

IMPACT OF THE COVID-19 PANDEMIC ON ESTIMATING ELECTRICITY DEMAND AND SUPPLY IN LAMPUNG PROVINCE USING A SIMPLE LINEAR REGRESSION AND CORRELATION APPROACH

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ABSTRACT

This research was conducted to predict the effect of COVID-19 to the total of energy produced by the amount of electricity per capita. The amount of energy produced has the property of being an independent variable or can be affected and electricity consumption per capita has the nature of being an independent or influential variable. This research examines the effect of per capita electricity consumption on the total amount of energy produced in the Lampung region. The research was conducted using regression and correlation experiments. Regression research proves that there is no relationship between electricity consumption per capita and the total amount of energy produced. In contrast, in the linear correlation experiment, there is a correlation between electricity consumption per capita and the total amount of energy produced.

Keywords: Electrical energy, Regression, Correlation

1. INTRODUCTION

As we know, the need for electrical energy has increased along with population growth and technological developments. During this pandemic, it also had a significant impact on all aspects of life, including the energy sector, especially electrical energy. In the crisis situation caused by Covid-19, energy has become a primary need for a country. This increasing energy consumption is also accompanied by the development of activities (industry, transportation, offices, etc.) where each activity requires energy to drive it. In this research, the data we took came from the PLN Statistics Book for 2014-2018 regarding total energy produced and electricity consumption per capita for the Lampung region. This time we used 2 research methods, namely regression analysis and correlation analysis.

The aim of this research is to determine the effect of per capita electricity consumption on the total amount of energy produced in the Lampung region. Based on the context of the problem and the goals to be achieved, we designed the problem formulation as follows:

1. How does per capita electricity consumption affect the total amount of energy produced in the Lampung region?

2. METHODOLOGY

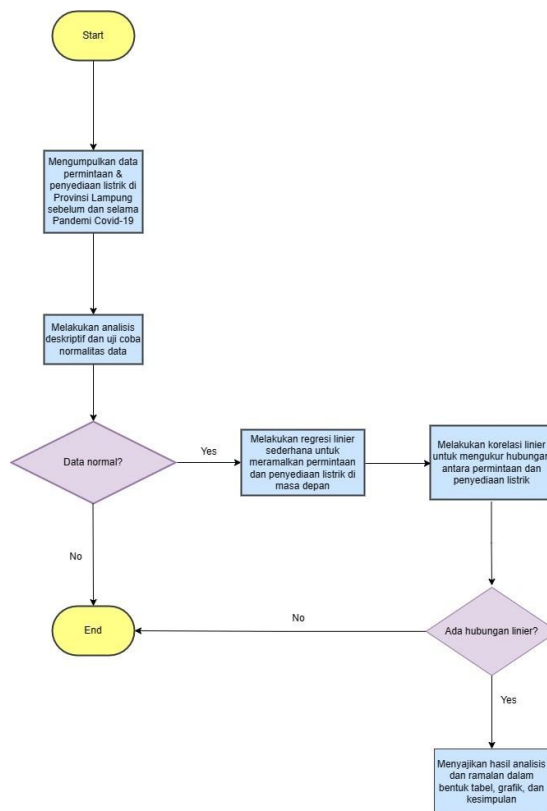


Figure 1: System work flowchart

In this research we use secondary data published by PLN for the 2014-2018 period as the data that we will process and 2019-2021 as data to compare the forecasts that we issue. And for sampling,

we took the total amount of energy produced and electricity consumption per capita in the Lampung region/province.

[1] This research was analyzed using the Simple Linear Regression and Correlation method.

1. Simple Linear Regression Equation

This analysis is used to study and measure statistical relationships occurs between two or more variables and is determined by an equation.

Simple Linear Regression Equation :

$$Y = a + b X$$

To find the values of a and b :

$$a = \bar{Y} - b \bar{X} \quad ; \quad b = \frac{n\sum xy - (\sum x)(\sum y)}{n\sum x^2 - (\sum x)^2}$$

2. Simple Linear Correlation Analysis To find the determinant coefficient:

$$r^2 = \frac{a(\sum y) + b(\sum xy) - n(y)^2}{\sum (y)^2 - n(y)^2}$$

To find the correlation coefficient:

$$r = \pm \sqrt{r^2}$$

Data Preparation (GWh) :

Table 1 : Data Preparation

Lampung	Total Amount of Energy Produced (y)	Per Capita Electricity Consumption (x)
Tahun 2014	0,17	0,0004227
Tahun 2015	0,13	0,0004399
Tahun 2016	0,13	0,0004656
Tahun 2017	0,18	0,0004823
Tahun 2018	0,3	0,0005057

3. RESULTS AND DISCUSSION

A. Data Processing

Table 2 : Data Processing

\bar{x} :	0,00046324
\bar{y} :	0,18200000
$\Sigma(x)^2$	0,00000536
:	
n:	5
b:	1502,218373
a:	-0,513887639
t:	3,182446
Sb:	858,5412155
RUt:	1,749733555
Interval	- 1230,04268413258 < B < 4234,479 43

B. Scatter Diagram

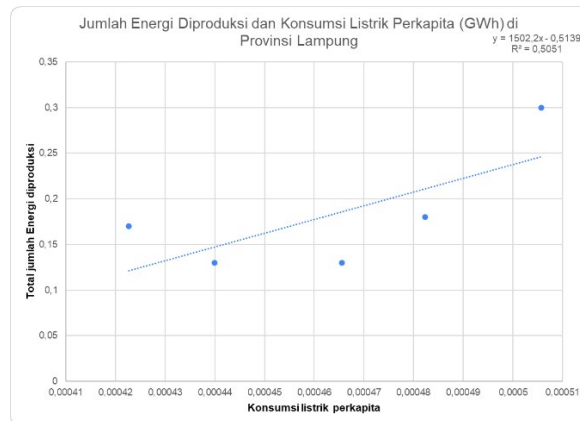


Figure 2 : Scatter Diagram

C. T Slope Test

A) hypothesis

$$H_0 : B = 0$$

$$H_1 : B \neq 0$$

B) $\alpha = 0,05 \rightarrow \frac{\alpha}{2} = \frac{0.05}{2} = 0,025$

C) The $t(0.025)$ distribution is used with
 $df = n - 2 = 5 - 2 = 3$

D) The limits of the two tailed test rejection area from the t distribution table, the critical limit is
 $= t_{cr} = 3,182446$

E) Decision Rules

Reject H_0 and accept H_1 if the standard difference between the sample slope (b) and the hypothesized population slope (BH_0) is less than $- 3,182446$ or more than $3,182446$. Otherwise, accept H_0 .

F) Test Ratio

$$S_b = 858,5412155$$

$$R_{ut} = 1,749733555$$

G) Decision-making

Because $R_{ut} = 1.749733555$ is in the limit value range $t_{cr} = 3.182446$, then $H_0 : B = 0$ is accepted. This means that the initial hypothesis states that there is no relationship between X (Per Capita Electricity Consumption) and Y (Total Amount of Energy Produced). The above conclusion can also be strengthened by determining the estimated interval for the B value with a 95 percent confidence level as follows: $b - t(S_b) < B < b + t(S_b)$ -
 $1230.04268413258 < B < 4234.47943$

D. Prediction Data Range for 2019, 2020, 2021 (GWh)

Table 3 : Data Preparation

Lampung	Increase in consumption per capita (3.08%/year)	Estimated consumption/capita (x)	Estimated electricity production (y)
2019	1,55756E-05	0,000521276	-0,4905
2020	1,60553E-05	0,000537331	-0,4897
2021	1,65498E-05	0,000553881	-0,4890
Total		0,001612487	-1,4693

Table 4 : Results of Regression and Correlation Analysis

\bar{x} :	0,000537496
\bar{y} :	-
$\Sigma(x)^2$:	2,60011E-06
n:	3
b:	44,88584196
a:	-
The rate of increase in consumption/capita	3,650676547

Table 5 : Estimation Results

Intervals Estimated Energy Produced	Lower	Upper
2019	-3,636745848	2,655766355
2020	-3,636025193	2,65648701
2021	-3,635282342	2,657229861

Looking at the consumption/capita calculation data for 2019-2021 and data from PLN Lampung Region statistics, the calculated consumption/capita is greater than the consumption/capita in the PLN statistical data. This also occurs in data on the amount of electrical energy production (in GWh units), for the total amount of electrical energy production in 2019 of -0.490489747 GWh is still within the predicted range, namely around $-3.636745848 < y < 2.655766355$, and also applies to 2020 and 2021 with the interval values obtained for each year.

This means that the alternative hypothesis states that there is a slope in the regression line for population as well as a regression relationship which means that there really is a relationship

between the consumption/capita (kWh) variable and electricity production.

Table 6 : Correlation Coefficient Results

R ²	0,505078514
R	0,71068876

The correlation or relationship between the two variables x and y tends to be weak because the R (correlation coefficient) is not too close to 1 or -1, namely 0.71068876

4. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on regression analysis and simple linear correlation for the Lampung region/province, we can conclude that the amount of electricity consumption per capita, which is variable x, influences the amount of energy produced by variable y, although it tends to be weak.

Recommendations

- Ensure that the data sources used in research are valid and reliable.
- Make sure to be careful when calculating data.
- Check again whether the data that has been processed is in accordance with the formula used or not.
- Make sure the units of each data match and are the same as specified.

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