International Journal of Sciences: Basic and Applied Research (IJSBAR)

ISSN 2307-4531
(Print & Online)

http://gssrr.org/index.php?journal=JournalOfBasicAndApplied

Inequality in Indonesia's Electricity Access

Khalid Zuhri[a*], Lukytawati Anggraeni[b], Tony Irawan[c]

[a]*BPS-Statistic of Central Kalimantan Province, Palangka Raya, Indonesia*

[b,c]*Department of Economics, IPB University, Bogor, Indonesia*

[a]*Email: khalid@bps.go.id*

Abstract

This study aims to look at the inequality of electricity access experienced by households in Indonesia by measuring the distribution of household energy consumption and electrification determinants based on regional and household characteristics with the probit model. The data used Susenas 2018 data, with a total sample of 282 772 households. The Gini coefficient value of electricity consumption shows that in urban Indonesia the inequality of consumption between households is relatively more unequal than in rural areas. PLN's electricity access in Indonesia from the household side is strongly influenced by the level of education and gender of the head of the household. Territorial status and homeownership status are obstacles to PLN's electricity access. Access to electricity in rural areas is still relatively low due to Indonesia's geographical factors which are very difficult and require large costs for electricity infrastructure in the region. The role of the private sector needs to be increased through the public-private partnership (PPP) program in the development of electricity infrastructure and CSR programs related to the provision of electricity access to PLN for people who do not have access to electricity, especially in rural areas.

Keywords: electrification; electricity consumption; Lorenz; probit.

1. Introduction

Indonesia in 2014 had a Multi-Dimensional Poverty Index (MPI) of 29.7 percent, while monetary poverty released by the Central Statistics Agency was 11.3 percent. The distribution of MPIs in 2014 shows the eastern region has a relatively higher value of MPIs compared to the western regions of Indonesia.

---

* Corresponding author.

Based on the poverty figures released by Statistics Indonesia (BPS), we can see a positive linear relationship between the two. The decrease in MPI in 2014 was not as big as the decrease in MPI in 2013. On average, the decrease of MPI was 5.64 percent. Figure 1 shows that rural areas are still areas that need greater attention in accelerating poverty alleviation.

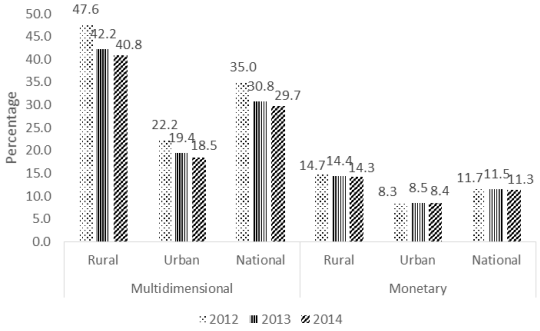

Figure 1: Comparison of Multidimensional Poverty Index (MPI) and Indonesian macro poverty by urban and rural, 2012-2014

Source: PRAKARSA, 2016

Three indicators in the 2014 MPI that have relatively high poverty severity are sources of lighting (87.8 percent), access to clean water (77.6 percent), sanitation (75.9 percent) and cooking fuel (75.1 percent). If the indicator is lowered in percentage, linearly poverty, in general, should also decrease. In general, two of the four poverty indicators in Indonesia that are still relatively high are related to energy. Based on the MPI characteristic values, poor households have the highest problems related to lighting sources that come from State Electricity Company (PLN) / other PLN electricity. The government through the Ministry of Energy and Mineral Resources targets the electrification ratio in Indonesia to reaching 99.00 percent in 2019. The condition of Indonesia's electrification rate until 2017 has reached 97.35 percent, with the RPJMN target of only 92.35 percent.

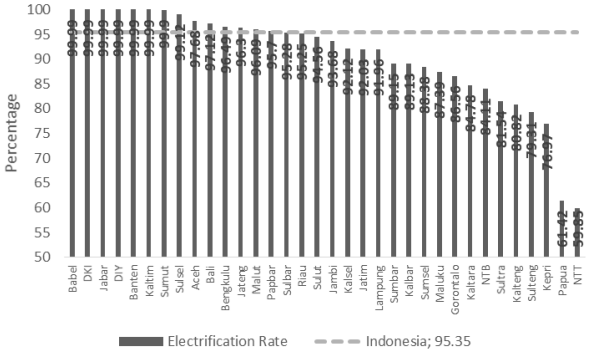

Figure 2: Indonesian Electrification Rate by Region, 2017

Source: KESDM, 2017

Indonesia's electrification rate in 2017 shows inequality, which also indirectly illustrates the economic conditions in the region (Figure 2). Some provinces with energy resources that are dominant enough to be used as power plants, actually still have electrification rate values below 90 percent. This condition is certainly alarming, considering that this country has won independence for 73 years, but inequality in the energy sector is still happening. There is 35.29 percent of provinces that still have electrification ratios in 2017 below 90 percent. Of the 35.29 percent or 12 provinces, NTT has the lowest ratio (59.85 percent) and West Sumatra has the highest ratio value (89.15). Previous studies have shown that electricity has an important role in production and economic growth [1,2,3]. Some of these studies show the role of electricity, especially in some developing countries. On the side of productive activities, it allows production activities to be carried out at night, related to work that requires light. Even studies [4] found that electrification can reduce 1.5 percent of poverty points in Bangladesh. At the macro level, electrification can stimulate economic growth and hence indirectly reduce poverty. The existing studies in Indonesia are still limited to the macro level. But actually, at a more micro level, electrification can directly increase the income and non-income aspects of poverty through several channels. Reference [5] his research on the role of infrastructure development in poverty alleviation in Indonesia studies in Java and Outside Java. Static panel analysis from 1993 to 2009 in 26 provinces in Indonesia. The results stated that water, electricity and health infrastructure in Java had a positive effect on economic growth. Furthermore, economic growth can reduce poverty only in Java. Studies at the micro level such as at the household level, are still minimal in Indonesia. Indonesia is committed to providing sustainable energy access by issuing Presidential Regulation No. 59 of 2017 on July 4, 2017, concerning the Implementation of Achieving Sustainable Development Goals.

This regulation is a commitment of the government in implementing Sustainable Development Goals (SDGs), which is targeted to be realized in 2030. One of the 17 objectives listed in the Perpres in point seven is Ensuring Affordable, Reliable, Sustainable and Modern Energy Access for All. But until now there is still an imbalance between the electrification rate in Indonesia, especially some regions in Eastern Indonesia, based on data released by the Ministry of Energy and Mineral Resources. Equitable electrification is expected to be able to move the wheels of the economy of the regions outside Java to grow faster. Electrification measurements so far have been from the electricity that has been distributed by PLN.

The measurement of access to electricity from the household side has not been done much. It should be necessary to measure whether the electricity supply that has been distributed has been accessible to all households. Indonesia's regional conditions become a challenge available in achieving equitable electrification ratio between regions. The influence of territoriality will complicate the construction of electricity infrastructure, and the influence of household diversity is also thought to influence household decisions on access to electricity. Based on the problem formulation above, this study will describe the distribution of electrification consumption among household groups according to the level of electricity consumption per capita and analyze the determinants of regional and household characteristics related to household electrification access. This is important to be able to identify the factors that affect electrification access, especially electricity from PT. PLN, from the household side. The benefits of this research are 1) for the government to be able to know about the factors that influence electricity access for households in order to accelerate the electrification ratio in Indonesia; 2) for academics, this research is expected to be a reference for further research.

2. Introduction

2.1. Electrification

According to the Big Indonesian Dictionary, electrification is defined as the use or replacement of electricity (previously not used electricity). In the era of industry 4.0, electrification ratios can be said to be the basic needs of society. Because, in the era of globalization that is rife in the use of technology as it is today, the need for electricity, especially in Indonesia, is increasing. The electrification ratio is the ratio of the number of household customers who have lighting sources from both the State Electricity Company (PLN) and other PLN electricity with the number of households. The benefit of the electrification ratio is knowing the number of households that have access to electricity [6].

2.2. Electrification and Poverty Linkage

At the macro level, electrification can stimulate economic growth and hence indirectly reduce poverty. At a more micro level, electrification can directly increase the income and non-income aspects of poverty through several channels.

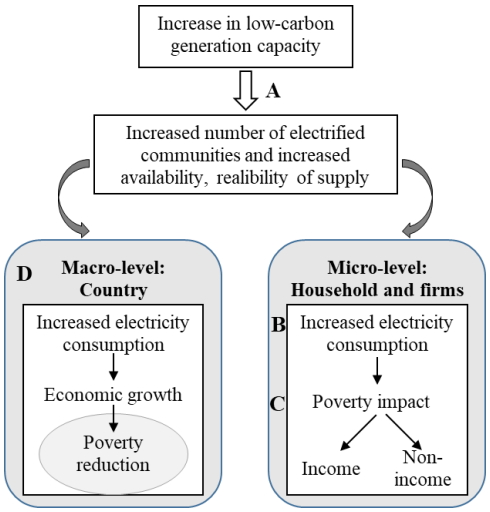

Figure 1: The relationship of electrification causality to poverty

Source: [7]

The magnitude of the impact is determined by the accessibility, reliability, quality, and affordability of the poor from services provided by electricity. In addition, the relationship is very complex and mediated by a number of other factors. Also, the causality between electrification and per capita income is unclear. Electricity infrastructure can cause growth, but growth also causes greater demand for electricity, called reverse causality or endogeneity. This problem can lead to estimates of the impact of excessive electricity on income and must be minimized by using appropriate techniques in macro-level econometric models or evaluation of impacts at the micro-level [7]. In the current industrial era 4.0, electricity needs are vital so that Indonesia is ready to enter this era. In the industrial era 4.0, everything is related to the internet, one of the main conditions is the availability of

electricity. Indonesia's current condition of poverty is generally experienced by people who work in the Agriculture sector. In the industrial era 4.0, agriculture-related work should be done automatically, not using a hoe. If agricultural modernization can be carried out, then the productivity of the agricultural sector will increase, poverty that occurs in this sector can also be reduced.

3. Research Methods

The data used in this research is the March 2018 National Socio-Economic Survey (Susenas) obtained from the Central Statistics Agency. The number of household samples used in this study was 282 772 samples.

3.1. Regional Classification Based on Household Electricity Access

The Klassen Typology approach is usually the capital of government planning to develop and set policy priorities. Klassen's typology is used to identify problems quickly based on previously available data, especially with regard to policy planning. This analysis basically divides the area based on two main indicators, namely the percentage of poor households, the percentage of households with access to electricity. Through this analysis, four characteristics of inequality that occur between regions are obtained.

3.2. Measurement of Determinants of Household Electric Access

The data used in this study are secondary data from the March 2018 National Socio-Economic Survey originating from Statistics Indonesia. The first objective of this study, describing the distribution of energy consumption between household groups, will be analyzed by calculating the Gini coefficient and the Lorenz Curve. Refrence [8] by adopting the general Gini ratio formula, calculating the distribution of energy consumption according to population groups in Africa. In this study, the same thing will be done. But the focus is on electricity consumption. In this study, *Yi* = (the amount of electricity consumed according to household groups) / (total electricity consumption), *Yi* is ranked from the lowest consumption to the highest consumption. *Xi* = (number of electricity users by household group) / (total population). The general formula used in calculating the Gini ratio is:

$$G_e = 1 - \sum_{i=1}^{n} (Y_{i+1} + Y_i) \,.\, (X_{i+1} - X_i) \quad (1)$$

The Gini coefficient value is in the range of perfect equality for all members of the population (G = 0) to perfect inequality (G = 1). In this study, the variables used in the probit regression model refer to the study [4] with some adjustments to the observed explanatory variables related to data availability. The probit model used is:

$$P_{1i}(Y_{1i}=1|X) = F(\alpha_0+\alpha_1 age + \alpha_2 member + \alpha_3 education + \alpha_4 female + \alpha_5 own\_house + \alpha_6 rural + \varepsilon) \quad (2)$$

Note:

Y_{1i} : Household access to PLN electricity (0 = no access to electricity; 1 = have access)

age : Head of household age (years)

member : Number of household members (people)

education : Length of education of the head of household (years)

female : Dummy gender of household head (0 = male; 1 = female)

own_house : Dummy ownership of residential buildings (0 = other; 1 = own house)

rural : Dummy status of residential area (0 = urban; 1 = rural)

ε : error

Regional characteristics in this study are represented by the variable status of residential areas which are distinguished by urban and rural. The criteria for cities and villages are grouped according to urban facilities owned by a village [9]. The characteristics of the household are described using variables of age, sex, and length of education of the head of the household; the number of household members, and ownership status of residential buildings. Unlike a regression model that requires assumptions that must be met, the probit model is relatively more flexible. This is because the Maximum Likelihood Estimator method used to estimate parameters in random samples implies that under very general conditions MLE is consistent, asymptotically normal, and asymptotically efficient [10].

4. Research Methods

Based on the results of calculations using 282 227 Susenas sample households in March 2018, information was obtained that there was 24.84 percent of households without access to electricity. Conditions for access to electricity tend to vary according to household demographics and economic conditions. In general, the average number of household members in Indonesia is 4 people and most live in rural areas (71.46 percent). In addition, the majority of household heads are male (85.39 percent) and have an average education of 7 years and an average age of 46 years. Based on its economic status, there is 14.24 percent of households categorized as poor households, meaning that the average household expenditure is below the poverty line.

Table 1: Descriptive statistics of households according to dummy variables

Variable	Frequency	Percentage
Gender Head of Household		
Male	240 990	85.39
Female	41 237	14.61
Electric Access		
Without access to electricity	70 100	24.84
Have access to electricity	212 127	75.16
Status of Residence Area		
Urban	80 559	28.54
Rural	201 668	71.46
Household Poverty Status		
No Poor	242 041	85.76
Poor	40 186	14.24

In general, PLN has been able to provide household lighting sources in the form of electricity by 75.16 percent, even in urban areas it has reached 98.26 percent.

In other conditions, households whose main source of lighting is not electricity is still relatively high, which is 13.35 percent. Although urban, in fact, there are still households whose main source of lighting is no electricity, although it is relatively very small at 0.74 percent or 598 households. The condition of households that do not yet have electricity is very high in rural areas, reaching 18.39 percent.

Table 2 also provides information that it turns out that households in rural areas in meeting their electricity needs have not been able to be met by PLN services, using other PLN electricity. Other PLN electricity, electric lighting sources managed by agencies/parties other than PLN including those using lighting sources from batteries, generators, and solar power plants (not managed by PLN) [11].

Table 2: Percentage of main sources of household lighting by region in Indonesia

The main source of household information	The region		
	Urban	Rural	Total
PLN electricity by meter	89.33	55.30	65.01
PLN electricity without meter	8.94	10.64	10.15
Other PLN electricity	1.00	15.68	11.49
Not electricity	0.74	18.39	13.35
Total	100.00	100.00	100.00

Indonesia's geographical condition causes difficulties for PLN in developing electricity transmission. This condition is one of the reasons for the unequal distribution of electricity in each region of Indonesia.

The results of the Village Potential Survey (PODES) 2018 stated that there were 72 451 villages with electricity users of PLN, 18 238 villages with other PLN electricity families, and as many as 29 650 villages with no families using electricity. Note for areas where there are no electricity users, including villages that have no electricity users at all or those that have electricity users, but in that area, there are non-electricity users [12].

4.1. Gini Coefficient of Electricity Consumption

In Table 3, the Gini coefficient of electricity consumption in Indonesia is 0.48698, in rural areas it has a relatively unequal Gini coefficient compared to urban areas. But the picture is on the island of Sumatra; Java, Bali; and Nusa Tenggara, Maluku, Papua on the contrary, electricity consumption inequality is relatively higher in cities. Similar conditions were also seen in Riau Province, South Sumatra, Bangka Belitung Islands, Riau Islands, West Java, West Nusa Tenggara, South Sulawesi, West Sulawesi, and North Maluku.

The average figure of inequality between regions shows that Sumatra Island has a relatively high variation in electricity consumption disparity between regions, while Java has a relatively lower variation in electricity consumption between regions compared to other islands.

Table 4: Gini coefficient values for electricity consumption by region

The region	Gini Coefficient		
	Urban	Rural	Total
Sumatra	0.48784	0.48603	0.48659
Java, Bali	0.48229	0.47980	0.48115
Kalimantan	0.48075	0.49808	0.49327
Sulawesi	0.48398	0.48857	0.48741
Nusa Tenggara, Maluku, Papua	0.48942	0.48879	0.48892
Indonesia	0.48544	0.48760	0.48698

The lowest Gini coefficient value on Sumatra Island is in Jambi Province and the highest is in the Bangka Belitung Islands, the difference between the highest and lowest Gini coefficient values is 0.0442. While in Java, the difference in the highest Gini coefficient value is 0.0156. However, caution must be taken in concluding the high or low coefficient of electricity, it could be that inequality is low because electricity consumption is very low and the difference in electricity consumption between households is also relatively small. Regional factors and economic conditions in the region can be related to electricity consumption.

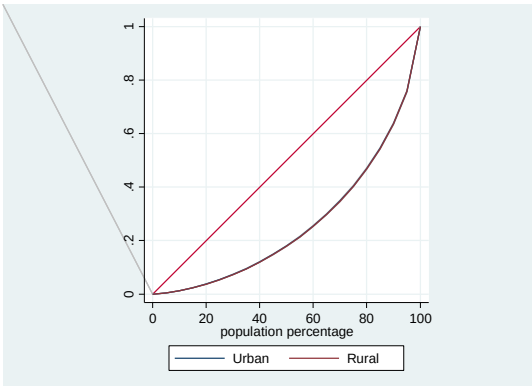

Figure 4: Lorenz curve of electricity consumption according to regional classification

4.2. Klassen's Typological Analysis

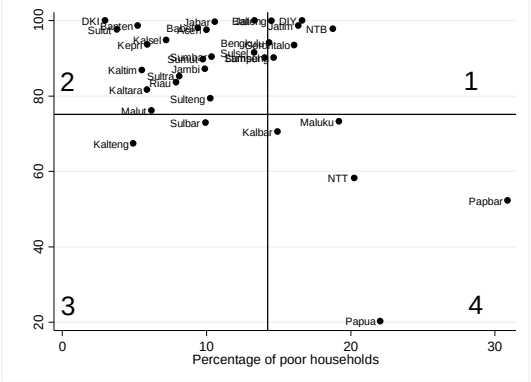

Figure 5: Distribution of households with electricity and poor households by province

Figure 5 maps the condition of the province based on electricity-access households and household poverty

levels, with the reference value being National. The ideal condition (quadrant II) is the percentage of households with high electricity access and low household poverty levels, and in 2018 based on the March 2018 Susenas data there are 20 provinces in Indonesia that are already in the group. Poverty in the regions in quadrant 1, namely Bengkulu, Lampung, Central Java, DI Yogyakarta, East Java, West Nusa Tenggara, and Gorontalo are also suspected of not being affected by access to electricity. Conditions in the region have relatively high access to electricity, but it turns out that poverty in the region is relatively high. This condition can indicate electricity problems including supply does not always affect poverty in Indonesia, especially in some areas above.

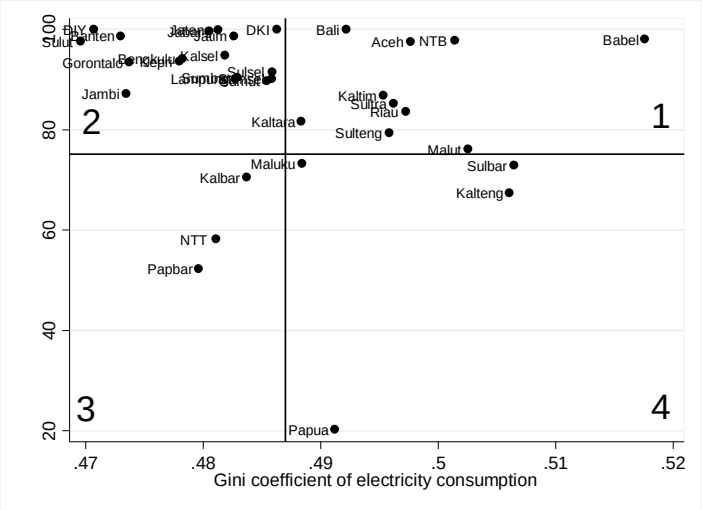

Figure 6: Distribution of households with electricity access and the coefficient of electricity consumption by province

Figure 6 maps the condition of the province based on household access to electricity and the coefficient of electricity consumption, with the reference value being National. The expected conditions in Kudaran II are the condition of areas with a high percentage of households with access to electricity and a low coefficient of electricity consumption. This ideal condition in Indonesia has occurred in 17 provinces in Indonesia. The regions in quadrant III are West Kalimantan, East Nusa Tenggara, and West Papua, meaning that the three regions are areas with a relatively low percentage of households with electricity access but inequality of electricity consumption between households in the region is relatively low. Conditions that require serious attention are regions that are in quadrant IV, namely Central Kalimantan, West Sulawesi, Maluku, and Papua. These regions have relatively high inequality in electricity consumption among groups of households, even though the percentage of households with access to electricity in the region is still relatively low. Meanwhile, in the region in quadrant 1 need to pay more attention to the imbalance of economic conditions between household groups. The high inequality of electricity consumption in this region can be an indication of the gap in the economic welfare of the people. The percentage of households that have access to electricity is already high, but the difference in electricity consumption between households is also high. If the condition of economic inequality is not corrected, other social and economic problems will follow, such as crime. This result also supports the fact that there is an imbalance in conditions in Eastern Indonesia. Geographical difficulties also contribute to the current conditions in Eastern Indonesia. The Director-General of Electricity (Dirjen Gatrik) of

the Ministry of Energy and Mineral Resources said that the problem of electricity infrastructure in NTB is experiencing developmental difficulties due to problems in the structure of the land which are so hard that it is difficult to install one electricity pole. While the problem of electricity infrastructure development in Papua so far has been constrained by the problem of access, but the problem can be immediately resolved with the completion of the Trans Papua road.

4.3. Determination of Household Electricity Access

Table 4 shows the results of estimates of the determinants of electricity access conditions in Indonesia. The overall model statistical likelihood value is 62 495.96 with a *p-value* of 0.000. This means that the overall significance test of the model is considered significant or the explanatory variables together affect the response variable at the level of α = 1 percent. Pseudo-R^2 in the probit regression model has a good enough value of 0.1975. This means that the amount of variation in the independent variable is able to explain 19.75 percent of the variation in the dependent variable in the model. These results are also supported by the value of estate output classification which shows that the model is able to predict the exact condition of access to electricity by 78.39 percent. Furthermore, a variable is partially considered to be statistically significant affecting the condition of electricity access if the value of P> | z | smaller than the value $\alpha = 0.05$.

Table 4: Results of probit analysis of factors affecting household access to electricity

Variable	coefficient	*Standard Error*	P>z	*Marginal Effect*
age	0.02240***	0.00023	0.00000	0.00571
member	0.01939***	0.00147	0.00000	0.00494
education	0.06389***	0.00065	0.00000	0.01628
female	0.19072***	0.00913	0.00000	0.04861
own_house	-0.26105***	0.00893	0.00000	-0.06653
orban	-1.55748***	0.01183	0.00000	-0.39694
constanta	0.67175***	0.01743	0.00000	
Pseudo R^2	0.1975			
LR Statistic	62 495.96			
p-value LR Statistic	0.0000			
Estat Classification Correctly Classified	78.39%			

Note: *** statistically significant 1%

Based on Table 4, it can be seen that all variables significantly affect household access to electricity. Based on the model used, it can be seen that the variables that support the PLN access to electricity for the household are the age of the head of the household, the number of household members, the length of education of the head of the household and the sex of the head of the household. The variables that hamper PLN electricity access are the status of ownership of the occupied house and the status of the residential area. A quite important variable in the interval scale data category that affects PLN electricity access to households in Indonesia is the old education variable of household heads. This means that if the head of the household has a relatively high education, then he has a greater chance of his household to have access to electricity. For dummy-scale data, the variable that

supports PLN electricity access for households is the gender variable of the head of the household and the variable that is the biggest obstacle to electricity access for households is the regional status variable. Based on the coefficient of the probit model it can be seen that there is a positive relationship between the age of the head of the household and access to household electricity, so the older the age of the head of the household, the tendency to have access to electricity will increase. By referring to the value of marginal effect, it can be seen that with each one year increase in the age of the head of the household, the tendency of access to electricity in that household will increase by 0.01 percent when the other variables are of a fixed value. These results are in line with research [4]. There is a positive relationship between the number of households with access to household electricity, so the more members of the household the tendency to have access to electricity will increase. The marginal effect value indicates that with each increase in one household member the tendency of access to electricity in that household will increase by 0.00 percent when the other variables are of a fixed value. This increase is assumed with the assumption that the more the number of household members, the more likely there is an increase in income derived from each working household member. This is as stated by [13,14]. There is a positive relationship between the length of education of household heads and access to household electricity, so the longer the education of household heads, the tendency to have access to electricity will increase. By referring to the marginal effect value, it can be seen that with every increase of one year of education the head of household tends to increase electricity access in the household by 0.02 percent when the other variables are fixed. Social indicators such as literacy are also higher in households with electricity, although this may be due to income factors [15]. In accordance with the energy ladder theory, household preferences in choosing daily energy service consumption will correspond to income conditions that can be signified by the level of education of the household head. This is in line with the results of research [13,16,17]. In line with high education, income will also increase. So with the income, the household has the opportunity to be able to pay the electrification fees used in the household. This is in line with the energy ladder theory, the higher the income, the more efficient and clean the energy used, both for lighting and cooking. In Indonesia, Reference [18] states that the impact of electricity on the distribution of income can be seen through improvements in the level of education. The relationship of the sex of the head of the household to access to electricity is significant and positive. Household access to electricity will be much higher in households with the sex of the female head of the household compared to households with male heads of households. The head of the household in Indonesia is dominated by men, both in urban and rural areas, as well as between islands in Indonesia. The highest female head of household is in Java, Bali with a percentage in 2018 of 17.03 percent. This condition is different from the findings [4]. This can be explained because generally women are more active (productive and non-productive) at home, so they will need more electricity for their activities, especially in the current digital era. Households headed by men will consume less energy than households headed by women, in other words, male heads of households are wiser in frugality in consuming energy. Research [19] in Ghana and [20] in Mexico show that male family heads have the possibility of using cleaner and more efficient energy than female household heads. The relationship between home status and electricity access is significant and has a negative value. Household access to electricity will be much higher for households that are not their own. Compared to other house statuses, the tendency of houses with own status to have access to electricity will decrease by 0.07 percent. The condition is in line with the findings [14], which state that the expenditure of households with their own ownership tends to be greater than other houses with ownership so that it is suspected to influence

household decisions on access to electricity. This is because of the cost of installing electricity which is felt to be quite high costs for lower-middle economic households. In addition, in general, houses with another ownership status (rent, contracts, services, grants) have PLN electricity facilities available.

5. Conclusion

Electrification gaps, especially PLN electricity, occur in Indonesia. Inequality of electricity consumption among household groups in rural areas is higher than in urban areas. The inequality of regional consumption between provinces is also very wide. Electricity consumption between regions in Java does not have a high variation in inequality compared to other islands. The relationship between electrification and poverty in several provinces occurs in several regions, most of which are located in Eastern Indonesia. The low access to electricity in the region is thought to affect the high poverty that occurred. PLN's access to electricity in Indonesia from the household side is strongly influenced by the level of education and gender of the head of the household. Territorial status and homeownership status are obstacles to PLN's electricity access. Access to electricity in rural areas is still relatively low due to Indonesia's geographical factors which are very difficult and require large costs for electricity infrastructure in the region. This study cannot measure the effect of electricity supply on electricity access due to limited data at the regional level. In order to overcome the electricity imbalance, it is necessary to sharpen the electricity infrastructure development program through a public-private partnership (PPP) program by revising the laws and regulations that hamper the implementation of this program, particularly Law No. 2 of 2012 concerning land acquisition for development for public use. In addition, it also involves the role of the private sector with CSR programs related to the procurement of electricity access to PLN for people who do not yet have access to electricity, especially in rural areas with a low electrification ratio.

Reference

[1] S. R. Khandker, D. F. Barnes, H. Samad, and N. H. Minh, “Welfare Impacts of Rural Electrification: A Case Study from Bangladesh,” 2009.

[2] C. C. Cook, T. Duncan, S. Jitsuchon, A. Sharma, and W. Guobao, Assessing the Impact of Transport and Energy on Infrastructure and Poverty Reduction. Manila: Asian Development Bank, 2005.

[3] A. Barkat, N. N. Ratna, M. Majid, A. K. M. Maksud, A. Karim, and S. Islam, “Economic and Social Impact Evaluation Study of the Rural Electrification Program in Bangladesh,” 2002.

[4] S. R. Khandker, D. F. Barnes, and H. A. Samad, “The welfare impacts of rural electrification in Bangladesh,” Energy J., vol. 33, no. 1, pp. 187–206, 2012.

[5] Nuraliyah, “Peran Pengembangan Infrastruktur dalam Pengentasan Kemiskinan di Indonesia: Jawa dan Luar Jawa,” IPB (Bogor Agricultural University), 2011.

[6] Bappenas, Metadata Indikator Tujuan Pembangunan Berkelanjutan, Pilar Pemb. Jakarta (ID):

Bappenas, 2017.

[7] A. Pueyo, F. Gonzalez, C. Dent, and S. DeMartino, The Evidence of Benefits for Poor People of Electricity Provision: Literature Review, no. 31. 2013.

[8] D. M. Kammen and C. Kirubi, "Poverty, energy, and resource use in developing countries: Focus on Africa," Ann. N. Y. Acad. Sci., vol. 1136, pp. 348–357, 2008.

[9] Badan Pusat Statistik Indonesia, Peraturan Kepala Badan Pusat Statistik Nomor 37 Tahun 2010 tentang Klasifikasi Perkotaan dan Perdesaan di Indonesia. 2010.

[10] J. M. Wooldridge, Introductory Econometrics A Modern Approach, 6th ed. Boston: Cengage Learning, 2016.

[11] Badan Pusat Statistik, Konsep dan Definisi Susenas Maret 2018. Jakarta (ID): BPS, 2018.

[12] Badan Pusat Statistik, Statistik Potensi Desa 2014. Jakarta (ID): BPS, 2014.

[13] Z. Ismail, "An Empirical Estimation of Energy Poverty in Poor South African Households," Energy Policy, vol. 6, no. 13, pp. 184–193, 2015.

[14] M. Nazer and H. Handra, "Analisis Konsumsi Energi Rumah Tangga Perkotaan di Indonesia: Periode Tahun 2008 dan 2011," J. Ekon. dan Pembang. Indones., vol. 16, no. 2, p. 141, Jan. 2016.

[15] H. Winkler, A. F. Simões, E. L. la Rovere, M. Alam, A. Rahman, and S. Mwakasonda, "Access and Affordability of Electricity in Developing Countries," World Dev., vol. 39, no. 6, pp. 1037–1050, 2011.

[16] Z. Ismail and P. Khembo, "Determinants of energy poverty in South Africa," J. Energy South. Africa, vol. 26, no. 3, pp. 66–78, 2015.

[17] F. O. Ogwumike and U. M. Ozughalu, "Analysis of energy poverty and its implications for sustainable development in Nigeria," Environ. Dev. Econ., vol. 21, no. 3, pp. 273–290, 2016.

[18] R. Jayanthi, "Dampak pembangunan infrastruktur listrik di indonesia terhadap tingkat kemiskinan dan distribusi pendapatan," Institut Pertanian Bogor, 2018.

[19] J. T. Mensah and G. Adu, "An empirical analysis of household energy choice in Ghana," Renew. Sustain. Energy Rev., vol. 51, pp. 1402–1411, 2015.

[20] I. C. C. Islas, "Energy Consumption of Mexican Households," J. Energy Dev., vol. Vol. 38, N, pp. 189–219, 2012.