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Relationship between Socio-economic Factors and Electrical Energy Consumption of Customer Groups in Indonesia

[1]Muhammad Saleh Mire, [2]Rachmad Budi Suharto

[1]Faculty of Economics and Business, Mulawarman University
[2]Faculty of Economics and Business, Mulawarman University.

Abstract
The research aim was to study Socio-Economic Analysis and its Relationship with Electrical Energy Consumption of Customer Groups in Indonesia using secondary data from 2018-2022 covering 34 provinces in Indonesia. Data sources generally come from Central Bureau of Statistics (BPS) and State Electricity Company (PLN) Indonesia.
The results of the analysis show that GDP per capita, education and MSMEs have a significant negative influence on poverty in Indonesia. Furthermore, GDP per capita is the only variable that has a significant positive effect on electricity consumption, while education, MSMEs and poverty have no effect on residential electricity consumption.
In the industry group, all variables have a significant effect on household consumption, except for education which has an insignificant effect, GDP per capita and MSMEs have a significant positive effect on electricity consumption, apart from that, education and poverty also have an effect but are not significant in the Business group. The research results also show that poverty does not have a significant impact, but GDP per capita, education and MSMEs have a significant positive influence on social electricity consumption. Furthermore, in the Government Office Buildings (GOB) group, GDP per capita and MSMEs have a significant positive effect, however, education and poverty do not have an influence on electricity consumption in this group. Finally, in the Public Street Lighting (PSL) group, GDP per capita, MSMEs and poverty have no effect, but MSMEs have an influence on electricity consumption.

Keywords: GDP per capita, Electrical energy consumption, Customer Group, MSMEs, Poverty, Education

1. Introduction

The world currently has 8.8 billion inhabitants due to natural population growth, which means energy use is also increasing. Likewise, the progress achieved in development began with the industrial revolution which triggered industrial growth in all sectors, making energy use also increase, especially electrical energy. Changes in the economic structure from primary to non-primary sectors can be seen from the increasing number of industrial companies developing in Indonesia today. This will have an impact on changes in electrical energy consumption. The increasing electricity consumption is due to a tendency to increase activity in the non-primary sector, namely industrial activities which tend to consume more electrical energy compared to activities in the primary sector[1]. Furthermore [2] states that individuals have to live with little or no access to electricity in some parts of the world which encourages decision makers to take major action in increasing access to electricity globally. This action is important considering the fact that modern energy consumption accelerates economic growth, reduces inequality, poverty, as well as environmental pollution and solid fuel consumption.

The development of electricity will indirectly improve people's standard of living and can stimulate economic growth in a reciprocal manner to the growth in electricity demand itself. Things that generally cause difficulties in providing electricity, especially for rural areas, include the condition of villages being isolated and far from generating centers and electricity networks, the lack of energy resources for

electricity, the lack of good enough road access for transportation of materials, electricity and fuel, and the small and scattered population make the electrical energy supply program very uneconomical[3]. Furthermore, it states that the electrification ratio has not yet reached 100%, but has reached 99.74% in 2023). This ratio, consisting of the electrification ratio (RE) reached 99.78%, while the village electrification (RD) ratio was 99.83%. The government continues to strive for fulfillment of RE and RD until it reaches 100%, to realize justice for all Indonesian people. In 2023, 98.32% of electricity will come from PLN electricity, and the remaining 1.46% will come from non-PLN electricity, such as from Energy Saving Solar Light (LTSHE) programs, as well as programs from other Ministries using Solar Power Plants. (PLTS) for remote areas[4]. Furthermore, the availability of electricity can be used to improve the quality of life, especially through education. The use of electrical energy in education can facilitate access to information and use of technology so that it can improve the quality of education itself.

Electricity is a very important need for everyone and has become a basic need for society because almost every community activity is very dependent on the availability of electrical energy. All types of social groups, both upper class and lower class society and entrepreneurs need electrical energy to carry out their activities. Electrical energy is a very important energy source for human life, both for industrial activities, commercial activities and in daily household life. Electrical energy is needed to meet lighting needs and also production processes involving electronic goods and industrial tools or machines. In the future, the need for electricity will continue to increase along with the increase and development in terms of population, investment, technological developments including the development of the world of education for all levels of education, even the electrical energy that can be obtained from non-fossil sources shows that Today this energy is increasingly needed. This means that oil production in Indonesia continues to decline because production wells are generally old. Therefore, it is important for every individual to save or be energy efficient to overcome the problem of decreasing energy reserves, namely by using a method used to efficiently use electrical energy by conserving energy[5].

Electrical energy is an input for various production activities that will produce goods and for consumption. This shortage and inability to use electrical energy can have an impact on poverty. Electrical energy is also closely related to people's ability to access the internet, so the role of electricity can also be a means of alleviating poverty. Therefore, the government continues to strive to supply electrical energy to meet growing demand with the development of the processing and refining industry (smelter). There are 52 smelter industries that will be built with electricity needs reaching 4,789 Giga Watt[6]. The electric vehicle battery factory that has been built is a manifestation of the government's seriousness in down streaming the nickel industry, which is the raw material for the battery industry. This can increase investment in other industries such as motorbikes and electric cars because there is a link between industries[7].

Electrical energy consumption is a key variable because of its relationship to economic activity and development. Electrical energy plays an important role in economic development and is an important factor that supports people's welfare[8]. Nowadays electricity is classified as a basic need used by four groups of electrical energy users. These groups are household, industrial, business and general groups. Electrical energy is a very important energy source for human life, both for industrial activities, commercial activities and in daily household life. Electrical energy is needed to meet lighting needs and also production processes involving electronic goods and industrial tools or machines. Meanwhile, according to the State Electricity Company, per capita electricity consumption in Indonesia in 2020 reached 1.09 MWH and in 2021 it amounted to 1.11 MWH; This means there will be an increase of 1.83%, then in 2022 electricity consumption will reach 1,173 MWH or an increase of 6.30% from the previous year and finally in 2023, consumption will reach 1,285 MWH or an increase of 9.54%. This is in accordance with Keynes' theory which states that when income increases, consumption will increase[9]. Apart from that, the increase in per capita income also has an impact on improving people's welfare. People can access education, health care and better infrastructure. The quality of life will increase and there is the potential to reduce the level of poverty which is still a social problem in Indonesia.

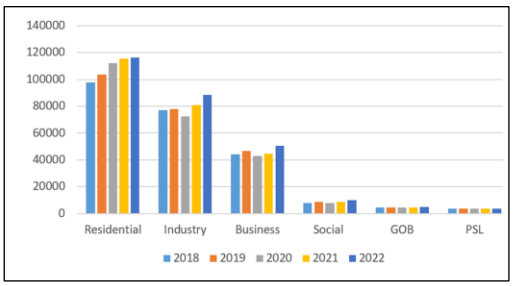


Figure 1. Development of Electricity Consumption (Gwh) in Indonesia

Nowadays electricity is classified as a basic need used by four groups of electrical energy users. These groups are household, industrial, business and general groups. Electrical energy is a very important energy source for human life, both for industrial activities, commercial activities and in daily household life. Electrical energy is needed to meet lighting needs and also production processes involving electronic goods and industrial tools or machines. Thus, electricity consumption is closely related to per capita income, where Keynes stated that income determines consumption that is, if income increases, consumption will also increase, including electricity consumption. The development of electrical energy according to customer groups can be seen in Figure 1

It was states that per capita income in Indonesia increases every year, while the rate of per capita income fluctuates every year [10]. Per capita income in Indonesia increased in 2020 by US$ 3,912 while in 2021 it reached US$ 4, 291 or an increase of 9.69%. Furthermore, in 2022 it will reach US$ 4,783.9 or an increase of 11.47% and in 2023 it will reach US$ 5,108 or an increase of 6.77% compared to the previous year. Increase in per capita income in 2023 accompanied by an increase in electricity consumption. If we observe the pattern of change, the increase in nominal and real per capita income in Indonesia has almost increased from year to year. The increase in real per capita income shows two things, namely: (1) an increase in the production of goods and services that exceed the increase in the general price level, and (2) an increase in real income that exceeds the increase in population.

One of the important sectors that uses the most electrical energy is MSMEs because they have a large quantity. This sector has a strategic role in improving the country's economy. This can be seen from the large number of workers working in this sector, the high contribution to the formation of the national economy's gross domestic product (GDP), and helping to reduce public unemployment. And this sector has proven its resilience in facing the economic crisis that hit the Indonesian economy when many large companies went bankrupt. Furthermore that MSMEs are still faced with fundamental problems which generally include: 1) the difficulty of MSMEs accessing the market for the products they produce, 2) still weak business development and strengthening, 3) limited access to resources of financing from formal financial institutions, especially from banking[11].

The role of MSMEs in economic development is very strategic because they provide the largest contribution, as stated by [12] the research team said that the majority or 99% of businesses in Indonesia are at the MSME level. MSMEs themselves contribute 61.9% to the total gross domestic product (GDP) and absorb approximately 97% of the local workforce so that they can be used as a means of alleviating poverty. Other researchers also expressed the same thing, who stated that micro and medium industries contribute to job growth and increase people's [13]. Thus, an increase in the quantity of MSMEs can cause energy demand, especially electrical energy because basically MSMEs, like other large companies, have production factors that will produce output which has an impact on increasing energy demand, including electrical energy.

The development of education can be seen from the quality of education itself. Measuring the quality of education in Indonesia can be done using the average length of schooling of the Indonesian population. In 2020 the average length of schooling has reached 8.48 years and in 2022 it has reached 8.77 years. This fact shows that in the period there was an increase of 0.29 years or only an increase of 0.10 years every year or 1.2 per month. Meanwhile, Singapore has the longest average length of school compared to other ASEAN countries, namely 11.5 years. The next country is Malaysia with an average length of schooling of

10.2 years. Apart from that, the Philippines has an average length of schooling of 9.3 years. Meanwhile, in Indonesia, the average length of school is 8 years. Below Indonesia are Thailand (7.6 years), Laos (5.2 years), Myanmar (4.9 years), and Cambodia (4.8 years) [14]. So the quality of shooting in Indonesia within the scope of ASIAN cannot be said to be low even though it is still below Singapore, Malaysia and the Philippines

Another problem that arises is the occurrence of poverty both in urban areas and in rural areas. The number of poor people in March 2023 was 25.90 million people, a decrease of 0.46 million people compared to September 2022 and a decrease of 0.26 million people compared to March 2022. Furthermore, the percentage of poor people in March 2023 was 9. 36 percent, decreasing 0.21 percentage points in September 2022 and decreasing 0.18 percentage points in March 2022[15]. The development of the poor population is in contrast to GDP per capita which always increases every year. Poverty is a fundamental problem for countries in the world, especially in developing countries, one of which is Indonesia. For Indonesia, problems related to poverty are not something new. Almost all periods of government in Indonesia stated that poverty was a development problem[16]. Poverty is a situation where a person or group is unable to meet their daily needs for food, clothing and shelter. Poverty has an impact on the low standard of living of the population in meeting their limited needs. Many people live below the poverty line, and quite a few people's incomes are quite low.

Based on the background and objectives that have been discovered, a framework of thought can be created (Figure 2).

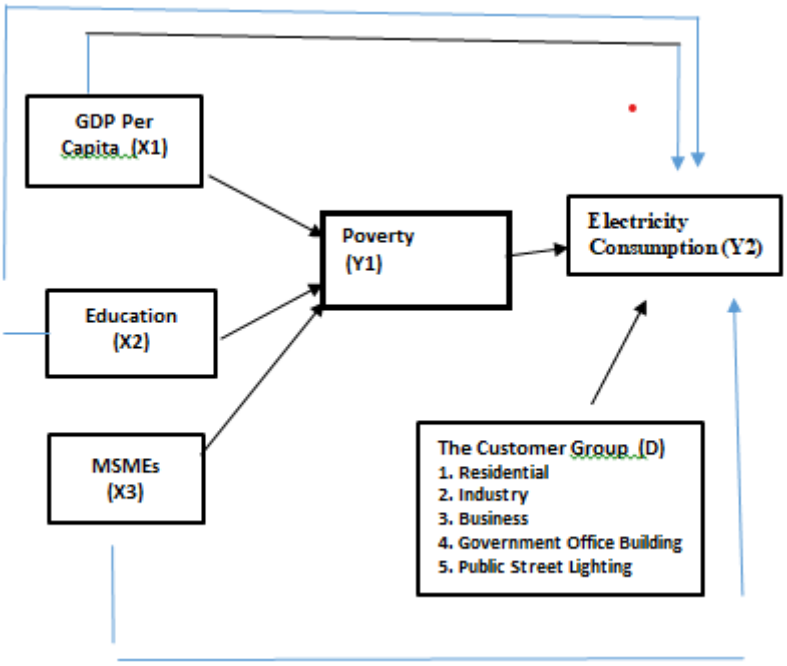


Figure 2. Framework

Based on the introduction and framework of thought that has been expressed, this research will provide information and study in depth about electricity consumption in Indonesia which includes:

1. Development of electricity consumption for electricity customer groups in Indonesia
2. Differences in the influence of GDP per capita on poverty and electricity consumption for customer groups
3. Differences in the influence of education on poverty and electricity consumption for customer groups
4. Differences in the influence of MSMEs on poverty and electricity consumption for customer groups
5. The effect of poverty on electrical energy consumption for customer groups

2. Literature Reviews

2.1. Consumption Function

It is commonly known that Keynes has developed a function called the consumption function which states that the Marginal Propensity to consume, MPC is in the interval 0 and 1, indicating that the increase in income is proportional to the increase in consumption. Keynes's consumption function is a short-term function because minimum consumption expenditure can only be financed with savings or wealth that has

been accumulated and cannot be carried out in the long term because it will run out and this form of consumption is often obtained from interpretation with statistical figures in the short term. Meanwhile, the long-term consumption function developed by Kuznet is characterized by the APC not decreasing, but being constant. In the long term, the value of Average Propensity to Consume (APC) does not change much and tends to remain constant, so that long-term consumption is a straight line starting from zero.

Industry; Business; Social; Government office buildings and public street lighting. However, each of these groups can be influenced by factors like GDP per capita, education, MSMEs and poverty as per the analysis model that has been proposed. Apart from that, electricity consumption can also be influenced by economic growth. Based on the Granger Causality Test, there is a bidirectional causality relationship between the electric power consumption and the economic growth[17]. Thus GDP per capita can also influence electricity consumption.

2.2. Education

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential [18]. The challenge facing many developing countries is to incorporate these aspects of sustainable development into the curriculum in an effective way, from primary to tertiary level.. The level of education in Indonesia can be measured by years of schooling. According to Central Bureau of Statistics' data, the average length of school for the Indonesian population in 2017 was 8.1 years and in 2020 it rose to 8.9 years and in 2022 it will reach more than 9 years or to be precise, 9.03 years. This fact shows that education as measured by years of schooling is not affected by the pandemic which started in 2020. This increase in education, which consistently increases every year, is expected to have an impact on reducing unemployment and encouraging economic growth, including the manufacturing industrial sector.

Robelo, 1991, pendidikan atau human capital merupakan salah satu dari investasi sumber daya manusia yang dapat mendorong pertumbuhan ekonomi, Konsep ini diberi nama dengan pertumbuhan eksogen yang merupakan pengembangan dari teri pertumbuhan endogen yang dikemukakan oleh Solow-Swam[19]. Selanjutnya Investing in education can create a highly skilled workforce that can better understand the needs of businesses, design solutions tailored to those needs, and increase overall productivity. Education inspires creativity, expands knowledge, encourages cognitive skills, and develops problem-solving abilities [20].

2.3. Poverty

The concept of poverty is multidimensional. Sida divides poverty into 4 dimensions, namely: Resources, power and voice, opportunity and choice and human security[21].So the problem of poverty is not only in the form of material fraud but also other dimensions. Poor people are individuals who do not have sufficient income and consumption to lift them from the minimum adequate level. So in short, poor people are those who live below the poverty line, which is determined by a national or international institution[22]. So understanding of poverty covers not only economics, but has expanded to cover various aspects of life, including other social dimensions, such as health, education and even entering the political dimension, although the definition of poverty is the inability to meet minimum standards of needs, both food and non-food. This kind of poverty is also called absolute poverty which is contrasted with relative poverty. Apart from that, Indonesia is known for structural poverty and temporary poverty. Structural poverty is certainly worse than temporary poverty, because in this type of poverty it is difficult to get out of poverty, because it has become chronic (chronic poverty) which is characterized by deprivation, discrimination, and living in areas that do not support the improvement of life [23].

Poverty is a frightening condition for developing and developed countries, because poverty can hit every country and region. Poverty is a situation where humans are unable to meet basic needs such as food, clothing, shelter, education and health[24]. Poverty is a problem of closed access to various opportunities for productive resources, including capital, natural resources and even jobs opportunities[25]. Poverty in Indonesia is still one of the main problems in development, even though the number of poor people in Indonesia is decreasing every year both in terms of numbers and in terms of percentage.

3. Methodology

This type of the research is quantitative, take the type of study of comparative causality that processes numerical data that can be calculated using statistical formulas . The data analysis technique used in this study is path analysis which estimates of the direct and indirect influence of exogenous variables on endogenous variables. This study uses secondary data, namely data that is already available and collected by other parties and it was panel data. The data was taken from the Indonesia Central Statistics Agency (BPS Jakarta) which covers 34 provinces in Indonesia. The data used is 2018-2022 with electrical energy consumption grouped into 6 groups, namely: Residential, Industry, Business, Social, Government Office Buildings (GOB) and Public Street Lighting (PSL), using the AMOS statistical program package.

Based on the conceptual relationship in the framework of thinking, mathematically functional relationships can be written as

$Y_1 = f(X1,X_2,X_3)$…..(1)

$Y_2 = f(X,X2, X3, Y_1, D1,D2, D3, D4, D5)$ …(2)

Whereas:

Y1 = Poverty (poverty percentage for each province)

Y2 = Electrical energy consumption (expressed by Gwh)

X1 = Per capita PDB (added value of all sector Economy divides by number of population)

X2 = Education (the average length of schooling of the population aged 15 years and over)

X3 = MSMEs (number of the manufacturing industry sector)

D = Dummy variable

Based on equations (1) and (2), the structural equation can be rewritten:

$$Y_1 = \alpha_0 + \alpha_1 \ln X_1 + \alpha_2 X_2 + \alpha_3 \ln X_3 + \mu_1 \quad \text{.....(3)}$$

$$\ln Y_2 = \beta_0 + \beta_1 \ln X_1 + \beta_2 X_2 + \beta_3 \ln X_3 + \beta_4 Y_1 + \beta_5 D_1 + \beta_6 D_2 + \beta_7 D_3 + \beta_8 D_4 + \beta_8 D_5 + \beta_9 D_1 \ln X_1 + \beta_{10} D_2 \ln X_1 + ... + D \quad \text{.....(4)}$$

Substituting the value of dummy variable

Regression Equation for Residential (group 1): $D_1 = \begin{cases} =1 \\ =0, \ \textit{the others} \end{cases}$

$$\ln Y_2 = (\beta_0 + \beta_5) + (\beta_1 + \beta_9) \ln X_1 + (\beta_2 + \beta_{10}) X_2 + (\beta_3 + \beta_{11}) \ln X_3 + (\beta_4 + \beta_{12}) Y_1 + \mu_1 \ldots (5)$$

Regression Equation for industry (group 2) $D_2 = \begin{cases} =1 \\ =0, \ \textit{the others} \end{cases}$

$$\ln Y_2 = (\beta_0 + \beta_6) + (\beta_1 + \beta_{10}) X_1 + (\beta_2 + \beta_{11}) X_2 + (\beta_3 + \beta_{12}) \ln X_3 + (\beta_4 + \beta_{13}) Y_1 + \mu_2 \ldots (6)$$

Regression Equations for business (group 3) $D_3 = \begin{cases} =1 \\ =0, \ \textit{the others} \end{cases}$

$$\ln Y_2 = (\beta_0 + \beta_7) + (\beta_1 + \beta_{11}) X_1 + (\beta_2 + \beta_{12}) X_2 + (\beta_3 + \beta_{13}) \ln X_3 + (\beta_4 + \beta_{14}) Y_1 + \mu_3 \ldots (7)$$

Regression Equation for social (group 3): $D_4 = \begin{cases} =1 \\ =0, \ \textit{the others} \end{cases}$

$$\ln Y_2 = (\beta_0 + \beta_8) + (\beta_1 + \beta_{12}) X_1 + (\beta_2 + \beta_{13}) X_2 + (\beta_3 + \beta_{14}) \ln X_3 + (\beta_4 + \beta_{15}) Y_1 + \mu_3 \ldots (8)$$

Regression Equation for Government Office Buildings (group 5): $D_5 = \begin{cases} =1 \\ =0, \ \textit{the others} \end{cases}$

$$\ln Y_2 = (\beta_0 + \beta_5) + (\beta_1 + \beta_{13}) X_1 + (\beta_2 + \beta_{14}) X_2 + (\beta_3 + \beta_{15}) \ln X_3 + (\beta_4 + \beta_{16}) Y_1 + \mu_3 \ldots (9)$$

Regression Equation for Public Street Lighting (group 6) $D_6 = \begin{cases} =1 \\ =0, \ the\ others \end{cases}$

$$\ln Y_2 = (\beta_0 + \beta_6) + (\beta_1 + \beta_{14})X_1 + (\beta_2 + \beta_{15})X_2 + (\beta_3 + \beta_{16})\ln X_3 + (\beta_4 + \beta_{17})Y_1 + \mu_3 \ldots (10)$$

4. Results and Discussion

4.1. Model fit test

Chi-square statistic, as stated earlier, is the most fundamental test to measure overall fit, it is very sensitive to the size of the sample used. The model is considered good if the Chi-square value is small. The smaller the value, the more feasible the research, meaning that the more it describes the match between the variance of the sample taken and the research population. The results of data processing that have been carried out using the AMOS 18 program are as shown in Table 1.

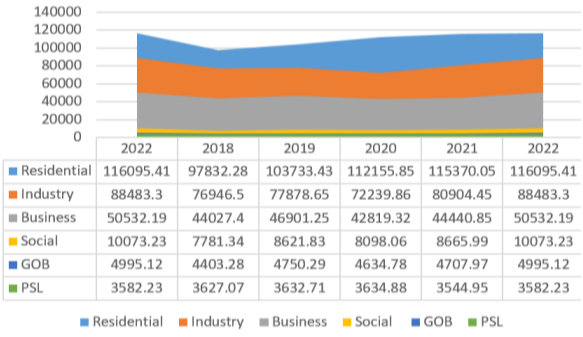
Tabel 1. Goodness of Fit Index

No.	Goodness of fit Measure	Cut-off Criteria	Estimation (cut off Value)	Fit Situation
1	Chi-Square (χ^2) Significance Probability (p)	smaller the better ≥ 0.05	2.380 0.882	Fit
2	RMSEA (the Root Mean Square Error of Approximation)	≤ 0.05	0.000	Fit
3	NFI (Normed of Fit Index)	≥ 0.95	0.997	Fit
4	IFI (Incremental Fit Indices)	≥ 0.95	1.005	Fit
5	CMIN/DF (the minimum Sample Discrepancy Function)	≤ 2.00	0.397	Fit
6	TLI (Tuckler Lewis Index)	≥ 0,95	1.053	Fit
7	CFI (Comparative Fit Index)	≥ 0,95	1.000	Fit
8	Hoelter's Index	≥ 200	3211	Fit

Sumber: Malkanthie, 2015; Wan, 2002. and Amos Result

4.2. Research Findings

PLN, as has been stated, divides electricity customers into 6 groups, namely: 1. residential, 2. Industrial groups, 3. Business 4. Social, 5. Government Office Buildings or GOB and 6. Public street lighting or PSL. Electricity consumption fluctuates from year to year, consumed by 6 customer groups, namely: Households, Industry, Business, Social, Government Office Buildings (GOB) and Public Street Lighting (PSL).



	2022	2018	2019	2020	2021	2022
Residential	116095.41	97832.28	103733.43	112155.85	115370.05	116095.41
Industry	88483.3	76946.5	77878.65	72239.86	80904.45	88483.3
Business	50532.19	44027.4	46901.25	42819.32	44440.85	50532.19
Social	10073.23	7781.34	8621.83	8098.06	8665.99	10073.23
GOB	4995.12	4403.28	4750.29	4634.78	4707.97	4995.12
PSL	3582.23	3627.07	3632.71	3634.88	3544.95	3582.23

Figure 3. Development of Electricity Consumption According to Customers

Figure 3 shows the development of electricity consumption from 6 customer groups from 2018 to 2022. Electricity consumption for household groups in 2018 reached 97832.28 Gwh and in 2022 it has reached 116095.41 Gwh or an increase of 18263.13 Gwh or an increase on average for each year by 4565.78 Gwh, in other words, experiences an average annual growth of 4.67%. Furthermore, the second customer group, namely Industry, experienced growth of 3.75%, Business experienced growth of 3.69% while the Social group experienced 7.36% and GOP and PSL respectively had growth of 3.36% and -0.31%. The minus growth in electrical energy sold or electricity consumption in the PSL group occurred in 2020, which was the peak of Covid-19, and in 2021 and 2022 there has been a positive change but on average it is still minus.

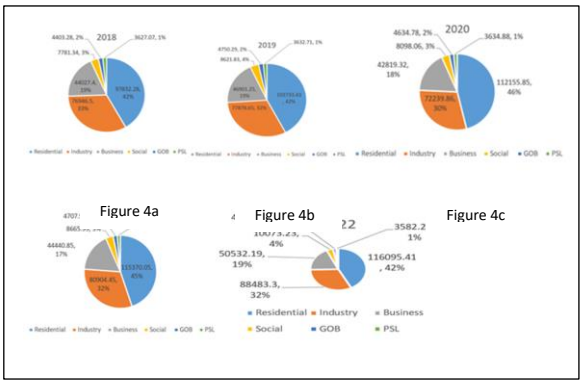


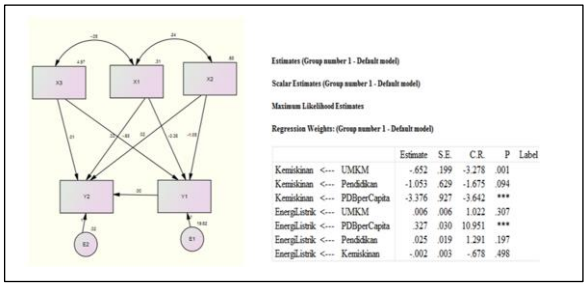
Figure 4d Figure 4e

Figure 4. Percentage Development of Electricity Consumption According to Customers

Figure 4 shows the percentage of electricity consumption from 6 customers, where from 2018 to 2022, households always have the largest electricity contribution or above 40%. In 2020 there was a sharp increase in consumption, reaching 46%, due to the influence of Covid-19 which caused residents to have to stay and work at home, thereby consuming more electrical energy, compared to other years. On the other hand, other groups, namely industry and business, actually experienced a decline in their contribution, while the GOP and PSL during that period had a constant contribution of 2% and 1% respectively.

Data processing and analysis using the AMOS statistical program package obtained results:

Group 1



Gambar 5. Residential Group 1
Resources: AMOS Data Processing

Based on Figure 5, a regression equation can be created as

$$\hat{Y}_1 = 65.21 - 3.38 \ln X_1 - 1.05 X_2 - 0.65 X_3 \quad \text{.....(11)}$$

$sig.$: 0.000 0.000 0.094 0.001

$$\ln \hat{Y}_2 = 3.42 + 0.327 \ln X_1 + 0.025 X_2 + 0.006 X_3 - 0.002 Y_1 \quad \text{.....(12)}$$

$sig.$: 0.000 0.000 0.197 0.307 0.498

The estimation results shown by the regression equation (11) state that GDP per capita has a very significant negative influence on poverty (P=0.000). If GDP per capita increases by 1% then poverty will decrease by 2.38%. This is in line with research conducted by [28] which states that per capita income is most strongly related to poverty reduction among the respondents, suggesting that improvement in per capita income among the respondents may be more critical for reducing poverty among the respondents. respondents in Nigeria. Furthermore the incidence of poverty is very sensitive to the changes in per capita income and inequality[29]. In the same equation it is also shown that education has a significant negative influence on poverty at the confidence level α = 0.10 with a coefficient of 0.025, stating that if education increases by one year, poverty will decrease by 0.03%. In more detail, education has a negative influence on the severity of poverty in Indonesia[30]. This is in accordance with research conducted by[31] in Thailand, which stated that Provinces with more educated populations are more likely to have lower poverty incidence, meaning that there is a strong relationship between increasing education and reducing poverty. Another variable is MSMEs which have a significant negative influence at the confidence level α= 0.05 on poverty. If MSMEs increase by 1%, it will have an impact in the form of reducing poverty by 0.65%. This is in accordance with the research which states that in general the MSMEs statistically affect poverty reduction in Indonesia both directly and indirectly[32].

Paying attention to household groups and equation 12, it is known that the influence of education, MSMEs and poverty on residential electricity consumption is not significant at the α= 0.05 level. The three variables, namely: Education, MSMEs and Poverty, have no influence on household electricity consumption because electricity consumption is almost evenly distributed with different levels of need. This is due to government electricity subsidies for households. The subsidized electricity tariff group includes household customers with 450 VA and 900 VA power from underprivileged communities who are included in the Integrated Social Welfare Data. In this way, all levels of society can enjoy electricity according to their needs. The amount of electricity subsidies received by household consumers of 450 VA and 900 VA power depends on the amount of electrical energy they use[33}. Furthermore, it is also known in the same equation that the GDP variable is the only variable that has an influence on household customers' electricity consumption. Of course, this is not questionable, especially from a theoretical perspective, Keynesian income influences consumption. In this case, changes can be seen taking into account the elasticity of electricity consumption for households of 0.33, meaning that if GDP per capita increases by 1% then household electricity consumption will increase by 0.33%. In general, this fact is in accordance with research[34] and[35]. which states that the income level is the most important variable influencing electrical energy consumption.

Group 2

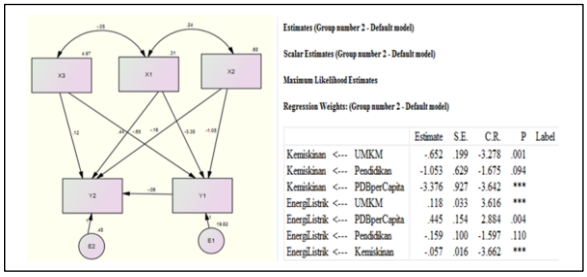


Figure 6. Industrial Group 2
Resources: AMOS Data Processing

Based on Figure 6, a regression equation can be created as follows

$$\ln \hat{Y}_2 = 8.57 + 0.445 \ln X_1 + 0.159 X_2 + 0.118 X_3 - 0.057 Y_1 \quad \text{.....(13)}$$
$$sig.: 0.000 \quad 0.004 \quad 0.110 \quad 0.000 \quad 0.000$$

The industrial group is one of the groups that has the highest electrical energy consumption value after households. This is understandable because industry requires relatively high energy in processing raw materials into semi-finished or finished goods. The results of the analysis or estimation show that the three variables, namely GDP per capita, MSMEs and poverty have a significant positive influence on electrical

energy consumption in Indonesia, but the influence of education is not significant on the level of confidence α=0.05. If GDP per capita increases by 1% it will cause an increase in electricity consumption of 0.44%; education causes consumption to increase by 0.16 per year, MSMEs cause consumption to increase by 0.12% while poverty causes electrical energy consumption to decrease by 0.06%. It is clear from this research that electricity consumption is closely related to per capita income. This is in accordance with Keynes's consumption function which generally states that consumption is positively determined by income, namely the higher the income, the higher the expenditure on consumption, including electrical energy consumption.

Group 3.

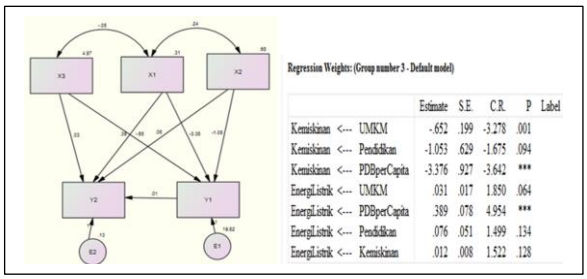


Figure 7. Business Group 3
Resources: AMOS Data Processing

Paying attention to Figure 7, the regression equation can be created as

$$\ln \hat{Y}_3 = 8.57 + 0.445 \ln X_1 + 0.159 X_2 + 0.118 X_3 - 0.057 Y_1 \quad \text{.....(14)}$$

sig.: 0.000 0.000 0.134 0.064 0.128

Equation 14 shows that in the business group only per capita income has a significant positive influence on electrical energy consumption at the confidence level α=0.05. However, at α=0.10, MSMEs have a significant influence on the electricity consumption of the Business customer group. In this group, it can be seen that education has no influence on electrical energy consumption. One of the things that can cause this is that the group consists of mostly MSMEs with low workforce. The performance of women-owned MSMEs is not directly impacted by digital transformation. It does have an impact on innovation and competitive advantage [36].

Group 4

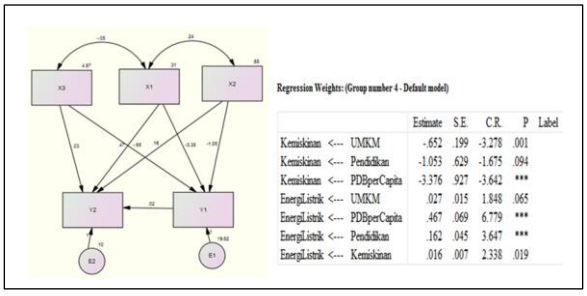


Figure 8. The Social Group 3
Resources: AMOS Data Processing

The Social Group referred to is the Social Group electricity customers who use electrical energy which is expressed by the number of Gwh sold from PLN for this group. The estimation results are expressed mathematically as $\ln \hat{Y}_4 = 8.57 + 0.467 \ln X_1 + 0.162 X_2 + 0.027 X_3 + 0.016 Y_1$ ....(15)

$sig.: 0.000 \quad 0.000 \quad 0.000 \quad 0.065 \quad 0.128$

The facts show that the influence of per capita income and education on electricity consumption in this group is very real at the confidence level α= 0.05. Meanwhile, MSMEs have an influence at α= 0.10. This social group provides an overview of the level of community welfare, where educational social institutions, community institutions and so on are a forum for fostering the development of human resources which can be influenced by the income of the community as a whole. Meanwhile, MSMEs have an influence on the electricity consumption of social groups because an increase in the number of MSMEs will absorb labor, thus having the impact of increasing the income of the MSMEs themselves. Furthermore, the increase in MSME income will have an impact on society's income as a whole because MSMEs are the business group that contributes the largest contribution to national income, including the income of the electricity customer group. Furthermore, in the same equation it can be seen that poverty has no influence on electricity consumption. Facts show that poverty has no influence on social groups' electricity consumption. This is because apart from household customers 450-900 VA, the government also provides electricity subsidies to all social customer groups which include places of worship and schools classified as S1, S2 and S3.

Group 5

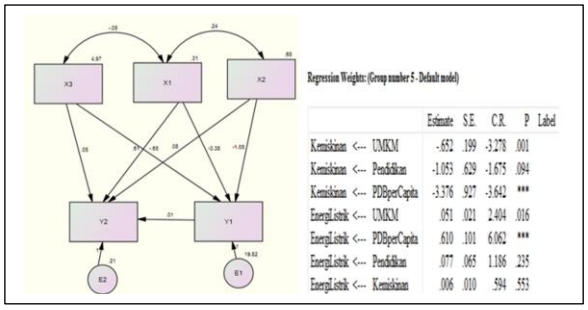


Figure 9. Group 5 Government Office Building
Resources: AMOS Data Processing

Based on Figure 8, an equation can be made as follows $\ln \hat{Y}_5 = 1.56 + 0.445 \ln X_1 + 0.159 X_2 + 0.118 X_3 + 0.006 Y_1$

$sig.: 0.174 \quad 0.000 \quad 0.235 \quad 0.016 \quad 0.553$

…(16)

Paying attention to the regression equation (16), it is known that GDP per capita and MSMEs have a significant influence on electricity consumption in Government Office Buildings at a confidence level of α= 0.05. From this equation it is known that if GDP per capita increases by 1%, the customer's electricity consumption will increase by 0.45% while MSMEs will increase by 0.02%. Furthermore, education and poverty do not have an influence on consumption of Government Office Buildings. Another thing that GDP per capita has an effect on consumption is because if PDR increases, it means that people's capacity will also increase, causing the government to be able to add government facilities and infrastructure which will cause an increase in demand for electricity consumption, while MSMEs have a significant positive influence because an increase in MSMEs means an increase in objects and tax subject so that government or state income will increase which can be used to improve physical facilities and human resources in an effort to improve services to the community. Meanwhile, education and poverty do not have an influence on the consumption of this group. Poverty does not have an impact because poverty is accompanied by subsidies so that it has no impact on increasing electricity demand or consumption for this group.

Group 6 Gambar 10. Penerangan Jalan Umum Group 6

Resources: AMOS Data Processing

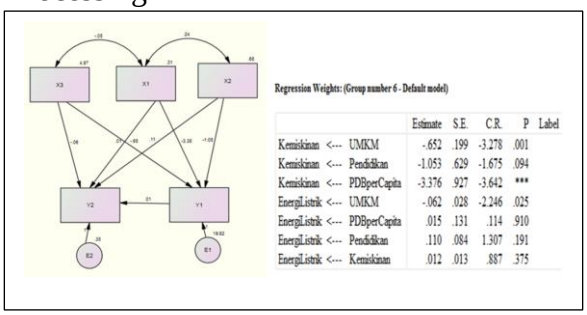


Figure 10. Group 5 Government Office Building
Resources: AMOS Data Processing

Based on Figure 10, a regression equation can be created

$$\ln \hat{Y}_6 = 9.227 + 0.445 \ln X_1 + 0.159 X_2 + 0.118 X_3 - 0.057 Y_1 \quad \text{.....(17)}$$
$$sig.: 0.000 \quad 0.910 \quad 0.191 \quad 0.025 \quad 0.375$$

Equation 17 shows that at the confidence level α= 0.05, of the four independent variables included in the model, only MSMEs have a significant positive influence on electricity consumption in the Public Street Lighting group. Street Lighting Tax can be a tool to increase public awareness of the importance of efficient and environmentally friendly energy use. Local governments can allocate a portion of tax revenue for the procurement of energy-saving lamps and the implementation of environmentally friendly technology. The three independent variables have no effect on the consumption of this group due to savings made by the regional government in 2020, where in 2021 there was an increase of 0.61% and in 2022 there was actually a sharp decrease of 10.67%. Meanwhile, MSMEs are not affected by the impact of Covid-19 which has hit the world, including Indonesia, so that MSME capacity in 2022 will also experience a decline.

5. **Conclusion and Recommendation**

5.1. Consolation

Based on the analysis and the results of the previous discussion, the following conclusions are drawn:

1. The results of data analysis show that GDP per capita, education and MSMEs have a significant negative influence on poverty in Indonesia
2. GDP per capita is the only variable that has a significant positive effect, while education, MSMEs and poverty have no effect on residential electricity consumption
3. In the industrial group, all variables have a significant effect on household consumption, except for education which has an insignificant effect
4. GDP per capita and MSMEs have a significant positive influence on electricity consumption, apart from that education and poverty also have an influence but are not significant in the Business group,
5. Poverty does not have a significant impact, but GDP per capita, education and MSMEs have a significant positive influence on social electricity consumption.
6. GDP per capita and MSMEs have a significant positive effect, however, education and poverty do not have an influence on electricity consumption in Government Office Buildings.
7. GDP per capita, MSMEs and poverty have no effect, but MSMEs have an influence on the electricity consumption of Public Street Lighting customers..

5.2. Recommendation

The suggestions to be put forward based on the discussion and conclusions that have been stated, among others:

1. The government should carry out projections of electrical energy consumption by paying attention to developments in GDP and population because they are the dominant influencing factors, to address excess or shortage of electrical energy supply for all electricity consumption groups
2. There are electricity consumption groups that still have a minus average growth, so it is best to pay attention and make efforts to increase the quantity of consumption for the Public Street Lighting group.
3. In an effort to increase electricity consumption for social groups and industrial groups, efforts should be made to improve the quality of human resources, especially through increasing the number of years of schooling
4. Even though the percentage of poverty has decreased in the last 2 decades, the government should continue to make efforts to eradicate poverty because it turns out that poverty has a negative influence on electricity consumption
5. The contribution of the customer group for Government Office Buildings and Public Street Lighting is still very small compared to other groups, so it is recommended to increase the contribution of these two sectors so that very high inequality can be controlled because both sectors are closely related to the welfare of society in general.

References

1. Rosadi, Mutia and Anwar B., Syamsul. 2019. Factors that Influence Electricity Consumption in Indonesia. Journal of Economic and Development Studies, Volume 1, Number 2, May 2019, Pages 273 – 286
2. Iniwasikima, D, P, & Ufot, C, U (2013) "The determinants of electricity access in Sub-Saharan Africa" Department of Economics, University of Ibadan,Vol 2, Issue 4[2
3. State Electricity Company. 2015. Electricity Supply Business Plan 2015-2024. PT PLN. Jakarta
4. Ministry of Energy and Mineral Resources, 2023. Handbook Of Energy & Economic Statistics Of Indonesia (HEESI). Jakarta
5. Presidential Instruction No. 13, 2011 and Government Regulation (PP) number 70 of 2009, Jakarta.
6. Ministry of Energy and Mineral Resources, 2021. Handbook Of Energy & Economic Statistics Of Indonesia (HEESI). Jakarta
7. Miller, R. E. and Blair, P. D. 2009. Input-Output Analysis : Foundations and Extensions. Cambridge University Press. All rights reserved. London.
8. Han, Sang-Yong (2004)"The Role of The Four Electric Power Sectors in The Korean National Economic" Energy Police, 136-701.
9. Branson, William H. 1992. Macroeconomics Theory and Policy. Hopper & Row Publishers, Singapore.
10. Bappenas. 2020. The National Medium Term Development Plan For 2020-2024. Jakarta.
11. Wijono, Wiloejo Wirjo. 2005. Empowering Microfinance Institutions as One of the Pillars of the National Financial System: Concrete Efforts to Break the Chain of Poverty. Economic and Financial Studies. Special Edition November 2005 pp. 86-100
12. Andriani, Fenny et all. 2021. The Policy of Cooperative and Small and Medium Enterprises Office inImproving Cooperative Achievement in Lampung Province. Administrative and Environmental Law Review, University of Lampung, under a Creative Commons Attribution-Share Alike 4.0 International License.
13. Latifi et al.. 2012. The Role of Micro And Medium Industries In Rural Sustainable Development: Case Of The Villages Around Sanandaj City. International Journal of Agriculture, 2 (3), 141-148.
14. Ministry of Education, Culture and Research and Technology, 2023. Actively Participated in the 46th SEAMEO HOM.
15. Central Statistics Agency, 2023. Statistical Year Book, 2023. ISSN/ISBN : 0126-2912. Nomor Publication Number : 03200.2303. Jakarta
16. Suhandi, N. et el. 2018. Analysis of the Influence of Population on the Number of Poverty Using the Linear Regression Method in Palembang City. Global Informatics Scientific Journal. DOI:10.36982/jig.v9i2.543

17. Prasetyo, Diki and Sasana, Hadi. 2020. Causality Analysis of Physical Infrastructure, Social Infrastructure with ASEAN Economic Growth 2008-2017. IESP Department, Faculty of Economics and Business, Diponegoro University, dikiprasetyo@students.undip.ac.id
18. Sisdiknas, 2003. Act of the Republic of Indonesia on National Education System.
19. Mankiw, Gregory. 2020. Macroeconomics. Worth Published, Harvard University. Ninth Edition. AMacmillan Education Imprint. New York
20. GGI, 2024. Education and Economic Development: Exploring Their Symbiotic Bond. Gray Group
21. Sida, 2017. Dimensions of Poverty Sida's Conceptual Framework. Sitrus Art.no.: Sida 62028en urn:nbn:se:sida-62028en, ISBN: 978-91-586-4259-1
22. Haughton, Jonathan. Khandkerand Shahidur R. 2009. Handbook on Poverty and Inequality. The International Bank for Reconstruction and Development/The World Bank1818 H Street, NW
23. Weiss, John, 2005. Poverty Targeting in Asia: Experiences from India, Indonesia, the Philippines, People's Republic of China and Thailand. Asian Development Bank Institute, Tokyo.
24. Central Bureau of Statistics, 2017. BPS Performance Report, 2016. ISSN/ISBN: 978-602-438-072-4, Publication Number : 02130.1702. Jakarta
25. Jain, T dan Khanna, O. 2009. Basic Economics, New Delhi: VK Publication
26. Malkanthie, Asoka. 2015. Structural Equation Modeling with AMOS Book. March 2015DOI: 10.13140/RG.2.1.1960.4647
27. Wan, T. T. H. (2002). Evidence-based health care management: Multivariate modeling approaches (1st ed.). Norwell, MA: Kluwer Academic Publishers.
28. [28]. Benjamin at al. 2012. Poverty and Income among the Smallholder Farmers in Nigeria. Journal of Human Ecology, Volume 37, 2012 - Issue 3.
29. Yao, Shujie, 1999. Economic growth, income inequality and poverty in china under economic reforms. The Journal of Development Studies Volume 35, 1999 - Issue 6, Pages 104-130
30. Mire, Muhammad Saleh. 2023. Analysis of Relationship between Socio-Economic Factors and the Level of Poverty Inequality in Indonesia. American Journal of Humanities and Social Sciences Research (AJHSSR), e-ISSN :2378-703X; Volume-07, Issue-11, pp-223-229
31. Tipayalai, K. and Subchavaroj, C. 2023. Assessing the spatial impact of educational attainment on poverty reduction in Thailand. Taylor & Francis Online. https://doi.org/10.1080/09645292.2023.2244702
32. Nursini, 2020. Micro, small, and medium enterprises (MSMEs) and poverty reduction: empirical evidence from Indonesia. Development Studies Research, Volume 7, 2020 - Issue 1.
33. State Electricity Company Statistics, 2018-2020. PT PLN Corporate Secretariat. Book. Jakarta
34. Souza L.C.L et al. 2010. Urban heat islands and electrical energy consumption International Journal of Sustainable Energy, Volume 28, 2009 - Issue 1-3
35. Johan, Stefanus and Ginting, Ari Mulianta, 2022. Determinasi Konsumsi Listrik di Indonesia. Media Ekonomi Vol. 30 No. 1 April 2022 : 106 - 117 ISSN : 2442-9686 (online) DOI: http://dx.doi.org/10.25105/me.v30i1.10662 ISSN : 0853-3970 (print)
36. Susanti et al. 2023. MSMEs performance and competitive advantage: Evidence from women's MSMEs in Indonesia. Cogent Business & Management, Volume 10, 2023 - Issue 2