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Comparison of Renewable and Non-Renewable Energy in the Long and Short Term of Indonesia Economy

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ABSTRACT

Indonesia has established Government Regulation Number 79 of 2014 concerning National Energy Policy (KEN). KEN as a public policy product was determined after going through a "top-down" debate since 2010. KEN's target only focuses on energy supply, even though energy policy has shifted to the side of energy demand. KEN does not set greenhouse gas mitigation targets. To support the achievement of KEN's goals regarding the mix of new and renewable energy (EBT). Indonesia has great potential, but can the potential be maximized by the government in the direction of better and environmentally friendly energy policies. This study analyzes the movement of renewable and non-renewable energy to the Indonesian economy from 1990-2021, using the Error Correction Model (ECM) statistical method by considering short-term and long-term results in the model. Long-term results Consumption of non-renewable energy (CFE) has a positive and significant impact on increasing economic growth by 7.14%. Renewable energy in the form of electricity (RE) has a positive and significant influence in increasing economic growth by 0.18%, while the results of renewable energy through water resources (RIF) do not have a positive but not significant impact on Indonesia's economic growth. In the short-term results of the Error Correction Model (ECM), consumption of non-renewable energy (CFE) has a positive and significant effect on increasing economic growth by 5.35%. while the results of renewable energy in the form of electricity (RE) and renewable energy through water resources (RIF) do not have a positive but not significant impact on Indonesia's economic growth during 1990-2021.

Keywords: Economy, Renewable Energy, CO_2 Emissions
JEL Classifications: O44, Q43, Q56, Q58

1. INTRODUCTION

The Indonesian government through the National Energy Council (DEN) has drawn up a roadmap for the energy transition towards net zero emissions in 2060. Every year the target for new renewable energy will increase, starting from 2025 with a target of 23% to 2060 with a target of 66%. The Indonesian government is trying to reach the target of 23% new renewable energy in 2025 but in fact new renewable energy in Indonesia only increases 0.55% per year. The target that should be achieved by the government for the achievement of new renewable energy per year is 0.9% (DEN, 2020). Therefore, it is necessary to plan a more progressive policy direction to achieve these new energy achievements. Thus, an analysis is needed related to how the government observes macroeconomic factors that influence the use of new renewable energy because so far the comparison of the use of new renewable energy with conventional energy such as; oil, natural gas and new coal are only at 10 in comparison. The use of conventional energy is still many times greater than the use of new renewable energy. The following shows the mix of energy utilization in Indonesia. Efforts to achieve the ideal energy mix, especially the New and Renewable Energy (EBT) mix, as in the government's scenario, have not met the expected targets. Some of the problems that often arise in efforts to achieve Renewable energy achievements in Indonesia include; Indonesia's new renewable energy potential is scattered, the network's ability to absorb electricity is limited, some new renewable energy is intermittent, so a power plant with large storage is needed. In addition, the ability of the domestic industry which is still limited in terms of technology and market uncertainty are also obstacles not increasing according to the target (Sekretariat Jenderal Dewan Energi Nasional, 2022a).

With regard to this issue, the Indonesian government has tried to increase the productivity of Renewable energy procurement with the consistency of investment efforts in this field. The Directorate of Energy Conservation noted that investment realization in 2017 reached IDR 48 billion, exceeding the target set at IDR 41.4 billion. Throughout 2017, most of the implementation of energy efficiency investments was the result of investment grade energy audit (IGA) partners in 2015 and 2016. Cooperation between the central and regional governments in the field of energy efficiency is increasingly visible from the emergence of investment from the regional budget since 2017 (Sekretariat Jenderal Dewan Energi Nasional, 2022b).

In general, Indonesia really hopes for renewable energy for the future and makes a transition from changing energy to renewables. Several studies on how world conditions serve as a reference for Indonesia in advancing renewable energy and a picture of non-renewable energy are presented by several important findings (Zhe et al., 2021). The use of renewable energy and financial development does not have a strong influence on economic growth. However, it was identified that the use of renewable energy has a positive impact on financial development. Therefore, it is highly recommended that the use of renewable energy should be encouraged by domestic policy makers. However, to understand the main indicators of economic growth, many different factors must be considered (Nguyen et al., 2021). The concept of renewable energy and renewable energy sources, the relationship between renewable energy sources and sustainable energy supply is positively confirmed and consistent with the findings of previous relevant studies. In addition, the most important point from the findings of this study is that sustainable energy supply was found to have a positive effect on sustainable economic growth in the context of Vietnam (Salman and Hosny, 2021). One of the main components of accelerating economic growth in the energy sector is government support which is one of the main drivers of the positive impact for such energy and renewable energy which is significant from electricity generated from renewable energy sources, CO_2 emissions, on economic growth. However, the positive and significant impact of carbon dioxide is still a challenge to achieve sustainability. Policies have been identified to develop the required energy grid in the future.

Renewable energy is a potential source of the world and especially Indonesia, in outline renewable energy must be able to be developed in a sustainable manner for the activities of a country. When viewed from the movement of renewable and non-renewable energy in Indonesia, it is presented as follows:

The Figure 1, is how the average consumption/use of renewable and non-renewable energy in Indonesia during 1990-2021, where 73% of Indonesia depends on non-renewable energy, 17% is generated by renewable energy electricity and 10% of renewable energy comes from water resources. Indonesia has established Government Regulation Number 79 of 2014 concerning National Energy Policy (KEN). KEN as a product of public policy was determined after going through a "top-down" debate since 2010. KEN's target is only to focus on energy supply, even though energy policy has shifted to the side of energy demand. KEN does not set greenhouse gas mitigation targets. To support the achievement of the KEN target regarding the mix of new and renewable energy (EBT), the Government of Indonesia has stipulated various regulations regarding the Feed-in Tariff for the selling price of electricity for EBT generators but it does not run optimally because the price is more expensive, this is an obstacle to the problem of using renewable energy in Indonesia, (Wahid, 2020). The emerging paradigm regarding energy is that several countries that are more advanced than Indonesia have not been successful and able to sustainably develop renewable energy, for example, several findings found that various countries are still dependent on non-renewable energy. (Asif et al., 2021), Looking at 99 countries of the world with low, middle and high income energy inclusive production functions, the consumption of non-renewable and renewable energy, capital and labor has a significant positive impact on economic growth. It was concluded that although energy consumption has a vital interest in driving economic growth and development but too much focus on non-renewable energy causes environmental problems and some countries still depend on non-renewable energy, therefore it is advisable to promote the renewable energy sector for efficient and friendly energy use environment. (Ibrahim, 2021), G-20 countries have always been the main proponents of the need to end global warming and other conditions of climate change. Unfortunately, they continue to finance the production of fossil fuels thus creating a bad scenario, they are still dependent on non-renewable energy for economic activity.

Indonesia's renewable energy problem is changing fiscal policy influenced by the different political interests of key renewable energy stakeholders, and overshadowed by various key agency issues. This is exacerbated by the limited inter-agency communication between Renewable Energy stakeholders. While the country has instituted a number of fiscal policies to attract high levels of foreign and domestic investment in infrastructure projects, including for RE, political instability and policy uncertainty are two of the main interrelated obstacles preventing Indonesia from achieving its ambitious renewable energy aspirations and targets, (Halimanjaya, 2019).

This study will comprehensively analyze the impact of renewable and non-renewable energy on the Indonesian economy throughout 32 years of Indonesia's activity in the economy. The expected result is to know in detail the long-term and short-term effects of renewable and non-renewable energy on an Indonesian economy, and is expected to become an important reference in Indonesia's energy development.

2. LITERATUR REVIEW

Economic growth of non-clean energy consumption and the interaction between trade openness and consumption of non-clean energy have a driving effect on carbon dioxide emissions, but clean energy consumption is known to reduce carbon emissions. In addition, the analysis confirms the existence of an inverted U-shaped environmental Kuznets curve and the pollution paradise hypothesis in the PIMC economics panel. Finally, there is one-way causality from non-clean energy consumption to economic growth, but no causality between clean energy consumption and economic growth. The goal of sustainable economic growth with a safe environment can be achieved by encouraging clean energy consumption in the economy (Luo et al., 2022).

Short-term and long-term two-way causality between renewable energy consumption and economic growth, the importance of renewable energy for economic growth, the expansion of renewable energy will also reduce dependence on foreign energy sources, volatile oil and natural gas prices on international markets, and reduce degradation long-term environmental issues associated with carbon emissions (Apergis and Danuletiu, 2014) consumption of renewable energy does reduce CO_2 emissions while financial development does not necessarily increase environmental degradation. Second, financial developments were found to lead to bilateral use of renewable energy. Increased trade activity can increase energy consumption and CO2 emissions which cause environmental degradation. To achieve the dual benefits of trade agreements, it is necessary to pay attention to the role of renewable energy in the national energy portfolio (Vo et al., 2022). Renewable energy consumption which continues to grow exponentially has become an important issue for almost every country. Development of the renewable energy sector is essential for countries that depend on foreign energy to be self-sufficient, (Sarkhanov and Huseynli, 2022).

International trade and economic growth will drive renewable energy consumption in the long term. However, whether increasing the percentage of renewable energy consumption can solve environmental problems depends to a large extent on the future trajectory of CO 2 emissions as the economy develops. Overall international trade leads to increased consumption of renewable energy as a long-term relationship. This means that in the future, economic development along with international trade and advances in environmental technology are expected to make it easier and encourage the consumption of renewable energy in each country (Rakhel, 2020).

Positive impact although statistically small, consumption of renewable energy on economic growth Also, causality is found between these two macroeconomic indicators, EU political decisions about the need to increase consumption of renewable energy. They also prove that consumption of renewable energy has a positive impact on economic growth. Thus, the inclusion of such politics into future EU and national strategies is further motivated. In addition, driven by the EU Directive 2009/28/EC which states that the share of renewable energy consumption into final energy consumption must reach 20% (Soava et al., 2018).

Changes in consumption of non-renewable energy constrain growth, it reduces emissions. Increased consumption of non-renewable energy products promotes growth and improves environmental quality. Consumption of this type of energy has a negligible impact on environmental pollution as it promotes economic growth. Oil-producing policy makers to explore avenues to invest in and promote carbon-reducing technologies in production processes (Awodumi and Adewuyi, 2020). Non-renewable energy still dominates world economic activity, future projections have been found. Energy predictions help countries make better decisions. It helps in planning for renewable and non-renewable energy, budgeting, production, consumption levels and risk management. Energy forecasting enables decision makers to efficiently allocate resources for future growth and manage production and consumption (Pandey et al., 2023).

3. RESEARCH METHODOLOGY

3.1. Types and Sources of Data and Variable Operational Definitions

This research is in the form of descriptive quantitative problem solving based on data, by presenting, analyzing and interpreting it. The data used is secondary data, this data is obtained indirectly from various publications, publications of official data platforms and publications of various data collection books. The data in the observation area is the coverage of the territory of the State of Indonesia, the data used is secondary data (time series) with the 1990-2021 time series. The data used is published on the official website https://data.worldbank.org/. The following is a summary of the variables, units, descriptions and data sources in the study:

1. Economic growth
   Growth and development of income (GDP) from the value of goods and services produced in Indonesia.
2. Consumption of non-renewable energy
   Fossil fuel energy consumption (% of total), Fossil fuels consist of coal, oil, petroleum and natural gas products.
3. Renewable energy is water resources
   Renewable internal freshwater resources per capita (cubic meters) Flow of renewable internal freshwater resources refers to the internal renewable resources (internal river flows and groundwater from rainfall) in the country. Renewable internal freshwater resources per capita are calculated using World Bank population estimates.
4. Renewable energy with electricity
   Renewable electricity output (% of total electricity output) Renewable electricity is the share of electricity produced by renewable electricity plants in the total electricity produced by all types of plants.

3.2. Data Analysis Procedures

1. Stationarity test (unit root test)

In general, time-series economic data is often not stationary at the series level. If this happens, stationary conditions can be achieved by differentiating one or more times. If the data is stationary at the series level, then the data is integrated of order zero or I(0). If the data is stationary at the first difference level, then the data is integrated of order one I(1). Unit root testing in this study will use Augmented Dickey Fuller (ADF) to test the stationary of each variable. Testing on each variable begins with testing at the order level. If the data is not stationary at the order level, then a level of integration (1st difference) test is performed to see the stationary data at this order. The results of the test are compared with the McKinnon Critical Value. The data is said to be stationary if the Test critical values are greater than the Augmented Dickey Fuller (ADF) test statistic, meaning that H0 is rejected and Ha is accepted, and vice versa. The results of the analysis tests were carried out with a significance level of 5 percent each. The hypotheses used in the stationary test are:

- H0: ρ=1, there is a unit root or non-stationary data, meanwhile
- Ha: ρ<1, there is no unit root or stationary data.

2. Cointegration test

The cointegration test carried out in this study used the Eagle-Granger (EG) test and to obtain the EG value the data used must have integrated to the same degree. The results of the OLS test on an equation are then estimated using the autoregressive equation model of the residuals based on the following equation:

$$\Delta\mu_t = \Delta\mu_t\text{-}1 + \Delta\mathrm{I}\sum_{i=1}^{m}\Delta\mu_t - 1$$

By testing the hypothesis as follows:
Ho=μ=level (1), meaning no cointegration
Ha=μ # level (1), meaning there is cointegration.

3. Ordinary Last Square (OLS) and Error Correction Model (ECM)

The data is stationary at the level, so the Ordinary Least Squares (OLS) method can be used to estimate the parameters of the multiple linear regression model. Regression is the study of how the influence of one dependent variable is influenced by one or more of the independent variables with the aim of estimating and/or predicting the average value of the dependent variable based on the known values of the independent variables. Multiple regression models are regression models that consist of more than one independent variable. The econometric model using the OLS (Ordinary Least Square) least squares method in this study is as follows:

$$EGt = \beta_0 + \beta_1 CFE_t + \beta_2 RIF_t + \beta_3 RE_t + et$$

Where:

GE	:	Economic growth
CFE	:	Non-renewable energy consumption
RIF	:	Renewable water resources
RE	:	Renewable energy with electricity
β1, β2, β3	:	Regression coefficient of each variable
t	:	Research year 1990-2021
et	:	Error Term

If the data is not stationary at the level level, but stationary at the difference level and the two variables are cointegrated or in other words have a long and short term relationship or balance. There are differences in what economic actors want and what happens, so adjustments are needed. Models that include adjustments to make corrections for imbalances are referred to as Error Correction Models/ECM (Widarjono, 2018). ECM analysis is used to determine the effect of independent variables on the dependent variable. The econometric model with the Error Correction Model (ECM) technique is as follows:

$$D(RER)t = \beta_0 + \beta_1 D(CD)_t + \beta_2 D(FD)_t + \beta_3 D(CA)_t + ect(-1)$$

Where:

GE	:	Economic growth
CFE	:	Non-renewable energy consumption
RIF	:	Renewable water resources
RE	:	Renewable energy with electricity
β1, β2, β3	:	Regression coefficient of each variable
t	:	Research year 1990-2021
et	:	Error term

4. Multicollinearity Test

Detection of multicollinearity can be done by looking at the Variance – Inflating Factor (VIF) value from the results of the regression analysis. If the VIF value is >10, there are symptoms of high multicollinearity (Widarjono, 2013). The speed of increasing variance or covariance can be seen with the Variance Inflation Factor (VIF), which is defined as:

$$VIF = \frac{1}{(1-R^2)}$$

As R2 approaches 1, VIF approaches infinity. This shows that as the range of collinearity increases, the variance of an estimator also increases and at a limit value can be infinite (Gujarati, 2009). H0: VIF >10, there is multicollinearity between the independent variables, Ha: VIF <10, there is no multicollinearity between the independent variables

5. Heteroscedasticity Test

In Widarjono (2013) the OLS method assumes that the disturbance variable has an average of zero, has a constant variance and the disturbance variable is not interconnected between one observation and another so as to produce a BLUE OLS. In heteroscedasticity, the regression model does not have a constant variance, thus the

Table 1: Unit root test results at level

Variable	ADF t-Statistic	Prob	Result	Conclusion
GE	−1.8222	0.3632	Accept H0	Not Stationary
CFE	−4.7673	0.0008	Reject H0	Stationary
RIF	−2.7490	0.0775	Accept H0	Not Stationary
RE	−1.5173	0.5117	Accept H0	Not Stationary

Table 2: Unit root test results at level 1

Variable	ADF T-Statistic	Prob	Result	Conclusion
GE	−8.0810	0.0000	Reject H0	Stationary
CFE	−3.6554	0.0108	Reject H0	Stationary
RIF	−8.5499	0.0000	Reject H0	Stationary
RE	−6.9026	0.0000	Reject H0	Stationary

Table 3: Engle-granger (EG) cointegration test results

Variable	ADF T-Statistic	Prob	Result	Conclusion
Ect(−1)	−39.827	0.001	Reject H0	Stationary

Table 4: Ordinary least square (OLS) results

Variable	Coefficient	Standard error	t-Statistic	Prob.
CFE	7.1432	2.8789	2.4811	0.0194*
RE	0.1884	0.0794	2.3723	0.0248*
RIF	0.0566	0.0409	1.3843	0.1772
C	−74.817	30.896	−2.4210	0.0222

Information: ***Significant at α=0.01. **Significant at α=0.05. *Significant at α=0.10

existence of heteroscedasticity causes the estimator to no longer have a minimum variance. So in the presence of heteroscedasticity, the OLS estimator does not produce the Best Linear Unbiased Estimator (BLUE) only the Linear Unbiased Estimator (LUE). There are several methods used to detect heteroscedasticity, namely through the informal method, the Park method, the Glejser method, the Spearman Correlation method, the GoldFeld-Quandt method, the Breusch-Pagan method and the white method.

6. Autocorrelation test

In Widarjono (2013) one of the important assumptions in the OLS method related to disturbance variables is that there is no relationship between one disturbance variable and another disturbance variable. Meanwhile, autocorrelation is a correlation between members of one observation with other observations at different times. In relation to the OLS method, autocorrelation is the correlation between one disturbance variable and another disturbance variable. So with autocorrelation, the OLS estimator does not produce the Best Linear Unbiased Estimator (BLUE) only the Linear Unbiased Estimator (LUE). There are several methods used to detect autocorrelation problems, namely through the Durbin-Watson method, the Breusch-Godfrey method.

4. RESULTS AND DISCUSSION

1. Stationary test results

Stationarity testing in this study used the Augmented Dickey-Fuller Test (ADF) method. If the absolute t-count value is greater than the absolute critical MacKinnon value, then H0 is rejected, meaning that the time series data is stationary and if vice versa, H0 is accepted, meaning that the time series data is not stationary. In the case if the t-count value is negative, it can be said that if the t-count value is less than the MacKinnon critical value, then H0 is rejected, meaning that the time series data is stationary, if otherwise H0 is accepted, it means that the time series data is not stationary (Gujarati, 2009).

Based on Table 1 the unit root test by comparing the value of the t-count with the critical value for each α, namely 1 percent, 5 percent, and 10 percent, it can be concluded that there are no variables that are stationary at the level level, so that the unit test will be repeated root test on the first difference on each variable and the results can be seen in the following table:

In Table 2, the unit root estimation results at the first difference level for all variables are stationary. This means that the data used in this study are integrated at order one or can be shortened to I (1) so that the data is free from spurious regression problems. Therefore, the stationary requirements have been met, the next stage can be further data processing.

2. Cointegration test results

The purpose of the cointegration test is to see whether there is a long-term relationship between the independent variable and the dependent variable. Cointegration testing was carried out using the Engel-Granger (EG) cointegration test method. If the absolute t-count value is greater than the absolute critical MacKinnon value, then the residual is cointegrated, meaning that there is a long-term relationship between the independent variable and the dependent variable. In the case if the t-count value is negative, then it can be said if the t-count value is less than the MacKinnon critical value, then the residual is cointegrated meaning that there is a long-term relationship between the independent variable and the dependent variable:

Based on Table 3 of the Engel Granger (EG) cointegration test, it can be seen that the residual (resid01) is stationary at the level which can be seen from the t-count value that is greater than the MacKinnon critical value of 5%, and 10%, the residual is cointegrated, meaning that there is a long-term relationship between independent variable and dependent variable.

3. Ordinary Last Square (OLS) and Error Correction Model (ECM)

The results of the ordinary least square (OLS) are the results of the long-term model between the effects of non-renewable energy consumption (CFE), renewable water resources (RIF) and renewable electricity (RE) on economic growth (GE), so the results of the long-term equation as follows (in Table 4):

$GE_t = -74.817 + 7.1432CFE_t + 0.1884RE_t + 0.0566\, RIF_t + et$ (−2.4210) (2.4811) (2.3723) (1.3843)

In the long-term model results, it is seen that there is a positive and significant influence between the consumption of non-renewable energy (CFE) and renewable electricity (RE) on Indonesia's Economic Growth, while Renewable Energy Water Resources (RIF) had no effect on Indonesia's economic growth in 1990-2021. The short-term model is formed because the model fulfills the conditions that include adjustments to make corrections for imbalances called the Error Correction Model (ECM) model calculates the effect in the short term and is presented as follows:

In Table 5, all variables are differentiated in the ECM model to determine the short-term relationship. The short-term equation obtained is:

$D(GE)_t = 0.023484 + D(5.356558)CFE_t + D(0.081624)RE_t + D(0.061373)RIF_t + (-0.039567)ECT(-1)$ (0.043855) (0.129627) (0.991494) (1.503249) (1.101781)

The negative sign (-) on the ECT coefficient indicates the validity of the model specification. The short-term ECM estimation results show a negative ECT coefficient value, namely −0.039567 and is significant at a significance level of 0.05. That is, the conditions for short-term estimation of the ECM are met and the ECM model

Table 5: ECM short term estimation results

Variable	Coefficient	Standard error	t-Statistic	Prob.
D (CFE)	5.356558	41.32297	0.129627	0.0089
D (RE)	0.081624	0.082324	0.991494	0.3322
D (RIF)	0.061373	0.040827	1.503249	0.1470
ECT (−1)	−0.039567	0.035912	1.101781	0.0282
C	0.023484	0.535500	0.043855	0.9654

Information: ***Significant at α=0.01. **Significant at α=0.05. *Significant at α=0.10, ECM: Error correction model

Table 6: Multicollinearity results

Short term equation		
Variable	**VIF Value**	**Conclusion**
CFE	8.288539	Within Tolerance Level
RE	1.006313	Within Tolerance Level
RIF	1.001674	Within Tolerance Level

Table 7: Heteroscedasticity test

Short term equation	
F-statistic	1.068087
Obs*R-squared	3.285974
Scaled explained SS	3.461190
Prob. F (3,28)	0.3784
Prob. Chi-square (3)	0.3496
Prob. Chi-square (3)	0.3258

Table 8: Autocorrelation test

Breusch-Godfrey serial correlation LM test	
Short term equation	
F-statistic	13.71759
Obs*R-squared	16.42973
Prob. F (2,36)	0.0001
Prob. Chi-square (2)	0.0003

Figure 1: Percentage of Indonesia's energy use during 1990-2021

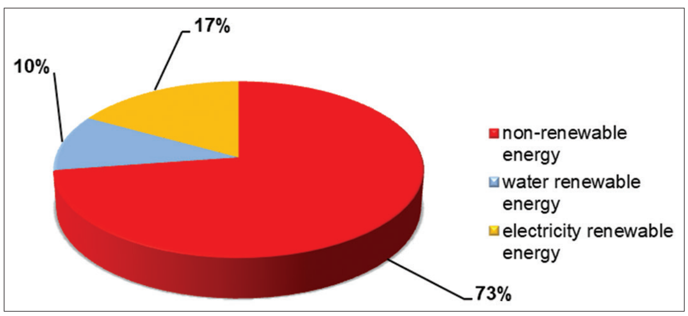
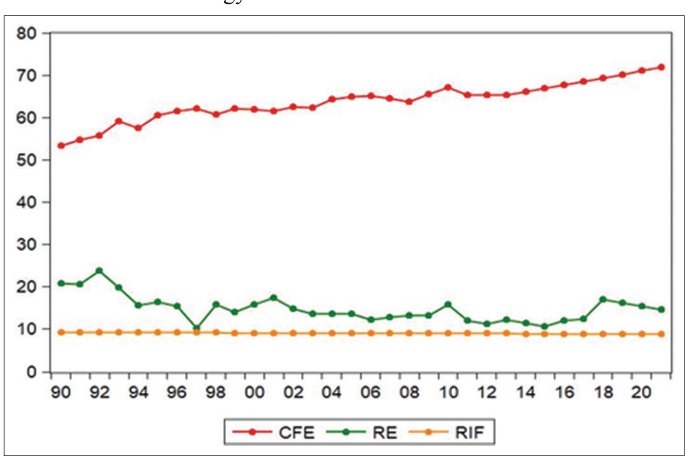


Figure 2: Average consumption of renewable and non-renewable energy in Indonesia in 1990-2021



is declared valid. short-term balance fluctuations (disequilibrium) towards long-term balance will be corrected, where 39.56% of the adjustment process occurs in the 1st year, while the remaining 60.44% of the adjustment process occurs in the following year. The speed of adjustment from the short term to the long term takes 1/0.0.39 or 25.6 months. The difference between the actual value of the real exchange rate and its balance value ($\hat{Y}$) is 0.039567 and will be adjusted in about 25.6 months/2 years.

4. Multicollinearity test

Multicollinearity, among others, by looking at the Variance Inflation Factor (VIF) value, if the VIF value is <10 then it is stated that multicollinearity does not occur, the following are the test results:

Based on Table 6 of data processing in the table, the value of each independent variable VIF >10 is obtained for each variable, so it can be concluded that there is no multicollinearity problem.

5. Heteroscedasticity test

In this study the Glejser method test was used, which was then presented in the estimation results of the heteroscedasticity test as follows:

Based on the Table 7, it shows that the Chi-square value of Obs*R-Squared in the short-term equation is 3.285974 or ≥5% of the equation, there is no heteroscedasticity problem.

6. Autocorrelation test

In this study, testing was carried out using the Bruesche-Godfrey Serial Correlation LM Test, which is presented as follows:

The test used is the Bruesche Godfrey serial correlation LM test which is presented in the table. Based, on Table 8, the Prob value is known. Chi-squared in the short-term equation is 16.42973 ≥5% which is concluded that there is no indication of autocorrelation.

5. DISCUSSION

The potential for new renewable energy in Indonesia is quite large, including ocean, geothermal, bioenergy, wind, water and sunlight. This potential really needs to be developed. Energy policy in Indonesia is currently following international energy policies, namely reducing greenhouse gas emissions, transforming towards new renewable energy, and accelerating the economy based on green technology. Indonesia's commitment to supporting international energy policies includes increasing the use of new and renewable energy, reducing fossil energy, increasing the use of electricity in the household, industrial and transportation sectors as well as the use of carbon capture and storage (Kementrian ESDM, 2019).

The statistical results above explain how the influence of renewable and non-renewable energy in Indonesia during the years 1990-2021, which finds results in the long term Non-renewable energy consumption (CFE) has a positive effect with a coefficient value of 7.1432 and is significant where every 1% increase in total consumption, will be able to increase economic growth by 7.14%. Renewable energy in the form of electricity (RE) has a positive influence with a coefficient value of 0.1884 and is significant where every 1% increase in total consumption will be able to increase economic growth by 0.18%, while the yield of renewable energy through water resources (RIF) has no effect positive but not significant to Indonesia's economic growth. In the short-term results of the Error Correction Model (ECM), consumption of non-renewable energy (CFE) has a positive influence with a coefficient value of 5.3565 and it is significant where every 1% increase in total consumption will be able to increase economic growth by 5.35%. While the results of renewable energy in the form of electricity (RE) and renewable energy through water resources (RIF) do not have a positive but not significant impact on Indonesia's economic growth during 1990-2021.

The development of renewable energy in Indonesia is (Halimanjaya, 2019), Indonesia has experienced multi-aspect principal-agent problems between PT PLN, the agent with the sole authority to manage electricity transmission, and various principals, namely the Ministry of State-Owned Enterprises (BUMN), the Ministry of Energy and Mineral Resources, the Ministry of Industry (MOI) as intermediaries between the RE industry domestic and foreign, and the Ministry of Finance. While changes to the Ministry of Energy and Mineral Resources' feed-in-tariff (FiT) policy send uncertain policy signals, the Ministry of Finance's fiscal incentive policies other than FiT to encourage RE development in Indonesia remain suboptimal.

Consumption of new and renewable energy shows a positive relationship but does not have a significant effect on gross domestic product in Indonesia, because attention has not been maximized in the development process, it is also related to regulations and Indonesia is currently still meeting its energy demand from non-renewable sources, (Muhammad Ferro Berlianto and Setya Wijaya, 2022). Electricity consumption has a higher and significant impact in the short term. Unfortunately, in the long term, the effect of electricity consumption on economic growth is insignificant in Indonesia, because it still depends on non-renewable energy, (Buhaerah, 2016).

In the long term, throughout 1990-2021, according to the results of the long-term model, Indonesia's energy consumption is very dependent on non-renewable energy such as oil, coal and natural gas and electricity consumption. Judging from the energy model for the Indonesian economy, only non-renewable energy has an impact on Indonesia's economic activities. When viewed from the energy consumption graph presented in the following figure:

In the Figure 2, it has an average consumption of non-renewable energy (CFE) of 63.72%, as seen in the graph, the trend of non-renewable energy use throughout the year has continued to increase. In electricity renewable energy (RE) the average consumption is 14.8%, the consumption is not that big and fluctuates, while renewable energy in water resources (RIF) has an average consumption of 9.08%, it is still minimal and moves constantly, does not experience an increase/significant decrease. Indonesia's potential in the energy transition could also be prioritized by consuming renewable electricity that is more environmentally friendly.

The potential for renewable energy in Indonesia can be exploited and can replace conventional energy for decades. Utilization of renewable energy for power generation can be carried out using government policies that support investors as executors of RE development. The selling price of electricity generated from EBT is cheaper compared to electricity generated from fossils; this makes the economy more affordable (Erdiwansyah et al., 2021).

From various studies on the consumption of renewable and non-renewable energy in Indonesia, the same results were obtained in the study (Purwanto et al., 2021). The results of the study show that all inflation, poverty and debt are significantly the causes of increased consumption of non-renewable energy both in the short and long term analysis. Non-renewable energy is consumed due to high inflation, debt and poverty in Indonesia. The model shows that increasing consumption of renewable energy reduces environmental degradation while increasing consumption of non-renewable energy increases CO2 emission levels. GDP has a negative while the square of GDP has a positive impact on CO2 emission levels. EKC This assumption does not apply to Indonesia because the income coefficient and income square are opposites, and the results of the current study are consistent and impartial. The high consumption of non-renewable energy Indonesia must immediately transition towards renewable energy, encourage the industry to adopt clean technology and renewable energy, and increase public awareness of ways to consume energy in a healthy manner (Idrus et al., 2021).

Consumption of non-renewable energy has an increasing effect and will boost the economies of various countries, but Indonesia, Malaysia and Colombia are all located on the equator, so the potential for solar energy is quite high with an average of 6–7 h of radiation per day. Therefore, the government has committed to building solar power plants for various applications. We must understand that we cannot continue to rely on fossil fuels in the future because the need for electricity is increasing along with economic and population growth (Soonmin et al., 2019).

6. CONCLUSION AND SUGGESTIONS

Indonesia during the years 1990-2021 has a range of non-renewable energy consumption of 63.72%, this can also be seen from the role of non-renewable energy in the long and short term in the Indonesian economy which has a positive and significant effect, while from a renewable energy perspective, Indonesia's potential is temporarily has the potential for an early transition to renewable energy where the average consumption and use is 14.8%, electricity also has a positive and significant impact on Indonesia's long-term economy, while renewable energy with water resources is still not able to help the economy significantly both in the short and long term.

The direction of Indonesia's energy policy must focus on one side of stable and potential contributing energy such as electricity and water, in order to move towards a renewable energy transition the Indonesian government must be able to develop first the potential for hydropower that produces electricity and various power plants such as the development of each region of Indonesia to hydroelectric power plants (PLTA), steam power plants (PLTU), solar power plants (PLTS), geothermal power plants (PLTP) and wind power plants (PLTB). Development must be carried out in all provinces according to the potential of renewable resources in order to move towards a slow transition and suppress non-renewable energy generation.

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