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Article

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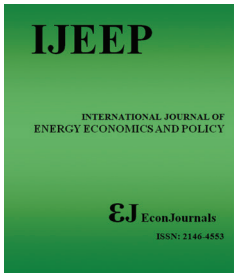

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Analysis of the Effect of Economic, Population, and Energy Growth, as well as the Influence on Sustainable Energy Development in Indonesia

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ABSTRACT

All economic activities require energy and are natural energy sources that can be utilized as much as possible by the community for prosperity and sustainable development. The potential for renewable/sustainable energy in Indonesia is very large and its utilization has not been maximized. Consumption of sustainable energy according to current data is still very low, this is because it is still dominated by fossil energy. This study aims to analyze the effects of economic growth, population, and subsidized energy, as well as their impact on sustainable energy development. Based on the secondary data used in this study was obtained from World Energy, the Indonesian Ministry of Finance, which was obtained in the previous three years (2018-2021). This analysis uses a multiple linear regression model and the results of this research model show that economic growth on population growth does not show a major influence on sustainable energy consumption in Indonesia for three years, fossil fuel energy consumption shows a positive and significant effect on sustainable energy consumption in Indonesia.

Keywords: Renewable Energy, Energy Forecast, Energy Consumption, Energy Economy
JEL Classifications: C13, C22, C36, C39, L94, Q42

1. INTRODUCTION

Utilization of energy to conduct economic business, for example, consumption needs, production, and so on. One of the sources of natural energy, utilization as much as possible for the welfare of the community refers to the development of sustainable (renewable) energy, then sustainable energy sources and fossil energy to support each other in the supply of energy in the future, (Owusu and Asumadu-Sarkodie, 2016).

International energy use continues to increase, where to the World Energy Agency (IEA) projection, world energy, needs until 2030 will increase by 45% or 1.6% per year and 80% of world energy use still depends on fossil fuels. Energy consumption is an integral and inseparable part of the economic development of a country, population growth, improved lifestyles, improved production, and economic competitiveness are some of the reasons for the high energy demand.

The negative impact of fossil fuel and carbon pollution will affect human development in the future, so a transformation of fossil energy into renewable energy is needed to save people from pollution and damage to the universe (Perera, 2017). Global warming is dangerous and serious which can cause environmental damage and the universe and can cause flooding, rising sea levels, and other problems (Shahzad, 2015).

One of the largest sustainable energy consumption in Southeast Asia and Asia Pacific, which is Indonesia compared to other countries because of its large population. Almost all over the world, including Indonesia, still depend on the use of fossil energy, based on the Director General of Renewable Energy and Conversion,

Ministry of Energy and Mineral Resources (2018), fossil energy reserves are running low. Data shows that coal reserves are currently around 7.3-8.3 billion tons which are predicted to be exhausted in 2026.

Meanwhile, oil stocks are currently at 3.7 billion barrels and are predicted to run out in 2028. For gas fuel, the reserves are 151.33 trillion cubic feet (TCF) and are predicted to run out in 2067. The continuous use of fossil energy will result in the energy reserves being depleted. Maintaining energy supplies in the future is one of the threats to economic development in Indonesia that must be a concern for all parties.

The development and consumption of renewable energy in Indonesia is a hot topic for discussion so that energy shortages do not occur by developing renewable energy and sustainability. To realize national energy independence and security, as stated in the master regulation, namely Government Regulation no. 79 of 2014 concerning National Energy Policy, the Presidential Regulation on General National Energy Plan (GNEP) prioritizes Indonesia's energy development that utilizes renewable energy to the maximum and at an economic level, minimizes the use of fuel oil, and uses optimal natural gas and new energy wisely.

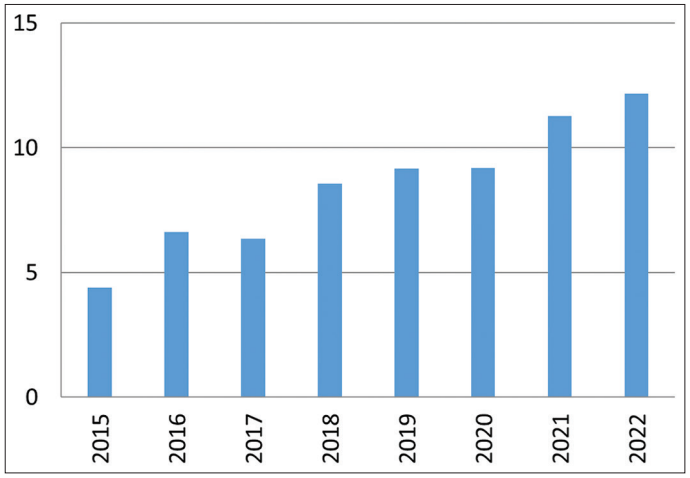
Utilization of natural energy sources is a policy that must be taken for sustainability in consuming energy in the future while taking into account the public interest in economic development (Dogaru, 2020). For this reason, it is necessary to develop renewable energy and conserve green energy or non-fossil energy, which if managed properly, these energy sources will not run out. The issue of renewable energy has become one of the world's central issues, considering that fossil energy is limited in the long term and is not environmentally friendly.

Renewable energy (green energy) is an energy source whose formation does not come from organic bodies. Some opinions suggest that green energy is clean energy that does not pollute or add to atmospheric pollutants. This energy can come from water, hydrothermal, hydropower, geothermal, wind, solar, garbage, biomass, biofuel, to ocean waves. In the future, all green energy should be the main policy of energy development and utilization.

So, renewable energy or renewable energy must be put forward, not used as an alternative. Because this energy source is a natural energy source that can be directly used freely and can be renewed continuously. The potential for renewable energy that can be utilized in Indonesia is very large, but not yet optimally developed. Geographical disparities between locations of energy supply and demand, relatively low technological efficiency, high technology investment, and social factors as energy users pose challenges for the government to develop renewable energy-based technologies. The development of sustainable energy is shown in Figure 1.

Figure 1 shows that sustainable energy consumption in Indonesia continues to grow and sustainable energy consumption in Indonesia is still very low, where the average sustainable energy consumption in Indonesia during 2010-2018 was only 6.05 million tons of oil

Figure 1: Indonesia's renewable energy 2015-2022



equivalent. This is because Indonesia's energy consumption is still dominated by the consumption of fossil energy such as oil, natural gas, and coal.

This is because public awareness of the environment is increasing, resulting in people slowly starting to switch to renewable energy consumption even though the increase is not so significant. Renewable energy still plays a big role in hydropower, biomass, geothermal, and biodiesel. Consumption of renewable energy in Indonesia will affect economic growth, population, and consumption of fossil energy.

According to Sadorsky (2009), The use of RES (renewable energy sources) and economic growth, when analyzed by Ward's method based on hierarchical clusters, reveal the existence of clusters in two countries; a group of countries with a high gross domestic product (GDP) and high RES user countries and another group of countries with low GDP and low RES consumption. The growing population encourages the economy to provide more goods and services which require more production of natural resources that must be extracted or taken stock of.

Research related to the relationship between energy use, economic growth, and CO_2 emissions in Pakistan (1965-2015) that, all-time series are stationary at the first level and difference and there is no time series at the second difference. The coefficient of economic growth has a positive effect on emissions from CO_2 in Pakistan for both observed periods (Khan, 2020). Energy consumption in Indonesia is still based on fossil fuel energy. It is hoped that shortly a significant source of sustainable energy can be found in 2046, if it is not found, it is feared that Indonesia will experience an energy shortage. The development and utilization of sustainable energy have been analyzed by PESTLE, and funds have been identified linking overlapping and cross-sectoral stakeholder interests in the renewable energy sector in Indonesia. Appropriate policies have made renewable energy stakeholders and actors face various risks such as economic and technological. In addition, Indonesia's renewable energy target can reach 23% of the primary energy mix by 2025 and the ASEAN target as a whole.

Author Contribution: Provide input to the government to think about and obtain sustainable energy in the future to provide energy reserves for economic needs and support further development.

2. RELATED WORK

Scientific future planning can influence strategic actions (Gabriel, 2014). The future is a virtual phenomenon of time and has no factuality (Neuhaus, 2006). The future scientifically needs to be considered because its aspects are blurred and the nature of this future is a function of anticipation (Habegger, 2010). Anticipate the future based on knowledge in everyday life and science by elaborating ideas in theoretical templates and generating scenarios (Gabriel, 2014).

The environment and economy are protected by not interfering with growth as a requirement (Lahidji et al., 1999). Energy technology utilizes and stores renewable energy in the energy supply (Whittingham, 2012). The biggest challenge in the use of electric vehicles and the use of electrification from residential buildings can cause uncertainty on the energy demand side (Chakir et al., 2022). The scale of changes in the energy system will have an indicative impact and uncertainty for the future is a challenge for the reliability of the energy system to respond to the possibility of a global community that has provided future solutions with energy transitions (Hadian and Madani, 2013).

Fossil fuels produced from the fossilization process are a type of hydrocarbon compound produced by living plants through the process of photosynthesis which converts solar energy directly into energy chemicals. Most fossil fuels were produced during the Carboniferous century in Earth's Paleozoic era about 325 million years ago. Fossil fuels are fuels that hurt the environment, while green energy is an energy source whose formation does not come from organic objects. Some opinions suggest that green energy is clean energy that does not pollute or add to atmospheric pollutants. This energy can come from water, hydrothermal, hydropower, geothermal, wind, solar, garbage, biomass, biofuel, to ocean waves. In the future, all green energy must become the main policy of energy development and utilization. So, it is better if renewable energy or renewable energy should be put forward not as an alternative.

The roles and impacts of integration on the environment and the adverse impacts of each source of RE, including technical and operational challenges and social challenges towards a sustainable electricity future and grid decarbonization are comprehensively analyzed. some literature shows that RE integration has improved dramatically and has many benefits; however, more is being given to mitigating harmful impacts and challenges have recently emerged, resulting in increasing RE generation and connecting it to the grid to enable future studies to find appropriate solutions towards green and sustainable energy towards sustainable power systems as shown in Figure 2.

An energy source is something that produces energy, directly or through a conversion or transformation process. Renewable energy sources are natural resources that can be used as energy sources or as energy. This energy source cannot be renewed if it has run out. Non-renewable energy sources consist of coal, oil, and natural gas. While renewable energy sources are natural energy sources that can be directly used freely and can be renewed continuously and indefinitely. Renewable energy sources include hydro energy, biomass, geothermal, solar, wind, tidal, ocean waves, and ocean heat. The desire to consume by individuals will lead to a demand for an item. Demand is the desire of consumers to buy goods with various alternative prices. Energy consumption is the use of energy to facilitate human life.

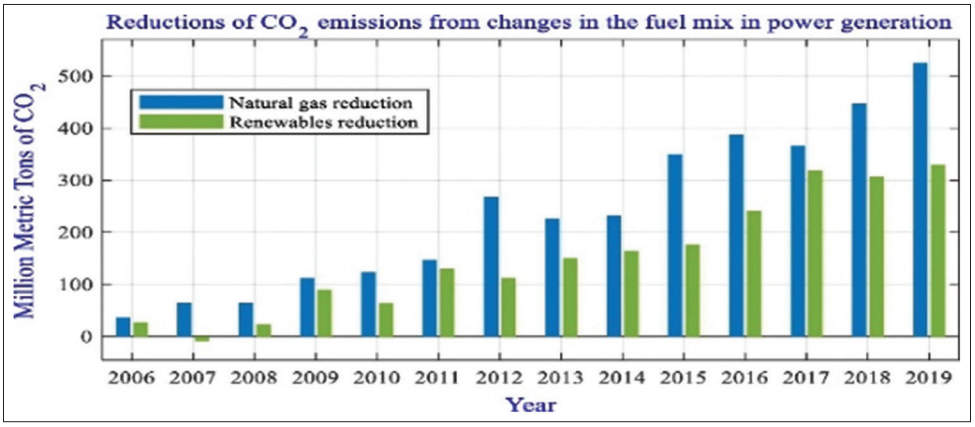
The desire to consume by individuals will lead to a demand for an item. Demand is the desire of consumers to buy goods with various alternative prices. Energy consumption is the use of energy to facilitate human life. The high use of energy can be caused by rapid economic growth. The use of energy can not be separated from human thinking to facilitate a job and want high profits or economic value. The richer a country is, the greater its energy needs, but the ratio of energy needs is not the same. The characteristics of modern society are indicated by the high consumption of energy, especially fossil fuels. The more people, the greater the need for energy. Energy can be used to produce clothing and food, shelter, transportation, communications, and other services that affect the quality of the environment.

The enormous use of energy in urban areas and industrialized countries can cause environmental damage. According to the National Energy Council (2016), The main driving factors for increasing energy demand are population growth, economic growth, energy prices, and technological developments. First, population changes greatly affect the size and composition of energy needs, both directly and as a result of the impact of economic development. The pattern of energy use in urban and rural areas is very different. Second, economic activity assuming GDP growth is very sensitive to energy forecasts. Third, technology plays an important role in determining future energy needs, such as for power generation.

Technology will influence investment decisions, different supply costs for each type of energy, and the level and composition of future energy demand. Economic growth is economic development that occurs from time to time and causes real national income to grow. Gross domestic product is one of the important indicators and the amount of added value to monitor the economic condition of a country during a certain period and is well based on constant prices, while GRDP (Gross Regional Domestic Product) is the basis of constant prices with the added value of goods and services using prices during the year. certain as the basis (Bank Indonesia, 2016). Economic growth and energy use have a positive relationship, meaning that a country's economic growth will increase energy consumption. Because an increase in a country's GDP will increase the country's tendency to increase its energy consumption.

Population Growth Population growth is a dynamic balance between forces that increase and forces that reduce population. When countries are encouraged to supply more energy due to high

Figure 2: CO_2 emission reduction from changing the fuel mix in a power plant



population growth then they will use a faster or cheaper way of using and using fossil fuels.

Energy Subsidy United Nations Environment Program (2008), explains subsidies energy as a direct payment made by the government to producers of energy or buyers to stimulate production or use for energy certain or convert it to a form of energy other. Meanwhile, The IEA states that energy subsidies are government policies related to energy policies that can reduce the cost of energy production, and can increase the value received by energy producers or reduce the value paid by energy consumers. New Energy Development Renewables (NEDR) are driven by the Indonesian government as the future national energy, because of the level high economy. Energy subsidies as forms of government action that aim to reduce production costs of energy, increase the income of energy producers or reduce the costs paid by energy consumers. Fossil energy consumption fossils are fuels derived from organic bodies (living things) that have undergone a sedimentation process for millions of years.

Most fossil fuels were produced during the Carboniferous century in Earth's Paleozoic era, about 325 million years ago. Indonesia still dominates the use of fossil-based energy, especially oil, and coal and it is hoped that shortly (2046) significant renewable energy sources will be found, otherwise, Indonesia will experience an energy deficit. Because they both show substitutions. Currently, fossil energy consumption continues to increase due to population growth, and small, medium, and large industries.

3. RESEARCH METHODOLOGY

Variable Operational Definition Sustainable energy consumption is the use of new energy by Indonesian people over the last few years. This variable data is obtained from the BP (British Petroleum) Statistical Review of World Energy (SRWE) and is measured in units of million tonnes of oil equivalent (equivalent to million tonnes of oil). Economic growth is the percentage of Indonesia's economic growth rate based on constant prices so far. The reason for using economic growth data at constant prices is that a country's economic growth is driven by the output produced in an economy whose input comes from energy consumption. This variable data is obtained from the World Bank and is measured in percent.

Population growth is the percentage of Indonesia's population growth rate in 2022 of 1.17%, which the previous year reached 1.22%, a decline caused by several factors including the declining birth rate. This variable data is obtained from the World Bank and is measured in percent with energy subsidies provided by Indonesia in 2030, the world's energy needs increase by 45%. This data variable is obtained from the Indonesian Ministry of Finance and is measured in billions of rupiah. Fossil fuel energy consumption is the amount of fossil energy consumed by the people of Indonesia. This data variable is taken from the BP SRWE and is measured in million tons of oil equivalent (equivalent to million tonnes of oil). Data Collection Techniques This research is descriptive analysis research with quantitative methods. In this study, the data used is secondary data in the form of time series data for three years in Indonesia.

The data used are renewable energy consumption data and fossil energy consumption data from BP SRWE, data on economic growth and population growth sourced from the World Bank, as well as data on energy subsidies sourced from the Ministry of Finance. This research is processed by using the E-Views analysis tool 10 Data Analysis Classical Assumption Test Technique.

3.1. Normality Test

The normality test was conducted to determine whether the data were normally distributed or not. This regression model will have a residual value that is normally distributed or close to normal. In addition to the tests above, there are three tests of normality-Kolmogorov-Smirnov (Kolmogorov, 1933), (Smirnov, 1948), Two approximation models for finding normality using graphical and numerical models.

The mathematical basis of the statistics for this normality test is quite large and can be obtained from the literature (Motulsky and Ransnas, 1987). Subtraction can be used to assess the curve of the proposed model. The use of a mathematical model, for subtraction for the i^{th} observation in the given data set, can be stated as follows (Equation 1).

$$e_i = y_i - f\left(x_i, \beta\right) \quad (1)$$

where, y_i shows the response of the i^{th} data from the given data set and x_i is the variable vector of each set in the i^{th} study that corresponds to the data set of this study.

3.2. Multicollinearity Test

Multicollinearity shows the condition of a strong correlation or relationship between two or more independent variables. The regression model consists of independent variables, where this model logically shows the effect of speed on the quality of customer satisfaction so that there should not be a high correlation between the two variables. The multicollinearity test is not carried out on a simple linear regression analysis but is carried out on an autocorrelation test that does not need to be applied to the intersecting data.

3.3. Heteroscedasticity Test

Assumptions made for errors in OLS regression are errors that have the same variance but are not expressed as homoscedasticity. If this assumption is violated, then it has heteroscedasticity properties.

- The result of Heteroscedasticity test results are;
- OLS estimators and regression predictions follow an unbiased and consistent determination.
- The OLS estimator is no longer BLUE, because it is no longer efficient and its regression prediction is also inefficient.
- Hypothesis testing (t_{test}, F_{test}) is no longer valid, caused by the inconsistency of the covariance matrix of the estimated regression coefficients.

3.4. Autocorrelation Test

The autocorrelation test is based on the relationship of the same variable to two consecutive time intervals and measures the value of the related variable with the original value in the time series. Durbin-Watson statistics are commonly used to test autocorrelation and have been applied to data sets with statistical software. The test results of the Durbin-Watson model are 0 to 4. A result that is close to 2 means that the level of autocorrelation is very low. A result that is close to a value of 0 means a stronger positive autocorrelation, and a result that is close to a value of 4 indicates a strong negative autocorrelation. The formula used for the Durbin-Watson Test can be seen below (Equation 2).

$$d = \frac{\sum_{t=2}^{n}\left(e_t - e_{t-1}\right)^2}{\sum_{t=1}^{n} e_t^2} \quad (2)$$

The symbol e_t is the error (residual) on the t^{th} observation, where n is the amount of data analyzed, and the simulation of the calculation of the d formula is shown below.

4. RESULTS AND DISCUSSION

The results of the research data analysis for the Classical Assumption Test obtained the results of the normality test that had been carried out with the Jarque-Bera value of 0.9596 with a probability of 0.6189 which was greater than the significance value of 0.05 (α = 5%) and it could be concluded that the data used were distributed normally.

The multicollinearity test can be seen in the VIF column, where the VIF value for the economic growth variable is 1.1862, the population growth variable is 1.4957, the energy subsidy variable is 1.5441, and the fossil energy consumption variable is 1.1529. This result shows that the VIF value of the four variables does not exceed 10, so there is no multicollinearity in the four independent variables.

The results of the classical assumption test of linear regression models using OLS, obtained a good regression model that is free from multicollinearity, so the model in this study is free from multicollinearity. In the results of the Glejser Heteroscedasticity Test, it can be seen that the Chi-square probability value of 0.111 is greater than the level greater than the significance value used (α = 5%), concluded that the model is free from heteroscedasticity and the results of the autocorrelation test, the probability of Chi-Squared value is 0.721 which is greater than the significance value used (α = 5%), so it can be concluded that this equation model does not experience autocorrelation symptoms.

4.1. Multiple Linear Regression Analysis

The estimation results using the following equation can be written:

$$y_i = \beta_0 + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_n x_n x_{in} + \varepsilon \quad (3)$$

y_i = dependent variable
x_i = independent variable
β_0 = y-intersect
β_n = slope coefficient for each independent variable
ε = residual

4.2. Test Statistics

The coefficient of determination has a degree of accuracy about the independent variable and the dependent variable. The results of the regression test obtained an R^2 value of 0.9147 which means that sustainable energy consumption is obtained from variations in the model of economic growth, population growth, energy subsidies, and fossil fuel-based energy consumption of 91.47%, and the remaining 8.53% is explained by other variables in outside the model.

Based on the results of regression analysis shows that the f_{count} value is greater than the f_{table} value, namely 64.304 > 2.99 which means Ha is accepted and Ho is rejected, so it can be concluded that together the variables of economic growth, population growth, energy subsidies, and consumption of fossil fuel energy together have a significant effect on sustainable energy consumption.

Discussion on the Effect of Economic Growth on Sustainable Energy Consumption in Indonesia for three years. The results of the analysis show that the regression coefficient of the economic growth variable is -0.0281. This shows that when there is an increase in the economic growth of 1%, there will be a decrease in sustainable energy consumption of 0.0281 mtoe (million tonnes of oil equivalent) assuming that the variables of population growth, energy subsidies, and consumption of fossil energy are fixed. The results of hypothesis testing are known that economic growth does not affect sustainable energy consumption.

This can be seen from the t-count -0.9691 < 1.7081 with a significance level of 0.739 (greater than = 5%). Economic growth does not affect sustainable energy consumption in Indonesia.

The results of this study are following the research conducted by Attiaoui et al. 2017, which states that economic growth has no significant effect on sustainable energy consumption. These results confirm that most African countries are still far from being able to exploit renewable energy. The results of this study are interesting to study because they are different from the research conducted by Sadorsky, 2009, that economic growth has a significant effect on sustainable energy consumption after all, energy demand and economic growth in developing countries can create opportunities for these countries to increase the use of sustainable energy.

Likewise, research conducted by Dasilva, 2018, says that economic growth has an effect positive and strong impact on renewable energy consumption. With increasing economic growth, the ability of a country to invest in renewable energy sources will also increase. Thus, it can encourage countries to increase sustainable energy consumption.

The Effect of population growth on sustainable energy consumption in Indonesia for three years shows the results of the analysis that the regression coefficient of the population growth variable shows the number 2.0064. The results of this analysis indicate that there is an increase in population growth of 1.0%, which will increase sustainable energy consumption by 2,006,355 mtoe with the assumption that the variables of economic growth, energy subsidies, and consumption of fossil energy are fixed. The results of hypothesis testing found that population growth does not affect sustainable energy consumption.

This can be seen from the t_{count} 1.1508 < 1.7081 with a significance level of 0.5573 (greater than = 5%). Based on this research, shows that population growth does not affect sustainable energy consumption in Indonesia, because the energy consumption, of the population in Indonesia is still dominated by fossil fuel energy consumption, so when there is an increase in population growth, people will consume fossil fuel energy. So, when population growth occurs, it will increase fossil energy consumption and do not affect on increasing sustainable energy consumption.

The increase in energy consumption can result in environmental damage. In addition, the pattern of energy consumption in Indonesia has not led to renewable energy because public awareness of the environment is still very minimal. The growing population encourages the economy to provide more goods and services to maintain or enhance the standard of living of a nation. Increased production of goods and services will demand more production of natural resources that must be extracted or taken stock. As a result, natural resources will The increase in energy consumption can result in environmental damage.

In addition, the pattern of energy consumption in Indonesia has not led to renewable energy because public awareness of the environment is still very minimal. Population growth encourages the economy to provide more goods and services to maintain or improve a nation's standard of living. Increased production of goods and services will demand more production of natural resources that must be extracted or taken stock. As a result, natural resources will increase in energy consumption can result in environmental damage. In addition, the pattern of energy consumption in Indonesia has not led to renewable energy because public awareness of the environment is still very minimal.

Economic growth and regional development require efficiency and effectiveness in the industrial, trade, and service sectors. Increased income and increased mobility will provide energy consumption and have an impact on environmental quality and will correlate with energy demand (Surya et al., 2021).

The results of this study are interesting to discuss because they are different from the research conducted by Dasilva, 2018, when countries are encouraged to supply more energy due to high population growth they will use the faster or cheaper way i.e., by utilizing and using fossil fuels. The Effect of Energy Subsidies on Sustainable Energy Consumption in Indonesia for three years results in an analysis that, the regression coefficient of the energy subsidy variable is –0.0044. This shows that when there is an increase in energy subsidies of one billion, it will reduce the consumption of renewable energy by 0.0044 mtoe with the assumption that the variables of economic growth, population growth, and consumption of fossil energy are fixed.

From the results of hypothesis testing, it is found that energy subsidies have a negative and significant effect on renewable energy consumption. This can be seen from the t-count -2.174974 >-0.70814 with a significance level of 0.0397 (smaller than = 5%), that energy subsidies have a positive and significant impact on sustainable energy consumption in Indonesia.

Energy subsidies have a negative and significant effect on renewable energy consumption because energy subsidies in Indonesia are mostly aimed at fuel consumption which is not renewable energy. In addition, energy subsidies are also allocated for electricity. Meanwhile, energy subsidies used for renewable energy development are still very low. The results result in a significant impact of energy subsidies on sustainable energy consumption in Indonesia. Where when fossil energy subsidies increase it can reduce the consumption of renewable energy.

Analysis, rapid innovation by facilitating the transition can lower the cost of sustainable technologies as well as technologies such as batteries so that advances in solar and wind technology are examples of future energy that can be directed in a certain direction through technology policy (Gielen et al., 2019). Thus, the government needs to shift the use of fuel to biofuels by preparing the downstream sector of the biofuel industry, the price of biofuel produced by producers is purchased according to its economic price, and the price of biofuel subsidies is optimized so that it can compete with fuel.

According to Bridle and Kitson, 2014, with fossil fuel subsidies, renewable energy does not benefit because it receives less funding from the government than fossil fuel sources. Fossil fuel subsidies can hinder the development of renewable energy. In addition, fossil fuel subsidies can impair the relative cost of renewable energy competitiveness.

The Effect of Fossil Energy Consumption on Sustainable Energy Consumption in Indonesia for three years with the results of the analysis that the regression coefficient of the energy subsidy variable shows several 0.0543. These results indicate that if there is an increase in sustainable energy consumption by one mtoe, it will increase sustainable energy consumption by 0.0543 mtoe with the assumption that the variables of economic growth, population growth, and energy subsidies are fixed.

The results of testing the hypothesis that energy subsidies affect sustainable energy consumption are shown from the results of t_count 5.7370 > 1.7081 with a significance level of 0.0000 (less than = 5%). Variables of subsidized energy, population growth, and consumption of fossil energy have a positive effect on CO_2 emissions and fossil energy consumption whose externalities are related to greenhouse gases and energy consumption, while sustainable energy consumption has a negative but significant impact on CO_2 emissions in Indonesia in 1990-2014 (Sasana et al., 2017).

Energy use in Indonesia is still dominated by the use of fossil fuels (oil and coal), so it is necessary to obtain sustainable energy in shortly future so that there is no energy deficit. The use of sustainable energy is a special concern for the government to reduce dependence on fossil fuel energy and make environmentally friendly energy. Meanwhile, in the research of Apergis and Payne, 2012 (Apergis and Payne, 2012), the results show that the consumption of fossil fuel energy affects sustainable energy consumption. If new energy sources are not found shortly, it is feared that they will cause an energy deficit.

Meanwhile, research by Apergis and Payne (Apergis and Payne, 2012) states that there is a two-way relationship between sustainable energy consumption and non-renewable energy consumption. Both have a negative relationship because it shows substitute goods or substitutions between the two. If the consumption of fossil energy increases it will reduce the consumption of renewable energy and vice versa if the consumption of fossil energy decreases it will increase the consumption of renewable energy.

Effect of Economic Growth, Population, Energy Subsidy, and Fossil Energy Consumption on Sustainable Energy Consumption in Indonesia for three years. Based on the analysis results show that economic growth, population growth, energy subsidies, and consumption of fossil energy together have a significant influence on renewable energy consumption. The results of the F_{count} test of 64.3035, which is greater than the F_{table}, which is 2.99. The results of the study can be concluded that economic growth, population growth, energy subsidies, and consumption of fossil energy for three years together have a significant influence on renewable energy consumption.

Increased economic growth can increase investment in renewable energy sources that will encourage an increase in the consumption of renewable energy in the country. In addition to economic growth, one important aspect of renewable energy consumption is population growth. With increasing population growth, the need for energy resources will also increase.

The need for energy will be used for public consumption. In addition, the existence of energy subsidies will be able to encourage technology investment, especially in the development of renewable energy so that it can encourage and facilitate public access to be able to consume renewable energy and can create opportunities for sustainable energy use to continue to increase. However, Energy subsidies in Indonesia are still mostly aimed at subsidizing fuel and electricity. Where fuel is an energy that is classified as fossil energy so it can lead to waste in the use of this energy because the price is cheaper. Fossil energy consumption can affect renewable energy consumption. Energy use in Indonesia is still dominated by the use of fossil fuels, and it is hoped that significant sustainable energy sources will be found in 2046.

The results of this study are in agreement with the research conducted by (Costello et al., 2018), research results show that economic growth, fossil fuel prices, population growth, imports, and emissions together affect sustainable energy consumption. The results of research conducted by Bridle (Bridle et al., 2017), state that with fossil fuel subsidies, sustainable energy does not benefit because it receives less funding from the government than other fossil fuel sources.

Fossil fuel subsidies can hinder energy development renewable. In addition, fossil fuel subsidies can interfere with the relative cost of power renewable energy competitiveness.

5. CONCLUSION

After analyzing and discussing the research, it can be concluded as follows;

1. The economic growth variable (X1) has no significant effect on sustainable energy consumption in Indonesia.
2. The population growth variable (X2) has no significant effect on sustainable energy consumption in Indonesia.
3. The energy subsidy variable (X3) will have a negative and significant effect on sustainable energy consumption in Indonesia.
4. The fossil energy consumption variable (X4) will have a positive and significant effect on sustainable energy consumption in Indonesia.
5. Economic growth, population growth, energy subsidies, and consumption of fossil fuel energy have a positive and significant impact on sustainable energy consumption in Indonesia.

Based on the research that has been done, the researchers provide the following suggestions:

1. The government needs to maintain increased economic growth which can also increase public awareness and attention to the environment and support environmentally sound development. Thus, the consumption of renewable energy can be increased to substitute fossil energy which is in very limited supply.
2. Energy consumption is still high in Indonesia due to high population growth. So, control is needed from the government through the Program (Family Planning).
3. There is a need for a review of energy subsidies in Indonesia and government policies are needed regarding the allocation

of energy subsidies for renewable energy such as those related to development and investment.
4. The government must be committed to reducing the use of fossil energy by implementing a green economy to support sustainable development.
5. The government must be committed to achieving the target of using renewable energy by utilizing the potential of existing renewable energy.

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