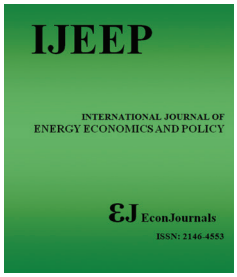

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The Effect of Energy Consumption and Renewable Energy on Economic Growth in Indonesia

Sodik Dwi Purnomo[1]*, Nur Wani[2], Suharno[2], Arintoko[2], Herman Sambodo[2], Lilis Siti Badriah[2]

[1]Faculty of Economics and Business, Wijayakusuma University Purwokerto, Indonesia, [2]Faculty of Economics and Business, Jenderal Soedirman University, Indonesia. *Email: sodikdwipurnomo@yahoo.com

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ABSTRACT

The economic growth in Indonesia showed a stable trend while the growth in energy consumption showed a declining trend. However, previous studies had revealed the existence of positive and significant relationship between energy consumption and economic growth. This study aims to analyse the effect of oil, gas, and biomass fuel consumption, road infrastructure, life expectancy, and average length of education on economic growth in Indonesia during the year of 1990-2019. This study used quantitative approach with linear regression as data analysis method. The data used are time series data from the period of 1990-2019. The result of this study showed that oil, gas, and biomass fuel consumption, as well as average length of education have a positive and significant effect, while road infrastructure and life expectancy have no effect on economic growth in Indonesia for the year of 1990-2019. This study recommends: (1) energy reserves should be improved by increasing the number of energy sources and developing more infrastructure in order to support and boost the supply of energy, (2) quality of educations should be upgraded by giving out scholarships as well as improving the educators and physical infrastructure.

Keywords: Economic Growth, Renewable Energy, Infrastructure, Human Capital
JEL Classifications: O13, O15, O18, O47, Q42, Q43

1. INTRODUCTION

Economic development, in addition to increasing the national income, is also intended to increase productivity. Furthermore, economic development also aims to reach a high economic growth, maintain economic stability, and a fair income distribution. A high economic growth would be able to improve the public welfare since it could mean an increase in work force (Haryanto, 2013).

Sukirno (2011) stated that economic growth is one of the goals that needs to be achieved by a country. This is because economic growth is a quantitative measure that reflects the yearly economic developments of a country in comparison to the previous year (Nugroho, 2014). According to United Nations Development Programs, by the end of 1999s, human development is indicated by economic growth. Economic growth is closely related to the increase in goods and services produced within the society, which means that the more goods and services produced, the better the social welfare within that society, and hence the better the quality of their human resources. This could then be one of the indicators for economic growth, as could be seen from the amount of Gross Domestic Product (Todaro, 2000).

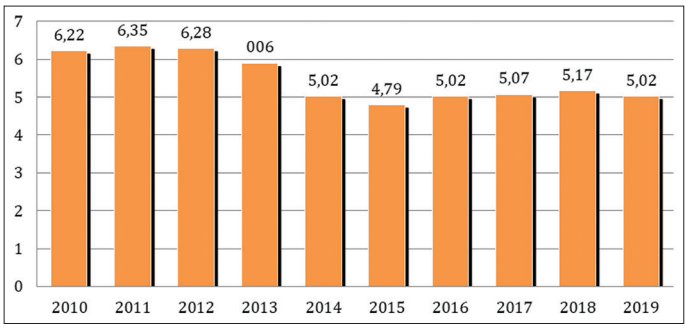
According to Mankiw (2007), economic growth reflects a country's national output that determines the rate of their living standard. In practice, a high economic growth could be one of the main goals for national development in developing countries. Economic growth could be seen as closely related to the increase in production of goods and services in society. A higher production of goods and services would be able to improve the social welfare.

Figure 1 shows the economic growth in Indonesia for the year 2010-2019. It could be seen from the chart that the economic growth in Indonesia for the past 10 years indicates a stable trend in the range of 5%. Taking the average from that time period, the economic growth in Indonesia is around 5.48%. However, looking from the point of view of the growth in energy consumption in Indonesia which includes oil, gas, electricity, and biomass fuels, the trend shows a significant decline. In the past 10 years, the average growth of energy consumption in Indonesia is around 0.9% (oil), 10.50% (gas), 6.31% (electricity), and −3.86% (biomass), as shown in Figure 2.

Referring to Figures 1 and 2, it could be seen that economic growth has a stable trend in the range of 5%, while energy consumption growth showed a declining trend. However, previous empirical study by Lolos (2002), Mahadevan (2007), Pradhan (2010), Apergis and Payne (2010), Rezki (2011), Adhikari and Chen (2013), Nnaji et al., (2013), Susanto (2013) Ishida (2013), Ouedraogo (2013), Purbaningrum (2014), Iyke (2014), Fariz (2015), Nazer and Handra (2016), Zuldarepa (2017), Akandy (2017), Fauzi (2017), Ula and Affandi (2019), and Setiawan et al. (2019) showed that energy consumption has a positive effect on economic growth.

The effort to improve economic growth within all sectors, such as: production, distribution of products and services, and consumption, requires some form of energy resources which could be in the form of oil, gas, electricity, and biomass fuel. Stern (2003) explained that the consumption of energy is a mean to propel economic industrialisation and a mean to accumulate complementary or substitutionary capital for development in order to produce economic outputs.

Figure 1: Economic growth in Indonesia for the year 2010-2019



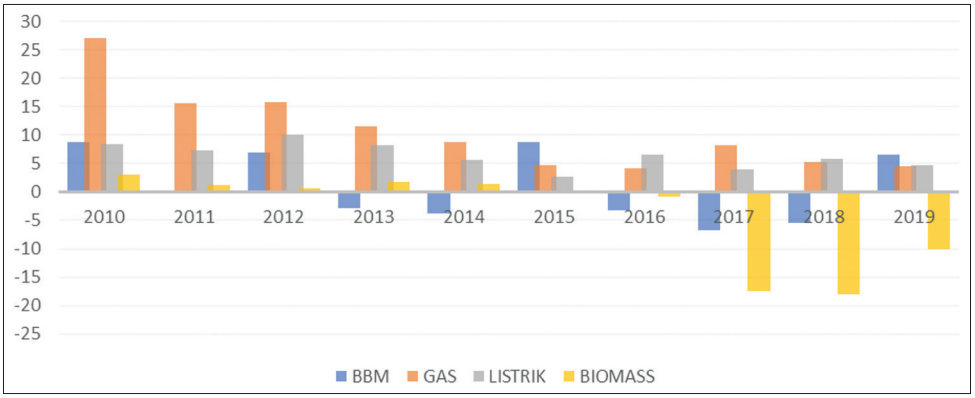
Source: Badan Pusat Statistik

In this study, energy would be differentiated into 4 types, namely: oil, gas, electricity, and biomass fuel. The distinction between those variables is based on, firstly, the difference in unit, secondly, the difference in usage where oil is mostly used in transportation and industrial sector and gas in household sector. The excessive use of fossil energy such as oil, gas, and coal could have a negative effect towards the environment (International Panel on Climate Change, 2007). To handle such problem, the government in South East Asian region should find an alternative source of energy to replace the environmentally damaging energy sources. Such alternative energy sources could be in the form of solar, wind, water, biomass, or other type of fuel that is more environmentally friendly.

Biomass energy is a form of renewable energy that still has not been explored further in Indonesia. Previous empirical studies done by Ula and Affandi (2019), Apergis and Payne (2010), and Soytas and Sari (2006) showed a positive correlation between the consumption of renewable energy and economic growth. The study done by Tugcu et al. (2012) looked into the effect of renewable and non-renewable energy on economic growth in the G7 countries. The result of their study showed a positive correlation between renewable energy consumption and economic growth. Frondel et al. (2010) focused their study on the implication of the use of renewable energy which is to create more employment and effective market operation in Germany. Furthermore, Inglesi-Lotz (2016) concluded that that there is a great advantage from the government policy in promoting the use of renewable energy by building the market for it while keeping the good environmental condition. Therefore, more analysis is needed on the effect of energy consumption and renewable energy on economic growth.

With the increase in the number of industries in every year, there is also an increase in demand for energy. Energy is also considered to be one of the most critical resources. It is highly needed in carrying out economical activities in Indonesia, both in consumption and production activities in various economic sectors. As a natural resource, energy needs to be utilized as efficiently as possible for

Figure 2: Energy consumption growth in 2010-2019 (percentage)



Source: Badan Pusat Statistik, 2019

the sake of the public welfare and needs to be managed according to the principles of sustainable development (Elinur et al., 2010).

In addition to analysing the effect of energy consumption on economic growth in Indonesia, this study also adds several control variables such as average length of education, life expectancy, and road infrastructure. According to Kuncoro (2010), physical economic capital could become more productive when a country has a sufficient human capital. Agents of developments could be more productive if they have the suitable knowledge, physical health, and skills in order to boost economic growth.

It has been widely acknowledged that human capital is one of the most important factors in economic growth (Brata, 2002). This is supported by several studies. Uppun (2011) showed that human development in terms of the quality of human capital could affect the economic growth. The availability of good quality human resources is an important requirement in the growing suistainable economic development (Sri, 2010). Todaro (2000) stated that improvement in human quality could be achieved through several policies, which means that educational development could shape the direction of economic development in the future. The development in health sector is also acknowledged to instill a culture of healthy lifestyle as well as increasing the scope and quality of healthcare services. For lower income residents, the improvement in human quality could be done by teaching practical skills, suppressing the rate of population growth through the implementation of family planning movement, balancing the spread of population density, and improving the economic growth.

The public welfare is directly proportional to the public need for a good quality education. The higher the education level of a person, the more productive they are, and hence improving both individual and national income. Improving individual income would also improve the consumption ability and therefore improving the economic growth. Life expectancy could be an indicator for the success of development in healthcare sector. An improvement in life expectancy could reflect the public socio-economic condition, health, and environment. Otherwise, a decline in socio-economic condition of one period in a society could result in the decline of life expectancy (Badan Pusat Statistik [BPS], 2018). Health and wellbeing could be seen as one of the most basic need of every person and without them the productivity of a country could be disturbed.

The development of infrastructure could boost economical welfare and economic growth by increasing the efficiency of economic activities. Restoration of infrastructures could contribute in improving productivity and is hoped to help supporting long term economic growth. Infrastructures has a crucial role in improving economic growth since a higher economic growth could be seen in places with sufficient availability of infrastructure. Any unavailability of infrastructure is one of the obstacles in achieving a rapid economic growth. Maqin (2011) stated that infrastructure has a statistically significant and strong impact on economic growth.

Based on the reasoning above, the effect of energy consumption, infrastructure development, and human development on economic growth should be proved in the form of research. It is hoped that a study that utilises time-series data analysis would be able to find the effect of the four variables on the rate of economic growth in Indonesia.

2. RESEARCH METHOD

This study is a type of quantitative study because the data used is in the form of numbers (Supranto, 2000: 65). This study is an empirical study to analyse the effect of energy consumption, renewable energy, economic infrastructure, and human capital on economic growth in Indonesia. The data used in this study is a secondary data from the period of 2000-2019 in Indonesia. The data was collected from relevant research bodies such as BPS, Ministry of State-Owned Corporations, and other relevant bodies. Table 1 shows the operational definition used in this study.

Before conducting the multiple linear regression on *eviews* application to determine the magnitude of effect of independent variables on the dependent variables, a stationarity test and cointegration test need to be run first. Stationarity test is aimed to see whether the mean data variance is constant over time and the variance between two or more time series data depends only on the lag between the two or more time periods (Gujarati and Porter, 2011).

Classical assumption tests on the regression model used were done in order to find out whether the regression model is a suitable model or not. The classical assumption tests used in this study are normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test (Gujarati and Porter, 2011).

The analysis of the effect of energy consumption, renewable energy, economic infrastructure, and human capital on economic growth in Indonesia by using the multiple linear regression method was done with the help of *eviews* application. The equation for the multiple linear regression used in this study is as follows:

$$EG_i = \beta_0 + \beta 1OFCi + \beta_2 GC_t + \beta_3 EC_i + \beta_4 BC_t + \beta_5 EI_{i-1} + \beta_6 LE_i + \beta_7 ALE_t + e$$

Note:
EG = Economic growth
β_0 = Constant
$\beta_{1,2,3,4,5,6,7}$ = Regression constant
OFC = Oil fuel consumption
GC = Gas consumption
EC = Electricity consumption
BC = Biomass consumption
EI = Economic infrastructure
LE = Life expectancy
ALE = Average length of education
e = standard error
i = time series

Table 1: Definitions of operational research variables

S. No.	Variable	Definition	Unit
1.	Economic growth	Gross domestic regional product in Indonesia	Percent
2.	Oil fuel consumption	The amount of energy consumed by the population both in industrial and non-industrial sector	Kiloliter
3.	Gas consumption	The amount of energy consumed by the population both in industrial and non-industrial sector	Tons
4.	Electricity consumption	The amount of energy consumed by the population both in industrial and non-industrial sector	Megawatt
5.	Biomass consumption	The amount of energy produced to be consumed by all sectors	Ton
6.	Economic infrastructure	The length of asphalt road built by the government	Kilometer
7.	Life expectancy	Average life expectancy of the population of Indonesia	Years
8.	Average length of education	Average length of education of the population of Indonesia	Years

3. RESULTS AND DISCUSSION

The data analysis done to find out the effect of energy consumption, renewable energy, economic infrastructure, and human capital on economic growth in Indonesia during the period of 1990-2019 using the multiple linear regression method with the help of *eviews* application was initiated by conducting the stationarity test.

Unit root stationarity test is the first test that needs to be done before conducting the regression analysis of the data. The aim of this stationarity test is to see whether the mean data variance is constant over time and the variance between two or more time series data depends only on the lag between the two or more time periods. The result of the stationarity test was summarised into the table below.

Table 2 shows that all variables give a probability value smaller the level of significant (α = 5%). This means that the data on the model could be concluded as stationary and therefore the analysis using Ordinary Least Squares (OLS) could be conducted.

The normality test is done to find out whether or not the residual follows a normal distribution (Gujarati and Porter, 2011). Residuals are said to be normal if the probability of normality produced are greater than or equal to the level of significant (α = 5%). The analysis result showed the value of probability of 0.4517 which is greater than the level of significant (α = 5%). Therefore, the residual of the model could be said to be normally distributed, hence the assumption of normality is achieved.

Heteroscedasticity test is used to find out whether or not the residual has a homogeneous variety (Gujarati and Porter, 2011). The heteroscedasticity test used in this study is the Glejser test. The criteria for this test stated that if the probability found from Glejser test is greater than or equal to the level of significant (α = 5%), therefore the residual could be concluded to have a homogeneous variety. The analysis result showed that the probability value of *obs*r-squared* is 0.0839 which is greater than the level of significant (α = 5% atau 0.05). This means that the residual could be said to have a homogenous variety.

Multicollinearity test is used to find out whether or not there is a correlation between the independent variables. The linear regression analysis does not allow for any correlation among the independent variables. The multicollinearity test was done by looking at the value of VIF for every independent variable.

Table 2: Summary of stationarity test

S. No.	Variable	Stationary Level	
		Level	
		Significance	Note
1.	Economic growth (Y)	0.0065	Stationary
2.	Oil fuel consumption (X_1)	0.0190	Stationary
3.	Gas consumption (X_2)	0.0001	Stationary
4.	Electricity consumption (X_3)	0.0033	Stationary
5.	Biomass consumption (X_4)	0.0208	Stationary
6.	Economic infrastructure (X_5)	0.0192	Stationary
7.	Life expectancy (X_6)	0.0489	Stationary
8.	Average length of education (X_7)	0.0441	Stationary

Source: Data processing result, 2020

The criteria for this test stated that if the value of VIF is <10 then that means there is no symptom of multicollinearity (Suliyanto, 2011:76). The summary for multicollinearity test for this study could be seen in the table below.

Table 3 shows that all independent variables used in this study has a VIF value of <10. This means that the model used in this study has no symptom of multicollinearity.

The autocorrelation test is used to find out whether or not there is a correlation between the residual error in the period t-1 (Gujarati and Porter, 2011). Based on the output of autocorrelation test, the value of Durbin-Watson (DW) was obtained to be 2.157921. This value is then compared to the DB table for n = 29 and number of variable (k) = 7, and the value found are d_U = 2,0520 and d_L = 0,9004. This showed that there is no autocorrelation in this model.

Table 4 showed a summary of the output for the multiple linear regression using the OLS model. This model has been acknowledged as the Best Linear Unbiased Estimator (BLUE) which means it has gone through the classic assumption test such as normality, multicollinearity, heteroscedasticity, and autocorrelation test.

3.1. The Effect of Oil Fuel Consumption on Economic Growth

The oil fuel consumption has a positive and significant effect on economic growth in Indonesia for the period of 1990-2019. It is consistent with the result of the study done by Bloch et al. (2015) and Adjave et al. (2016) which stated that there is a positive correlation between oil fuel energy and economic growth. The higher the consumption of oil fuel in a country, the higher their economic growth would be. This means that the fulfilment of

supply of oil fuel energy would contribute in the continuity of economic wheel. This is because oil fuel is the most used energy source by the household sector which still use kerosene of up to 484,392 kilo liter in 2019, the commercial sector which use kerosene, petroleum, premium, and diesel fuel of up to 370,865 kilo liter, and the transportation sector which use premium, petroleum, diesel, and avtur of up to 67,964,176 kilo liter, while the other sectors use up to 1,835,518 kilo liter.

The same goes to the research done by Razzaqi et al. (2012), which studied the relationship between energy and economic growth in Indonesia, Turkey, Malaysia, Iran, Egypt, and Bangladesh, whose result showed that there is a long term and short-term relationship in all countries except in Indonesia. Another study was done by Fariz (2015) in Indonesia as one of the energy exporter countries and the result showed that the economic growth is affected by oil fuel energy consumption.

3.2. The Effect of Gas Consumption of Economic Growth

The consumption of gas has a positive and significant effect on economic growth in Indonesia for the period of 1990-2019. This is consistent with the study done by Rezki (2011) and Kurnia (2019) which stated that gas consumption has a great contribution on economic growth, where gas consumption has a positive and significant effect on economic growth. It is also consistent with the study done by Ozturk and Al Mulali (2015) which found that the gas consumption affects the economic growth positively and in long term. This is because the majority of the sectors that produce a certain product or output needs gas as their fuel. The consumption of gas then become an important factor since it is the second main energy source after oil fuel in various sector because the supply of gas is still abundant in almost every country. According to Erdo et al. (2019), the thing that needs to be looked into the most is how to increase investment in gas energy projects to produce more supply of energy. Gas is one of the energy solutions that is environmentally friendly and could help reduce pollution. The use of gas fuel has spread across various sectors such as used as fuel in small industries, as fuel for motor vehicles, and as fuel for household, hotels, and restaurants.

Table 3: Summary of multicollinearity test

S. No.	Independent Variable	VIF Value
1.	Oil fuel consumption (X_1)	2.6183
2.	Gas consumption (X_2)	1.1996
3.	Electricity consumption (X_3)	1.5303
4.	Biomass consumption (X_4)	1.4302
5.	Economic infrastructure (X_5)	1.4204
6.	Life expectancy (X_6)	1.9051
7.	Average length of education (X_7)	2.4444

3.3. The Effect of Electricity Consumption on Economic Growth

Electricity consumption has a positive and significant effect on economic growth in Indonesia for the period of 1990-2019. This result is consistent with the study done by Shandra (2012), Silvia et al. (2013), and Thaker et al. (2019) which stated that electrical energy consumption has a positive effect on economic growth. In order to maintain the supply of energy, there is a need for other sources of energy to be developed which means a large capital is needed as well as a collaboration in developing a sustainable energy supply.

The president of Republic of Indonesia in 2017 has also instructed all ministry and governmental bodies to support the development of electric cars. The use of electric vehicles is increasing every day, both for two-wheeled and four-wheeled vehicles. In fact, almost every country in Europe, America, Australia, and China has introduced the use electric vehicles. Various vehicle rental companies around the globe has also started to use electric vehicles, which means that the world has agreed to support the development of clean energy as transportation mode. The use of clean energy should be implemented sooner and with a set of rules and regulations. Aside of transportation vehicles, in Indonesia, there is an ongoing campaign of conversion from gas energy to electrical energy as conveyed by PT PLN (Persero) which target a conversion of one million gas fuelled stove into electrically inducted stove. The ministry of energy and mineral resources has also encouraged the people to make the transition from gas stove to electric stove to achieve energy efficiency of 17% by 2025.

For now, in Indonesia, in order to improve the supply of electricity, the Ministry of Energy and Mineral Resources has collaborated with several countries such as Denmark to analyse the best scenario for Indonesia in terms of the most affordable electrical system. The use of electricity is still dominated by the household sector, which mostly is only used for daily needs and not for productivity. Therefore, it can be defined that there is only a one-way relationship between electricity consumption and economic growth.

Table 4: Summary of regression result

S. No.	Independent variable	Coefficient	thitung	ttable	Prob
1.	Oil fuel consumption (X_1)	0.1324	3.0520	2.0738	0.0061***
2.	Gas consumption (X_2)	0.3804	2.3746	2.0738	0.0272**
3.	Electricity consumption (X_3)	0.0139	2.0869	2.0738	0.0493**
4.	Biomass consumption (X_4)	0.7605	3.5553	2.0738	0.0019***
5.	Economic infrastructure (X_5)	−0.0002	−0.0309	2.0738	0.9757
6.	Life expectancy (X_6)	0.3545	1.8634	2.0738	0.0764
7.	Average length of education (X_7)	1.2765	2.9451	2.0738	0.0077***
R-Squared			=0.7852		
F_{hitung}			=10.9675		
F_{table}			=2.3970		

Source: Data processing result, 2020. *Significant at 10%, **Significant at 5%, ***Significant at 1%

3.4. The effect of Biomass Consumption on Economic Growth

Consumption of biomass energy has a positive and significant effect on economic growth in Indonesia for the period of 1990-2019. This result is consistent with the studies done by Ula and Affandi (2019), Akinlo (2008), Bhattacharya et al. (2016), Huang et al. (2008), and Streimikiene (2016). The results of their studies show that the consumption of renewable energy contributes positively to economic growth, because there are several sectors that regularly use biomass energy as fuel to produce goods or their output. Therefore, it could be said that the higher the use of biomass energy in producing an item, the higher the economic growth in Indonesia.

Biomass energy in Indonesia is only used in the industrial sector and the household sector. In 2019, the industrial sector used 42,862 thousand tons, while the household sector used 7,490 thousand tons of biomass energy. This could then be said to be the reason that biomass consumption has a positive effect on economic growth. Although the use of biomass energy has been going on for hundreds of years, ever since the humans switched to oil and natural gas, the use of biomass energy has begun to shift. However, in the last few years, the development of biomass energy has been kickstarted, such as the development of biomass power plants in various regions in Indonesia, as stated in the Minister of Energy and Mineral Resources regulation number 7, year 2014 concerning the purchase of electricity from biomass and biogas power plants by PT. PLN (Persero). Some of the drawbacks of this energy are in the large costs of processing tools. Also, the encouragement from the government for the potential of this energy has also been minimal. The processing of biomass energy is still considered to be minimal because it requires considerable research, so it is necessary to develop and increase the investment in the field of renewable energy so that its use could be maximized and hence give a positive impact on economic growth as well as a sustainable environment.

In Indonesia, in the effort to increase the consumption of renewable energy, the Ministry of Energy and Mineral Resources (2019) has collaborated with several countries such as Japan develop a sustainable renewable energy in Indonesia. This is fully supported by the Government which therefore encourages the millennial generation to create renewable energy businesses and innovations, so that the increase in renewable energy could one day replace fossil energy consumption without reducing the level of a country's economy.

3.5. The Effect of Economic Infrastructure on Economic Growth

Economic infrastructure has no effect on economic growth in Indonesia for the period of 1990-2019. This result is consistent with the study done by Sumadiasa et al. (2016) which stated that road length infrastructure has no effect on economic growth. It is also supported by the study done by Iriyena et al. (2019) which concluded that road length has no effect on economic growth. The economic infrastructure such as length of road has no direct effect on economic growth because it takes time to build asphalt roads and hence it could be the reason that it indirectly has no effect. However, road infrastructure should still be developed and improved to increase connectivity by increasing the access to potential areas such as industrial areas/special economic zones, agriculture, plantations, tourism in strategic areas, national and regional tourism, ports, airports, opening isolated, remote, underdeveloped areas, borders, as well as outermost and small island area. For similar reasons, the government has also been encouraging more and more programs in developing infrastructure. The presence of infrastructure can open new access or make it easier to reach new areas which can increase new economic activities. Infrastructure development in Indonesia seeks to connect and provide access between Indonesian regions in order to create a logistics network and link production centres, such as from agricultural and fishermen production to small industries.

Road infrastructure development in Indonesia from 1990 to 2019 was constrained by the monetary crisis in 1997-1998 which led to the delay in construction of 19 toll roads of 762 km in 1995-1997. Road construction in Indonesia at that time was stagnating, as proven by the building of only 13.3 km of road in 1997-2001. From the year of 2001 to 2004, 4 new toll roads were built with a total length of 41.80 km. In 2005 a new toll road regulatory agency was formed to act as the Indonesian toll road regulator, accompanied by the continuation of 19 toll road construction projects that were delayed in 1997 (Ministry of PUPR, 2019). Many of the road infrastructure development in the villages outside Java Island during 1990-2000 was still stagnant. The community still uses footpaths such as in certain vilaages in Kalimantan, Sulawesi, Nusa Tenggara, Maluku and Papua. The construction of asphalt roads to these remote areas had begun in 2000 and is still on going until now in order to connect Indonesian regions and establish a logistics network.

The result of this study, however, is in contrast to the study done by Warsilan and Noor (2015) which stated that infrastructure plays a positive role in economic growth. Likewise, the study done by Putri (2014) shows that domestic investment, capital expenditure, labor and infrastructure has a significant and positive effect on economic growth in Indonesia.

3.6. The Effect of Life Expectancy on Economic Growth

Life expectancy has no effect on economic growth in Indonesia for the period of 1990-2019. This is consistent with the study done by Handayani et al. (2016) and Nurwijayati (2017) which stated that life expectancy has no effect on economic growth. This means that a long life-expectancy without accompanied by any useful skills or expertise would become a burden for a country instead. Additionally, there is a lack of job opportunities for the elderly who are still able and willing to work. Life expectancy is the estimated average number of years that a person has from birth to death. This indicator is used to determine the level of public health because it could reflect the length and quality of life of a person. The length of life of a person without the support of good health would result in them being a burden instead.

According to the Central Statistics Agency (2019), the average growth in life expectancy from 1990 to 2019 was 0.5%/year. This

shows that the life expectancy of new-born babies is improving because of the advancement in public health. However, the growth in the number of elderly people is also getting higher every year. Based on the data from the Ministry of Health in 2019, the growth of the elderly population from 1990 to 2019 was 9.70%. The increasing number of elderly people has become a concern for the government considering that the elderly is part of the population that is unproductive and could be a burden for the family and government, especially those who have certain health or mental disorders due to chronic diseases, accidents, crime and other causes. Although life expectancy in Indonesia has increased, on the other hand, the death rate in Indonesia caused by non-contagious diseases is also high. Between 1990 and 2016, 82% of the total deaths were caused by non-contagious diseases. This also has an impact on economic growth, where life expectancy cannot affect economic growth if the population is dominated by elderly people who have low health quality and if the country has a high mortality rate.

The high life expectancy in Indonesia has not been able to have a positive effect on economic growth. Economic growth is determined by talents, abilities, quality, capacity and a set of skills, cultures, values, goals and motivation as well as the political structure of the institution (Jighan, 2010; 67). According to Putri (2014), in the current modern era, the slow and low-energy attitude is no longer appropriate because, economically, any slow action has high cost consequences. This leads to an argument that the community has a slow and low-energy attitude at work so that means that the productivity of the community is low.

3.7. The Effect of Average Length of Education on Economic Growth

The average length of education has a positive and significant effect on economic growth in Indonesia for the period of 1990-2019. This result is consistent with the study by Hasanah (2016), Nurwijayati (2017) and Muda et al. (2019) which stated that the average length of education has a significant effect on economic growth. Education, measured from the average length of education, is one of the important indicators that shows the quality of the population of a country. Generally, in developed countries, their population already has a high awareness of the importance of education and mastery of science and technology. This could be seen from the very high rate of participation of education in developed countries. Limited funding requires prioritization of various options in the field of education that are appropriate in the long run to drive economic growth.

One of the motivations to develop the education level in an effort to build a country's economy is that the higher the education, the better the people's knowledge rationality in thinking. This could cause people to take more rational steps in decision makings. Education could provide society with the technical knowledge necessary to lead and run modern enterprises and to develop a more modern small and micro businesses. The good and useful skills and knowledge obtained through education could become an incentive to innovate. The higher a person's education level and the longer their experience in schools or courses, the higher the knowledge and skills that they have, and hence the higher their productivity. The average length of education has been increasing every year which indicates that the quality of human resources in Indonesia is getting better and could compete well with other countries (Hasiani et al., 2015).

4. CONCLUSIONS

The economic growth in Indonesia showed a stable trend while the growth in energy consumption showed a declining trend. However, previous studies had revealed the existence of positive and significant relationship between energy consumption and economic growth. The result of this study showed that oil, gas, and biomass fuel consumption, as well as average length of education have a positive and significant effect, while road infrastructure and life expectancy have no effect on economic growth in Indonesia for the year of 1990-2019.

This study recommends: (1) energy reserves should be improved by increasing the number of energy sources and developing more infrastructure in order to support and boost the supply of energy, (2) the government should further develop integrated biomass processing industry in areas with high industrial waste, or in agricultural areas, and (3) the quality of educations should be upgraded by giving out scholarships as well as improving the educators and physical infrastructures.

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