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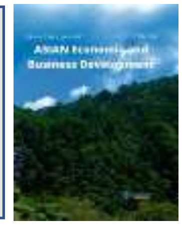

The Impact Of Implementing Blue Energy On Economic Growth In Indonesia

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Abstract

This study investigates the application of renewable energy which is one of the sectors in the blue economy to CO2 emissions and economic growth in Indonesia. This research examines data from 2000 to 2020 in order to produce "autoregressive vectors" that may be used to assess the causal link between variables. Based on secondary data from the World Bank, the following multivariate regression model was used to investigate the application of renewable energy which is one of the sectors in the blue economy to CO2 emissions and economic growth in Indonesia. We found that renewable energy from the blue economy concept in Indonesia significantly boosts CO2 emissions and economic growth. The increase in the use of renewable energy in Indonesia is still unable to reduce the impact of energy use, namely the increase in CO2 emissions in Indonesian air. The increase in CO2 emissions in the air is also in line with the increase in economic growth so the blue economy concept is still dealing with the preservation of nature. The concept of a blue economy and renewable energy by optimizing marine resources overcomes the problem of scarcity of fossil resources but still needs to develop environmental sustainability issues.

Keyword : Blue Energy, Economic Growth, Indonesia, CO2 emissions
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Background

Indonesia is an archipelagic country that has a fairly wide sea area. Economic activities related to the sea have contributed greatly to Indonesia's GDP. Aquaculture, renewable energy, mining, biotechnology, and new forms of tourism are the most viable growth niches in Indonesia. Most of the marine resources owned by Indonesia are still not optimally used for the benefit of Indonesia's economic growth. The Blue Economy is already a pillar for Indonesia but still offers a new sea of opportunities in the ocean (Hoshino et al., 2020).

Blue Economy is based on the development of all activities and sectors related to seas and oceans. Renewable energy, aquaculture and fisheries, agri-food industry, marine tourism, coastal and shipping, mining, transportation and logistics, biotechnology, shipbuilding, and so on. The Blue Economy is an apt summary of opportunities, will put people in the leadership position of Blue Growth in Indonesia (Amin et al.,2020).

Indonesia is a country with a large population and a large GDP (Widarni & Bawono, 2022). The most important production implementation in the blue economy to date is aquaculture (Campbell et al.,2021). Marine Energy is an energy resource that focuses in detail on the potential of Indonesia's ocean coasts to obtain electrical energy with various types of renewable energy (Muawanah et al.,2021). The potential for energy generation from Indonesian coastal ocean currents is basically centered in coastal areas in Indonesia. In this case, one of the best gross resources in the world with enormous potential for more than energy, and Indonesia has a very long coastline. In addition, offshore wind farms enable the installation of large, high-performance turbines with low impact on the landscape (Rizal & Ningsih, 2022).

The Indonesian ocean holds various potentials and abundant wealth for Indonesia's economic development (Langer et al.,2021). This study investigates the application of renewable energy which is one of the sectors in the blue economy to CO2 emissions and economic growth in Indonesia.

Research Method

This study examines data from 2000 to 2020 to generate “autoregressive vectors” that can be used to assess causal relationships between variables. Based on secondary data from the World Bank, the following multivariate regression model is used to investigate the application of renewable energy which is one sector in the blue economy to CO2 emissions and economic growth in Indonesia with the following model:

$$RE_t = \beta_0 + \beta_1 CE_t + \beta_2 GDP_t + e_t \qquad \text{eql 1}$$
$$CE_t = \beta_0 + \beta_1 RE_t + \beta_2 GDP_t + e_t \qquad \text{eql 2}$$
$$GDP_t = \beta_0 + \beta_1 RE_t + \beta_2 CE_t + e_t \qquad \text{eql 3}$$

Description :

RE : Renewable energy
CE : CO2 emissions
GDP : Gross domestic product
e : error term
t : time series
β : the magnitude of the effect of causality
eql: equation

This study uses vector calculations where each regression relationship will be brought together so that each variable will alternately become the dependent variable and the independent variable. The zero theory of Dickey-Fuller, taken from the PP test, and p=1 is the formula in $\Delta yt = (\rho - 1)yt\text{-}1 + ut$, in which Δ – for the first time different operators. This research used the following equation for the "unit root test":

$$\Delta Y_1 = \alpha_0 + \beta_0 T + \beta_1 Y_{t-1} + \sum_{i-1}^{q} \alpha_1 \Delta Y_{t-1} + e_t$$

Description:

Y as the variable is being examined for unit root
T as the variable which indicates the “linear trend,” the “lag difference” means is $\Delta Yt{-}1$,
$\alpha 0$ are shown as “constant term,” with the
"t" as a "time trend" indicator.
The null and alternative hypotheses for the "unit root test" are as follows:
H_0: $\alpha=0$
H_1: $\alpha\neq 0$

Result and Discussion

The ADF test evaluates the probability of autocorrelation in the error component if the series being evaluated is non-stationary. The following are the results of the unit root test:

Table 1: ADF's Unit Root Test on RE, CE, and GDP data in Indonesia

Variable	Unit Root	Include in the examination Equation	Statistics for the ADF Test	5% Critical Value	Description
Renewable energy (RE)	Level	Intercept	1.109572	0.9955	
	First Diff	Intercept	-3.297739	0.0326	Stationer
Gross domestic product (GDP)	Level	Intercept	-0.527808	0.8660	
	First Diff	Intercept	-1.929268	0.3129	
	Second Diff	Intercept	-3.319458	0.0293	Stationer
CO2 emissions (CE)	Level	Intercept	-0.152050	0.9303	
	First Diff	Intercept	-3.501360	0.0197	Stationer

The RE and CE data are stationary at the first difference, and the GDP data at the second difference level is stationary. The ADF test is worth -3.297739 with a critical value of 0.0326. Smaller than the p-value, in this case, the RE data shows stationary at the first difference compared to the original data. From here we can take the next step in determining vector analysis.

The lag duration sensitivity is required for both the VAR and the causality tests. It's vital to pick an appropriate optimal lag time before starting a VAR or causality test inquiry. The following are the findings of the lag test:

Table 2 : Optimum lag test at Lag 0 to 3 RE, CE, and GDP data in Indonesia

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-143.6187	NA	2386.719	16.29096	16.43936	16.31142
1	-111.1752	50.46759*	180.3908*	13.68613	14.27972*	13.76798
2	-107.7079	4.237814	371.2428	14.30088	15.33965	14.44411
3	-90.00535	15.73561	189.6637	13.33393*	14.81788	13.53855*

Table 2 shows the findings of the Optimum Lag test. At Lag 0 to 3, the results show that the variable lengths of lag RE, CE, and GDP data are at LR, FPE, and SC at Lag 1. Because the findings of the five components are identical, then lag 1 will be chosen.

Table 3 : VAR Model Analysis

	RE	CE	GDP
RE	1.018923	0.351882	0.081290
	(0.06400)	(0.19503)	(0.06346)
	[15.9194]	[1.80422]	[1.28105]
CE	0.029302	0.501294	0.011607
	(0.13109)	(0.39945)	(0.12997)
	[0.22353]	[1.25496]	[0.08931]
GDP	-0.031126	0.210079	0.859251
	(0.60924)	(1.85645)	(0.60401)
	[-0.05109]	[0.11316]	[1.42257]
C	-3.232531	7.958337	-2.963110
	(6.60174)	(20.1164)	(6.54510)
	[-0.48965]	[0.39561]	[-0.45272]
R-squared	0.966779	0.472155	0.222702
Adj. R-squared	0.960550	0.373184	0.076958
Sum sq. resids	47.41354	440.2385	46.60339
S.E. equation	1.721437	5.245465	1.706667
F-statistic	155.2091	4.770641	1.528041
Log likelihood	-37.01053	-59.29461	-36.83818
Akaike AIC	4.101053	6.329461	4.083818
Schwarz SC	4.300199	6.528608	4.282964
Mean dependent	33.28707	44.38413	4.911251

S.D. dependent	8.667022	6.625429	1.776389

The relationship between RE and RE itself is significantly positive, with a coefficient of 1.018923 and a t-statistic of 15.9194. The relationship between RE and CE is significantly positive with a coefficient of 0.351882 and a t-statistic of 1.80422, meaning that the higher the RE, the higher the CE. Likewise, the relationship between RE and GDP is also significantly positive, with a coefficient of 0.081290 and a t-statistic of 1.28105, meaning that the higher the TR, the higher the GS. This shows that increasing consumption of renewable energy will increase gross domestic product, and this will also increase economic growth, but in this study, although consumption of renewable energy also increases, it will also increase co2 emissions.

Table 4 : Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
CE does not Granger Cause RE	20	0.06406	0.8032
RE does not Granger Cause CE		3.49533	0.0789
GDP does not Granger Cause RE	20	0.01371	0.9082
RE does not Granger Cause GDP		3.35149	0.0847
GDP does not Granger Cause CE	20	0.04409	0.8362
CE does not Granger Cause GDP		1.46746	0.2423

Table 4 shows the findings of the Granger causality test study. The findings reveal that there is no single causal link between variables, as shown by the fact that none of them has a probability of less than 5%.

Conclusion

Renewable energy from the blue economy concept in Indonesia significantly boosts CO2 emissions and economic growth. The increase in the use of renewable energy in Indonesia is still unable to reduce the impact of energy use, namely the increase in CO2 emissions in Indonesian air. The increase in CO2 emissions in the air is also in line with the increase in economic growth so the blue economy concept is still dealing with the preservation of nature. The concept of a blue economy and renewable energy by optimizing marine resources overcomes the problem of scarcity of fossil resources but still needs to develop environmental sustainability issues.

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