TITLE: ELECTRICITY CONSUMPTION PROJECT

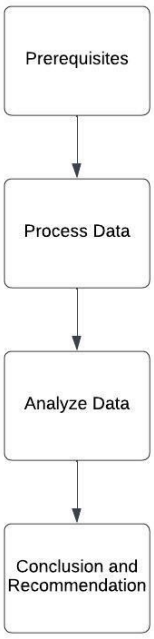
AUTHOR: MUHAMMAD SATRIO PAMUNGKAS SUHAROYO

BEGIN – END DATE: 1-7 DECEMBER 2023

OUTPUT: PDF DOCUMENT

FRAMEWORK

To complete this project, I have developed a framework for myself to ensure a more organized workflow. The following are the steps:



Flowchart 1 Framework

1. Prerequisites: In this stage, the background and variables within the data are described. Additionally, this stage outlines the objectives or goals to be achieved.
2. Process Data: In this stage, mathematical operations using Excel formulas are performed to create new variables for data analysis. Data merging is also conducted using Excel formulas to enhance the depth of analysis.
3. Analyze Data: In this stage, data exploration and visualization are carried out.
4. Conclusion and Recommendation: In this stage, conclusions are drawn from the data analysis, and appropriate recommendations are provided based on the analysis results.

ELECTRICITY CONSUMPTION PROJECT

PREREQUISITES

ABOUT DATA

This data is about contains electricity consumption data for a building from 2020 to 2021. This data is detailed by usage on each floor and in each zone within that floor. The presented data includes Initial Meter readings, Final Meter readings, and the electricity fee per KWh.

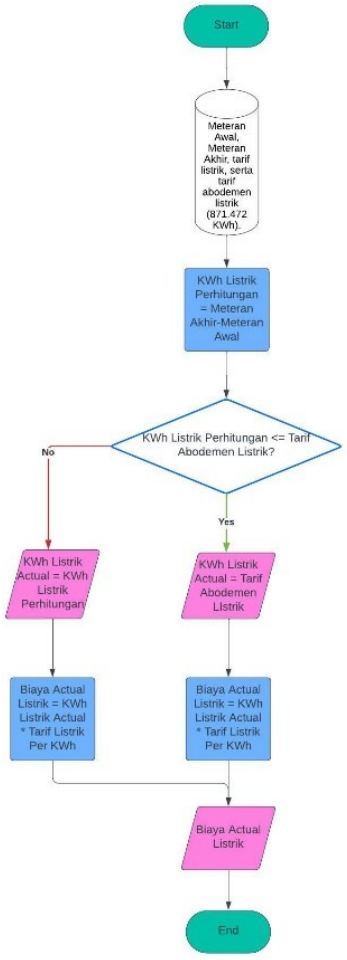
GOALS

The goals to be achieved are as follows:

- To determine the comparison between "Total Actual Electricity Costs vs. Total Actual Electricity KWh Per Month from 2020 to 2021."
- To identify the relationship between "Total Actual Electricity Costs vs. Total Actual Electricity KWh Per Floor and Per Zone for the months of February to April in 2021."
- To ascertain the correlation between "Total Actual Electricity Costs & Total Estimated AC Costs vs. Total Actual Electricity KWh & Total Estimated AC KWh Per Month in 2020."

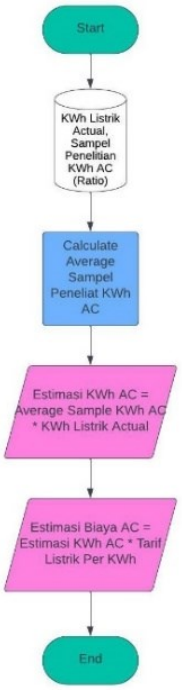
PROCESS DATA

For the analysis, several new variables have been added, Electricity Calculation KWh, Actual Electricity KWh, and Actual Electricity Costs, which can be obtained from the Initial Meter readings, Final Meter readings, electricity fee, and minimum electricity subscription fee (871,472 KWh).



Flowchart 2 Create New Variable "Biaya Actual Listrik"

It is also necessary to introduce new variables, Estimated AC KWh and Estimated AC Costs, which can be obtained through the calculation of Actual Electricity KWh and the average sample of AC KWh in the research.



Flowchart 3 Create New Variable "Estimasi Biaya AC"

ANALYZE DATA

OUTLIERS DATA

There are 2 data for initial and final meter readings that exhibit a significant difference. The assumption is that this discrepancy may be attributed to data entry errors or inadequate data cut-off, as in these instances, the initial meter reading is larger than the final meter reading.

Table 1 Outliers Data from Dataset

Periode	Lantai	Zona	Meteran Awal (KWh)	Meteran Akhir (Kwh)
June-21	6	A	94.882	96.264
June-21	6	B	73.493	74.556
July-21	6	A	96.264	1.159
July-21	6	B	74.556	926

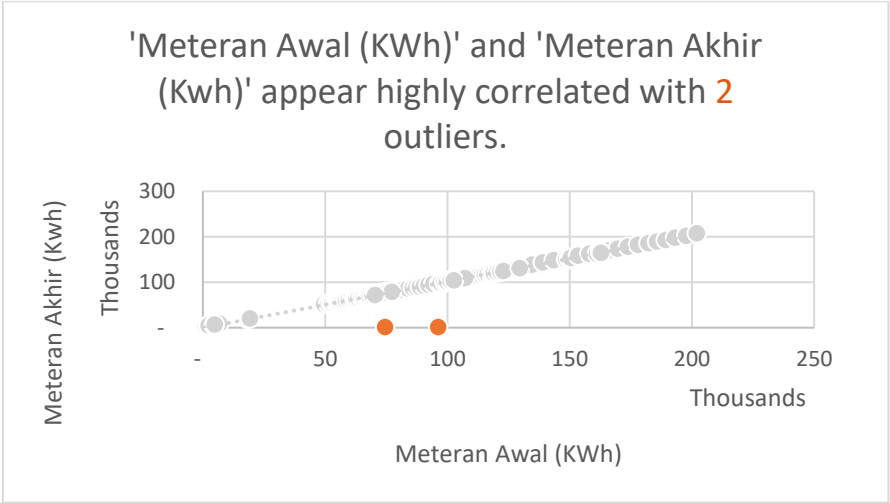


Figure 1 Correlation between "Meteran Awal" and "Meteran Akkhir"

CONSUMPTION AND COST OF ELECTRICITY PER MONTH

The actual electricity costs and actual electricity KWh exhibit a high correlation. This is due to the constant fee applied during the period of 2020-2021. The greater the electricity consumption, the higher the electricity costs.

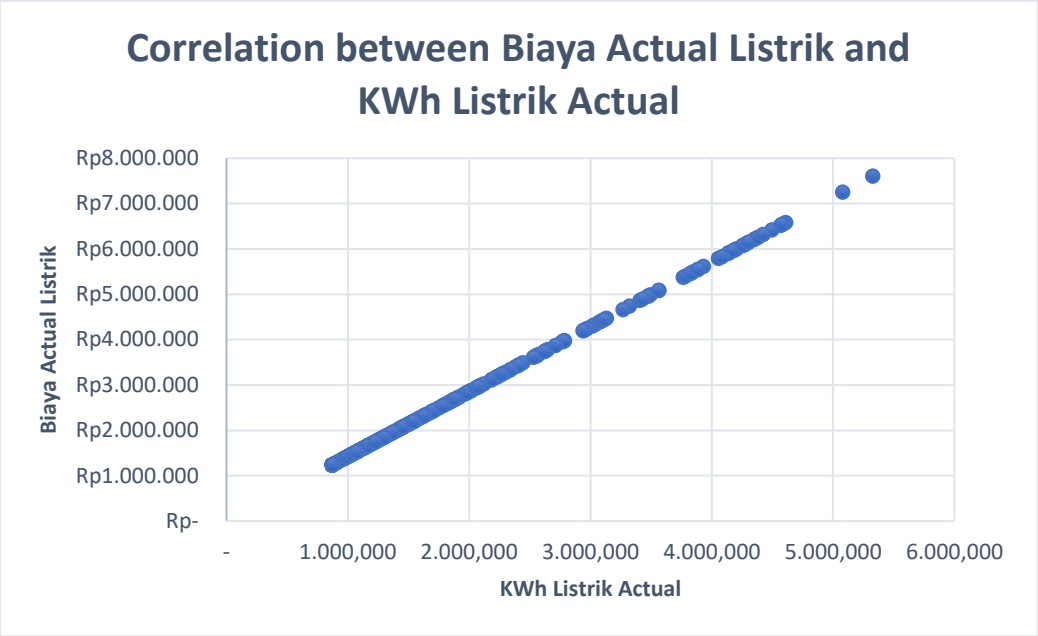


Figure 2 Correlation between "Biaya Actual Listrik" and "KWh Listrik Actual"

Looking at the Monthly Trend in Electricity Consumption, it is observed that the trend is decreasing. Electricity consumption at the beginning of 2020 and the end of 2021 is relatively high, surpassing the average electricity consumption over these two years. July and August 2021 exhibit the lowest consumption compared to other months within that two-year period.

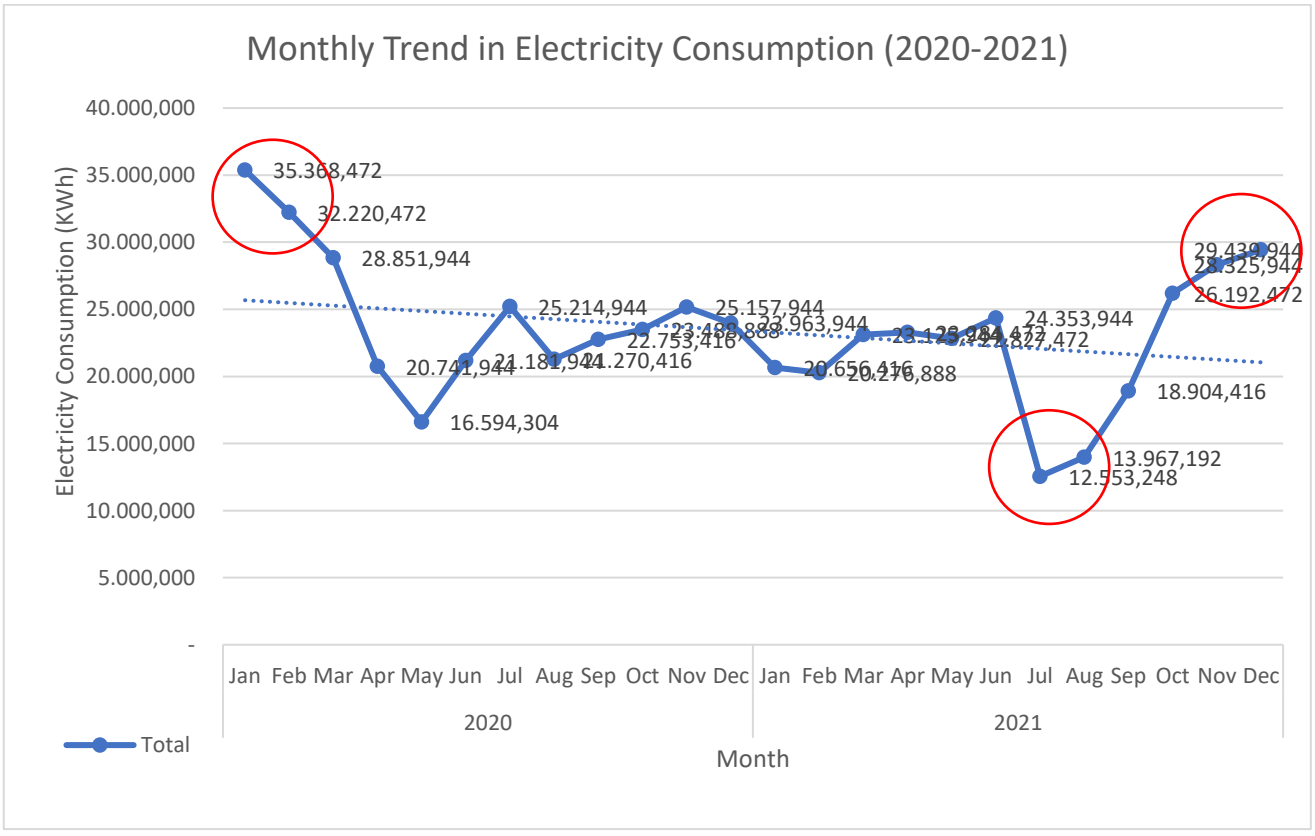


Figure 3 Monthly Trend in Electricity Consumption (2020-2021)

If we look at the electricity costs and electricity consumption, there is no difference in the trend. This is because it is known that electricity costs and electricity consumption in KWh are directly proportional. The monthly trend in cost of

electricity actually shows a decrease, but there are significant spikes at the beginning of 2020 and the end of 2021. With reference to the available data, it is possible to identify the floors and zones with the highest electricity consumption.

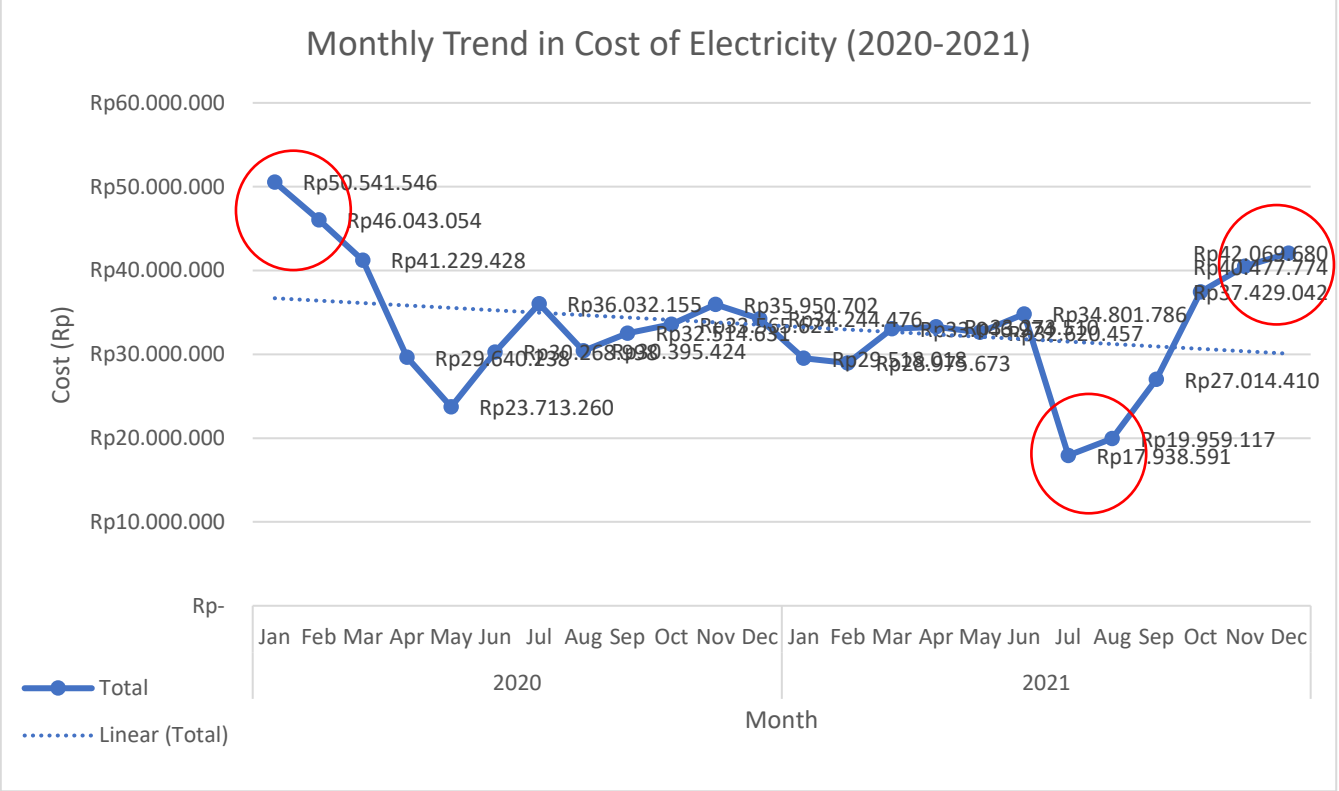


Figure 4 Monthly Trend in Cost of Electricity (2020-2021)

CONSUMPTION AND COST OF ELETRICITY PER FLOOR AND ZONE

Analysis of the Total Cost and Electricity Consumption per floor and per zone is required for the months of February-April 2021. During this period, there is no data for floor 16, or it can be assumed that the floor was not in use. The report for floor 16 is available for the months of November-December 2021.

Table 2 Electricity Consumption in February-April 2021

Electricity Consumption in February-April 2021	
Floor and Zone	**Total KWh Listrik Actual**
6	**30.040,416**
A	3.263,472
B	3.370,000
C	4.911,000
D	11.272,000
E	4.351,000
F	2.872,944
15	**36.646,888**
A	4.017,000
B	3.079,472
C	3.921,000
D	7.708,000
E	12.091,000
F	3.216,000
G	2.614,416
Grand Total	**66.687,304**

Table 3 Electricity Consumption in 2020-2021

Electricity Consumption in 2020-2021	
Floor and Zone	**Total KWh Listrik Actual**
6	**253.050,744**
A	34.264,776
B	30.231,944
C	43.730,944
D	78.746,472
E	38.353,416
F	27.723,192
15	**301.252,296**
A	33.061,944
B	24.304,192
C	36.302,944
D	56.616,472
E	98.081,000
F	31.970,416
G	20.915,328
16	**6.413,944**
B	4.671,000
C	1.742,944
Grand Total	**560.716,984**

During the period of February-April 2021, floor 15 exhibited higher electricity consumption compared to floor 6. Floor 15 has 7 zones, while floor 6 has 6 zones. Electricity consumption above the average, when compared with other floors and zones, is observed in floor 6 zone D, floor 15 zone D, and floor 15 zone E. These three points contribute to 46.5% of the total electricity consumption during that period. Monitoring of electricity usage at these three points is necessary to prevent excessive electricity consumption at these locations.

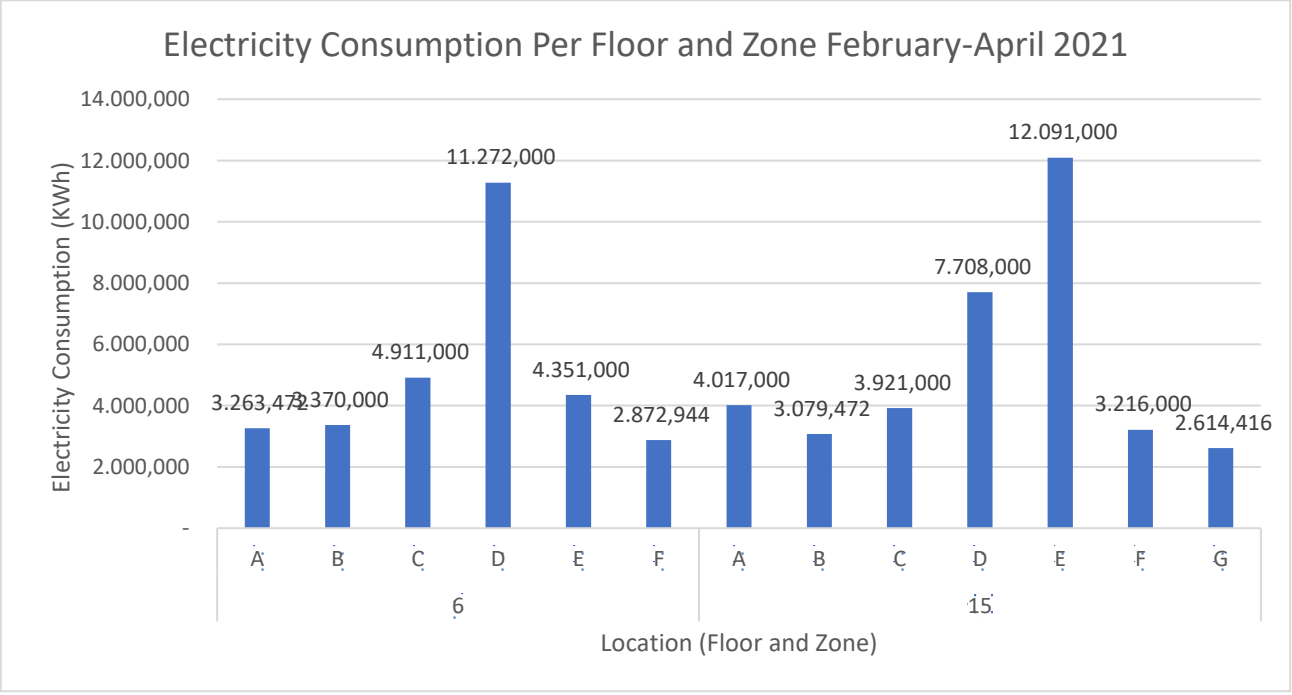


Figure 5 Electricity Consumption Per Floor and Zone February-April 2021

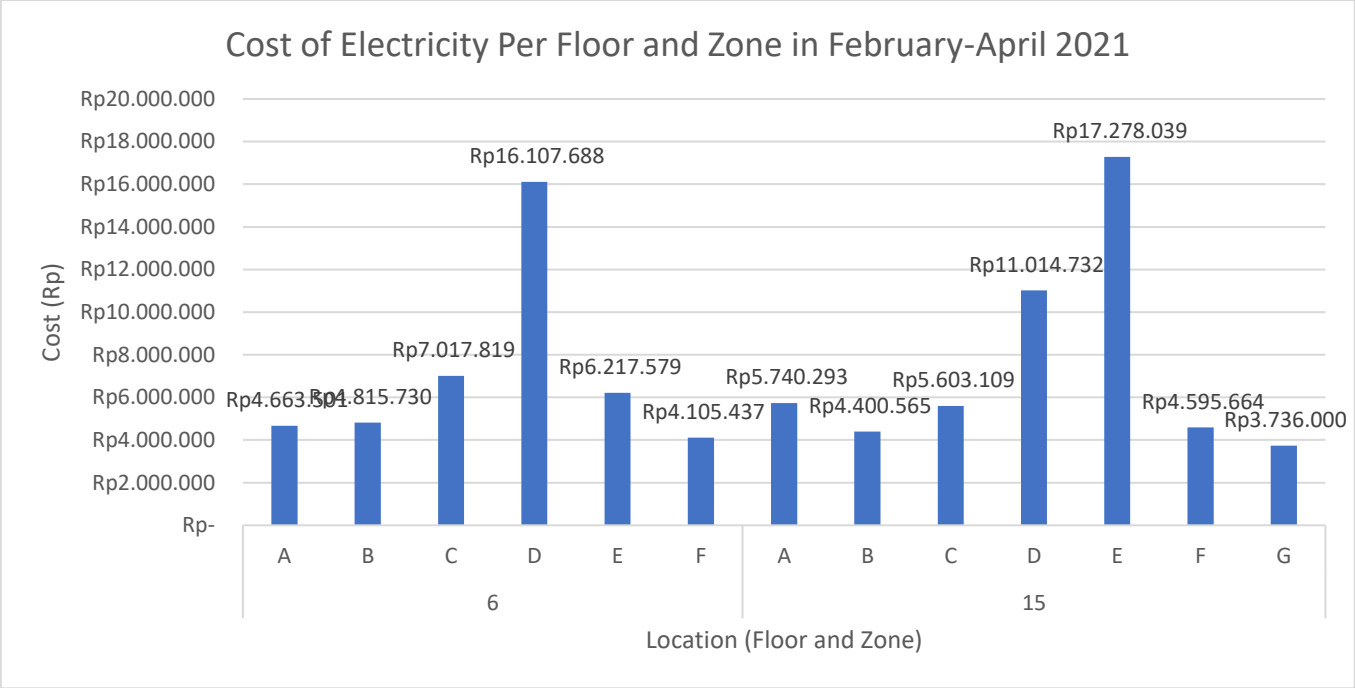


Figure 6 Cost of Electricity Per Floor and Zone in February-April 2021

It is already known that electricity consumption and electricity costs are directly proportional. The greater the electricity consumption, the higher the costs. Therefore, there is no difference between the two graphs.

January-February 2020 marked the highest electricity consumption in the span of two years. Upon reviewing the consumption per floor and per zone, it is evident that the usage is more evenly distributed across floors and zones. On floor 6, electricity consumption appears to be uniform across various zones. However, similar to the period of February-April 2021, floor 15 zones D and E exhibit high electricity consumption.

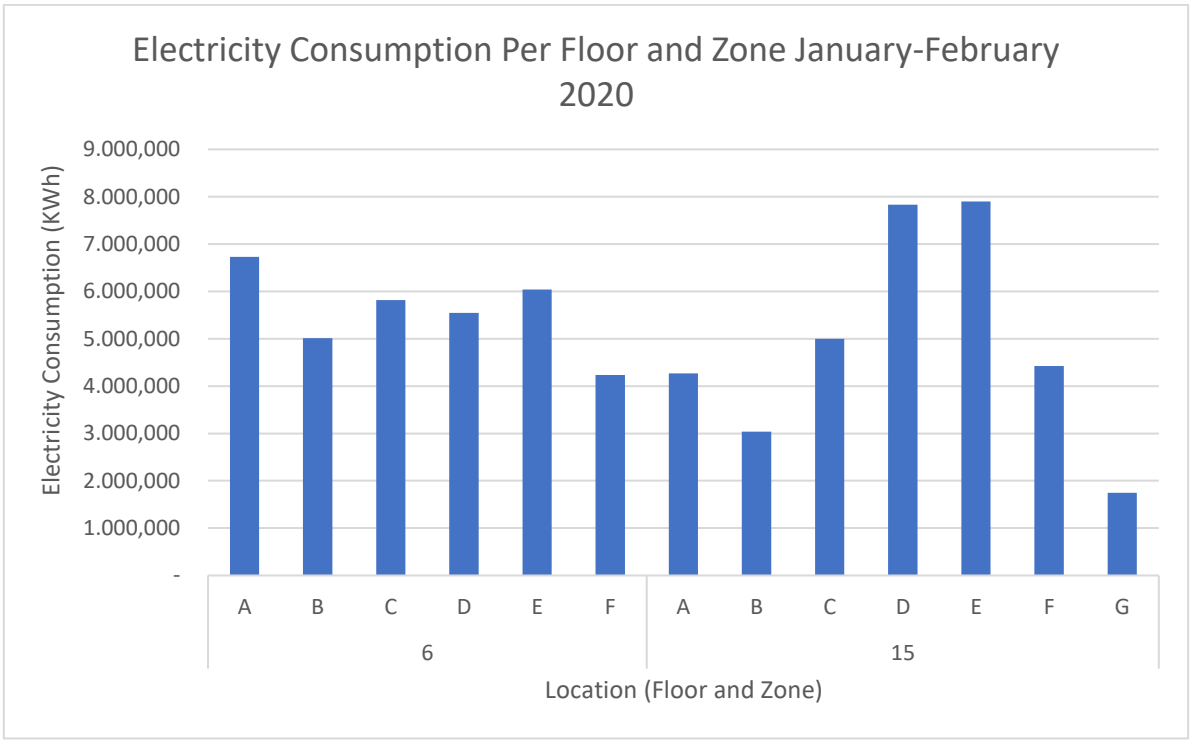


Figure 7 Electricity Consumption Per Floor and Zone January-February 2020

CONSUMPTION AND COST OF ELECTRICITY FOR AC

The Estimated AC KWh can be determined by calculating the average ratio from the research samples. The average ratio is 73.7%, indicating that 73.7% of the electricity consumption is attributed to the use of air conditioning.

Table 4 Research Sample

Sample Penelitian	Simulasi KWh AC	Total KWh Listrik Actual	Ratio *)
1	15.803	23.066	***68,51%***
2	20.796	23.254	***89,43%***
3	17.650	22.797	***77,42%***
4	18.923	23.546	***80,37%***
5	11.794	18.814	***62,69%***
6	13.884	19.225	***72,22%***
7	15.473	22.343	***69,25%***
8	15.585	21.027	***74,12%***
9	15.868	23.411	***67,78%***
10	16.633	23.140	***71,88%***

As the ratio used is constant, the trend exhibited by the Estimated AC KWh is the same as the Actual Electricity KWh. Furthermore, when compared to the electricity costs, the trend will also be the same, as it is known that electricity costs are directly proportional to electricity consumption.

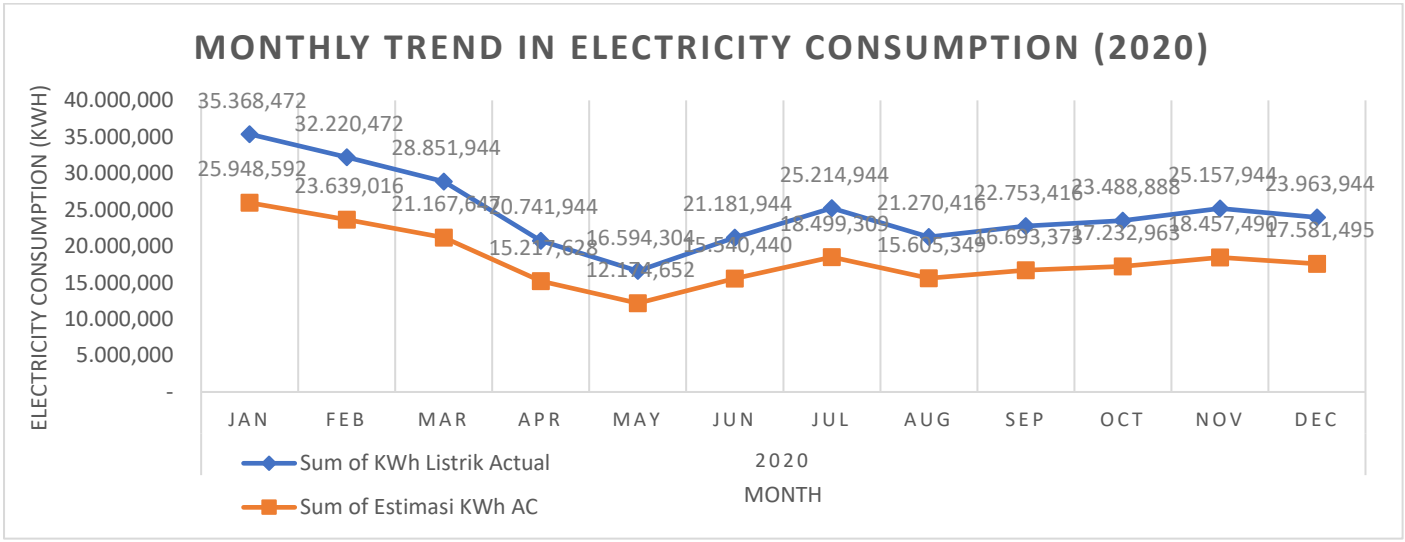


Figure 8 Monthly trend in electricity consumption (2020)

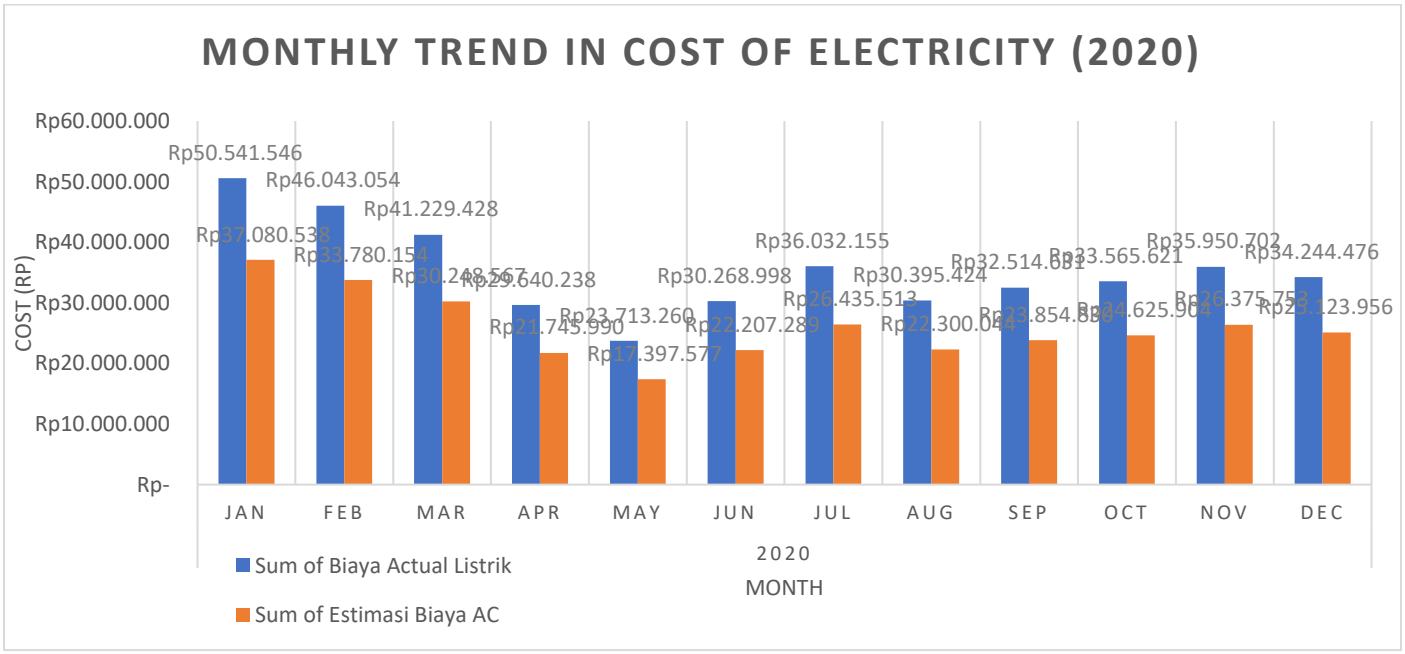


Figure 9 Monthly trend in cost of electricity (2020)

The electricity consumption in January-February 2020 was the highest. This is because, during that month, the average consumption on each floor and in each zone increased. Additionally, when compared to the electricity consumption from February-April 2021 (3 months), the electricity consumption in January-February 2020 (2 months) was higher.

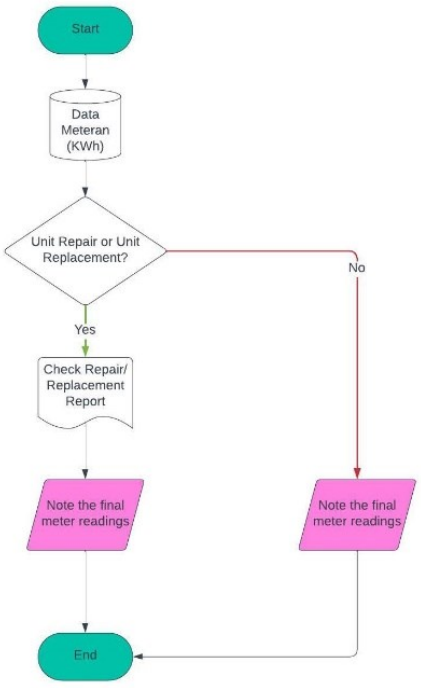
CONCLUSION

From the analysis results, the following conclusions can be drawn:

- Electricity costs and electricity consumption in KWh are directly proportional. The greater the electricity consumption, the higher the costs. Electricity consumption at the beginning of 2020 and at the end of 2021 was significant, exceeding the average consumption over the two-year period. The trend in electricity consumption for the years 2020 and 2021 is decreasing. It can be assumed that, given the global circumstances, the world experienced a seismic event with the onset of the coronavirus pandemic in 2020-2021, which could contribute to the decline in the trend of electricity consumption.
- In the months of February-April 2021, floor 15 exhibited higher electricity consumption compared to floor 6. Floor 15 consists of 7 zones, while floor 6 has 6 zones. Electricity consumption above the average, when compared with other floors and zones, is observed in floor 6 zone D, floor 15 zone D, and floor 15 zone E. These three points contribute to 46.5% of the total electricity consumption during that period. January-February 2020 marked the highest electricity consumption in the two-year period. Upon reviewing the consumption per floor and per zone, it is evident that the usage is more evenly distributed across floors and zones. On floor 6, electricity consumption appears to be uniform across various zones. However, similar to the period of February-April 2021, floor 15 zones D and E exhibit high electricity consumption.
- 73.37% of the electricity consumption is used for air conditioning. The trend exhibited by the Estimated AC KWh is the same as the Actual Electricity KWh. Furthermore, when compared to the electricity costs, the trend will also be the same, as it is known that electricity costs are directly proportional to electricity consumption.

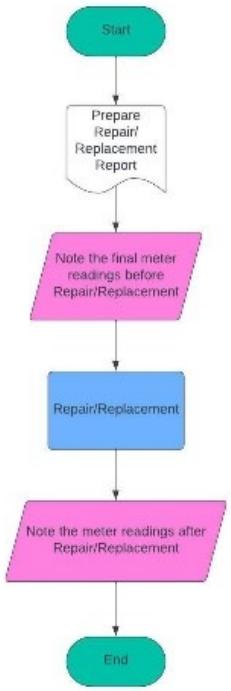
RECOMMENDATION

The recommended action pertains to controlling data recording. Two data outliers have been identified, which could potentially lead to losses for both the building and the electricity provider. The assumption regarding the cause of these two data outliers is that there might have been a meter replacement or the meter was reset to zero. It is necessary to implement a procedure to control these recordings. The following is a proposed workflow that can serve as a guideline for recording in subsequent periods.



Flowchart 4 Meter Readings Procedure

The Repair/Replacement report includes the report date, Initial Meter reading before the Repair/Replacement, and Final Meter reading after the Repair/Replacement. The format can be adjusted accordingly, but the report must contain these three elements. For subsequent Repair/Replacement procedures, a process is established to streamline the Repair/Replacement tasks and their documentation.



Flowchart 5 Repair/Replacement Procedure

It is hoped that these recommendations can be beneficial in streamlining work processes and minimizing both technical and non-technical error.