. Thus, it is essential to assess the reliability of these prediction tools. Assessing the distribution of electricity in the Mojokerto area proves challenging, prompting the need for effective strategies to manage power supply adjustments due to unexpected client demands (Suhardi et al., 2020).

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The accuracy of forecasting largely depends on the ability to establish and maintain effective frameworks. Failure to do so can lead to numerous weaknesses for supply officers. Therefore, the spread of power in the Mojokerto area requires constant attention and resources.

The Moving Average technique is commonly used to analyze short- and long-term data. It involves using historical information to understand current trends. Many stock clients and forex traders use this strategy to analyze market fluctuations (Abbas, 2016). This method is deemed suitable for predicting power distribution in the Mojokerto area, especially for younger individuals who are familiar with using this technique to assess price changes in items like gold. In selecting the most appropriate assessment method, it is crucial to consider factors such as MSE (Mean Squared Error) and RMSE (Root Mean Squared Error) to accurately predict and assess data (Abbas, 2016).

2. METHOD

This section discusses two methods for predicting the amount of distributed electricity:

2.1 Moving Averages

Moving averages are a simple method that combines mathematics and statistics to predict future dates. This method requires real or current data to create forecast data. It is a widely used and effective technique that can be implemented using tools like Microsoft Excel. The formula for the moving average (MA) is:

$$MA = \frac{(y_1+y_2)}{2}$$

Information :

MA : moving average

Y1 : actual data

Y2 : next actual data

2.2 Analysis using MSE (Mean Squared Error) and RMSE (Root Mean Squared Error) parameters

Mean Squared Error (MSE) is useful for assessing the accuracy of forecasts. It is a common and straightforward technique for measuring accuracy. On the other hand, Root Mean Square Error (RMSE) is a method to determine the accuracy of price information. The equation for Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) are as follows:

$$MSE = (\frac{(At-Ft)^2}{n}$$

Information :

At : actual data on electricity distribution

Ft : electricity distribution forecasting data

n : the amount of electricity distribution forecasting data

The Root Mean Square Error (RMSE) is a method used to assess the accuracy of price information obtained. It is similar to Mean Squared Error (MSE) but provides a more easily interpretable result. RMSE is calculated as the square root of the average of the squared differences between predicted and observed values. The lower the RMSE, the better the accuracy. The equation for Root Mean Squared Error (RMSE) is as follows:

$$RMSE = \sqrt{MSE}$$

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RMSE : square root of MSE results

3. RESULTS AND ANALYSIS

3.1 Original Data

In the course of this research, the researcher sought original data for reference and obtained electricity distribution data from the Central Statistics Agency for the period between 2014 and 2020, focusing on the Mojokerto area. The data was presented using Excel.

Table 1. Data on the amount of electricity distributed

Amount of Electricity Distributed							
Month	2014	2015	2016	2017	2018	2019	2020
January	2E+08	2E+08	2E+08	1E+08	3E+05	2E+08	4E+08
February	1E+08	1E+08	2E+08	1E+08	3E+08	2E+08	3E+08
March	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	4E+08
April	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	3E+08
May	2E+08	2E+08	2E+07	1E+08	3E+08	2E+08	3E+08
June	2E+08	2E+08	2E+08	9E+07	3E+08	2E+08	3E+08
July	2E+08	2E+08	2E+08	9E+07	3E+08	2E+08	3E+08
August	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	4E+08
September	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	4E+08
October	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	4E+08
November	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	4E+08
December	2E+08	2E+08	2E+08	1E+08	3E+08	2E+08	4E+08

3.2 Predictions Data

When conducting predictive data research in the Mojokerto area, researchers can obtain forecasts for electricity distribution from 2014 to 2020. This data is valuable for improving the efficiency of electricity distribution and preparing for future demands. The researchers present their findings using Excel.

Table 2. Prediction data Amount of electricity distributed

Amount of Electricity Distributed							
Month	2014	2015	2016	2017	2018	2019	2020
January	1,7E+08	1,7E+08	1,9E+08	1E+08	316730	2E+08	3,6E+08
February	1,5E+08	1,5E+08	1,7E+08	1E+08	3E+08	1,9E+08	3,5E+08
March	1,6E+08	1,6E+08	2E+08	1E+08	3,2E+08	2,1E+08	3,7E+08
April	1,7E+08	1,7E+08	1,9E+08	1E+08	2,9E+08	2E+08	3,5E+08
May	1,7E+08	1,7E+08	1,9E+07	1E+08	3,2E+08	2,1E+08	3,2E+08
June	1,7E+08	1,7E+08	1,9E+08	9E+07	2,8E+08	1,8E+08	3,3E+08
July	1,6E+08	1,6E+08	1,6E+08	9E+07	3E+08	2,1E+08	3,5E+08

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August	1,6E+08	1,6E+08	2E+08	1E+08	3,2E+08	2,1E+08	3,5E+08
September	1,7E+08	1,7E+08	1,9E+08	1E+08	3E+08	2,1E+08	3,6E+08
October	1,8E+08	1,8E+08	2E+08	1E+08	3,3E+08	2,2E+08	3,7E+08
November	1,9E+08	1,9E+08	1,9E+08	1E+08	3,2E+08	2,1E+08	3,7E+08
December	1,8E+08	1,8E+08	1,9E+08	1E+08	3,2E+08	2,1E+08	3,6E+08

3.3 MSE and RMSE results

During the research, the researchers calculated the mean squared error (MSE) and root mean squared error (RMSE) for the seven years of electricity distribution. A higher value of MSE and RMSE indicates poor performance. Below, you'll find the MSE and RMSE Data Table:

Table 3. MSE and RMSE calculation data

MSE	3,77E+12	4,37E+14	1,95E+14	1,05E+12	3,19E+14	1,13E+13	8,11E+12
RMSE	1942473	20894916	13979071	1023363	17859561	3357233	2848327

3.4 Data visualization of the amount of electricity

Electricity distribution data from January to December 2014-2020 is visualized in a line chart below.

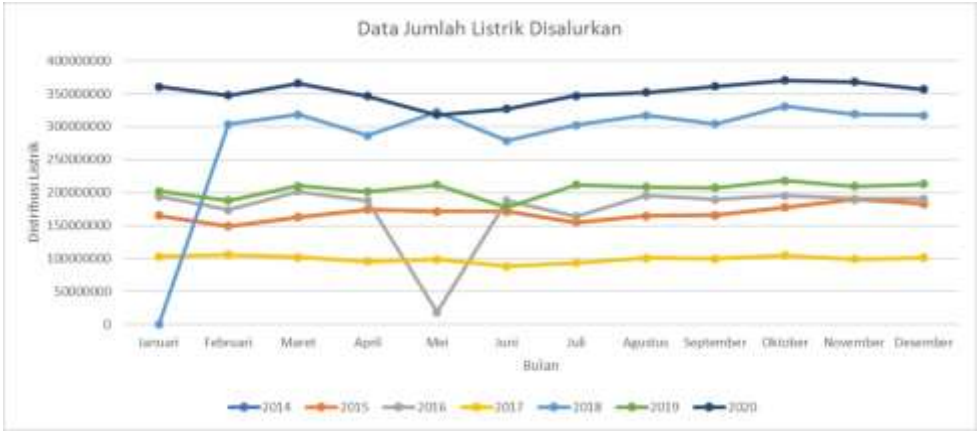

Figure 1. Data line diagram of the amount of electricity distributed

3.5 Visualization of Prediction Data on the Amount of Electricity Distributed

The line diagram below visualizes the prediction data from January to December for the years 2014 to 2020.

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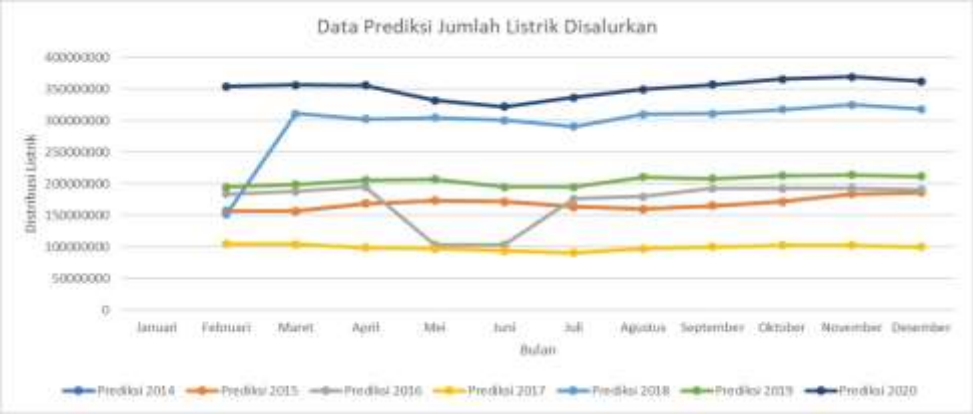

Figure 2. Data line diagram predicting the amount of electricity distributed

3.6 Data Visualization Comparison of Electricity Distribution Numbers and Prediction Data

Data from January to December 2014 to 2020 showing electricity distribution and prediction is visualized using a line diagram, as depicted in the image below.

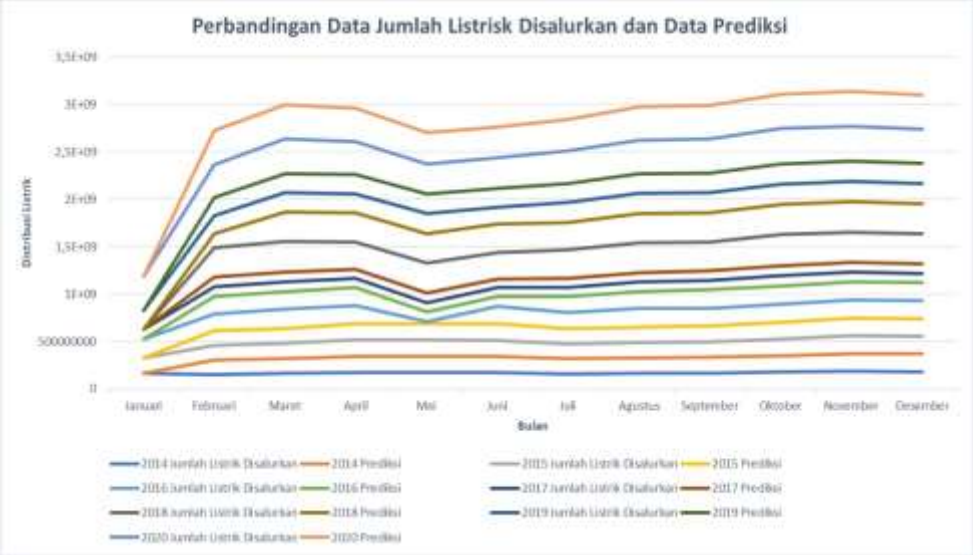

Figure 3. Line diagram comparing data on the amount of electricity distributed and prediction data

4. CONCLUSION

The consistent reliability of this standard forecasting model using Microsoft Excel enables future predictions based on data spanning a 7-year period. Analyzing data from 7 years ago is valuable for projecting future outcomes. Additionally, visualizing the relationship between the original data and future figures is essential. Don't forget to calculate MSE and RMSE to ensure accurate results for informed decision-making.

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6. DECLARATION OF COMPETING INTEREST

We declare that we have no conflict of interest.

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