

The Effect of National GDP Growth on Indonesia's CO2 Emissions Per Capita

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Abstract:- Economic growth is closely related to energy consumption. This is in accordance with energy elasticity, which states that a certain amount of energy is needed to achieve a certain level of economic growth. The object of this research is Indonesia, by analyzing the effect of economic growth on Indonesia's carbon emissions from 1999-2019. This study uses secondary data from publications from Bank Indonesia data and what is collected includes data on National GDP growth and CO2 emissions per capita. The period of data used is from 1999 to 2019. The analytical model used to test the hypothesis is statistical analysis in simple linear regression. In the long term and short term, renewable energy is a solution offered to reduce CO2 emissions and environmental degradation that can cause global warming.

Keywords:- Carbon, Emission, National GDP, Global Warming, Climate Change.

I. INTRODUCTION

Economic development is the main goal to be achieved by all countries. Traditionally, *economic development* is defined as the capacity of an initially static start over a long period to change for the better to create and sustain an increase in gross national income. In economic development, the term Trickle Down Effect is also known, which indicates the condition in which the distribution of results of economic and social growth is evenly distributed. In other words, economic growth has become unmatched in economic development from a traditional economic perspective. Meanwhile, the new economic view states that it looks at more than just economic growth as the main thing in its measurement. However, economic development is seen as a multidimensional process that includes all changes in social structure, community attitudes, national institutions, income, poverty, and accelerated economic growth (Todaro, 2006).

Economic growth is closely related to energy consumption. This is in accordance with energy elasticity, which states that a certain amount of energy is needed to achieve a certain level of economic growth. Indonesia's energy consumption level is still dominated by energy derived from fossil fuels. This causes problems with the amount of CO2 emissions produced by providing energy from fossil fuels. This increase in CO2 emissions will cause a greenhouse effect, majorly impacting human health.

On the other hand, using new and renewable energy is one of the solutions to reduce the amount of CO2 that increases yearly. High CO2 conditions will affect the human development process in Indonesia. One of the indexes used to measure human development is the Human Development Index (HDI). The Human Development Index is an index that looks at the human development process in a country by looking at three important indicators in the calculation process, namely longevity and healthy life, education (school expectations and average length of schooling), and a decent standard of living.

Global warming is one of the world's major environmental problems. Seasonal changes and extreme weather are effects of global warming in several regions. Greenhouse gases (GHGs) such as carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O), and three types of fluorinated gases (HFCs, PFCs, and SF6) are on the rise as a result. Carbon dioxide gas provides the most to these six factors, 75%. (Sukardi, 2012). Eighty percent of CO2 emissions are caused by human activity, with the remaining twenty percent coming from deforestation and forest degradation (Sukardi, 2012). Anthropogenic factors that contribute to CO2 emissions include things like "(1) population; (2) economic activity; (3) technical advancement; (4) political and economic structures; (5) attitudes and beliefs," according to Dietz and Rosa (1997).

Previous research found that the increase in CO2 emissions was accompanied by an increase in the Human Development Index and had a causal relationship with the case in Pakistan. Meanwhile, trade in Pakistan hampers the human development process (Wang, Zhao, et al., 2018).

II. METHOD & DATA

The object of this research is Indonesia, by analyzing the effect of economic growth on Indonesia's carbon emissions from 1999-2019. This study uses secondary data from publications from Bank Indonesia data and what is collected includes data on National GDP growth and CO2 emissions per capita. The period of data used is from 1999 to 2019. The analytical model used to test the hypothesis is statistical analysis in the form of simple linear regression.

Table 1. Data on GDP growth and increase in CO2 emissions per capita

Year	CO2 ton/kapita	PDB (miliar US\$)
1999	1.34	140
2000	1.33	165
2001	1.41	160
2002	1.41	196
2003	1.52	235
2004	1.53	257
2005	1.51	286
2006	1.59	365
2007	1.64	432
2008	1.60	510
2009	1.64	540
2010	1.72	755
2011	1.94	893
2012	1.94	918
2013	1.78	913
2014	1.90	891
2015	1.89	861
2016	1.84	932
2017	1.95	1,016
2018	2.16	1,042
2019	2.29	1,119

T-Test The linear regression model used is $Y = \alpha + \beta x$

III. RESULTS AND DISCUSSION

In his 2012 study, Akram examines the effects of climate change on economic growth in Asian nations between 1972 and 2009. He used panel data from 1972 to 2009 for his study. The findings indicate that urbanization and population expansion increase carbon dioxide emissions, that agriculture is most vulnerable to climate change, and that the manufacturing sector is least impacted by it. Economic growth also has a negative influence on carbon dioxide emissions.

Kasman and Duman (2015) looked into the links between carbon dioxide emissions in the EU from 1992 to 2010 and factors such as energy consumption, economic development, trade openness, and urbanization. The findings demonstrate a short-term unidirectional panel causation that links carbon dioxide emissions to energy consumption, global trade openness, and urbanization. In addition, Sun et al. (2019) examined trade and carbon dioxide (CO2) emissions in 49 high-emission nations in the Belt and Road Region from 1991 to 2014 by incorporating economic growth and energy usage as the primary potential factors. U-Kuznet and the Vector Error Correction Model (VECM) are the research methodology. 49 countries were divided into high, middle, and low-income groups between 1991 and 2014. The VECM results demonstrate a long-term causal relationship between energy consumption, economic growth, and trade openness on carbon dioxide (CO2) emissions in the Belt and Road

region between 1991 and 2014. According to the Environmental Kuznet curve, commerce and carbon dioxide (CO2) emissions have an inverse U-shaped relationship.

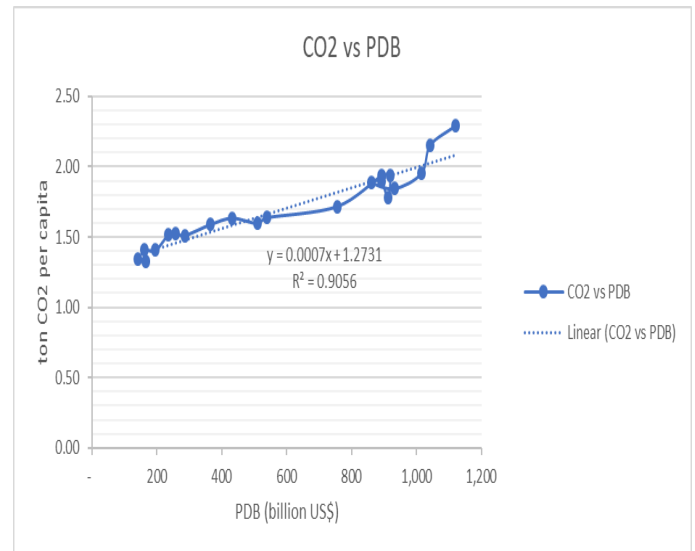


Fig 1. Result of the plot of increase in GDP vs CO2 Emissions

<i>Regression Statistics</i>	
Multiple R	0.952
R Square	0.906
Adjusted R Square	0.901
Standard Error	0.084
Observations	21

Table 2. Simple linear regression results

From the output shown in table 2, the coefficient of determination (R Square) is 0.905, meaning that the GDP variable's effect on CO2 emissions is 90.5%. Carbon dioxide emissions are negatively impacted by economic growth. This outcome is consistent with Akram's (2012) assertion that rising economic activity leads to a considerable increase in carbon dioxide emissions. The findings of Shahbaz et al. (2013), which claim that economic expansion has a favorable impact on carbon dioxide gas emissions, do not match the conclusions of this study. Carbon dioxide emissions decrease when a country's economic growth increases. This occurs because a nation with rapid economic development has the ability to lower its carbon dioxide emissions by paying attention to the environment and implementing numerous sustainable development policies that will improve environmental quality and lower carbon dioxide emissions.

ANOVA					
	df	SS	MS	F	Significance F
Regression	1	1.273	1.273	182.250	3.45881E-11
Residual	19	0.133	0.007		
Total	20	1.405			

Table 3. ANOVA Test Results

In the long term and short term, renewable energy is a solution offered to reduce CO₂ emissions and environmental degradation that can cause global warming. The use of new and renewable energy can substitute fossil fuels, a category of natural resources that cannot be renewed. This encourages using new and renewable energy to overcome the problems related to the energy supply needed by Indonesia. The increasing consumption of new and renewable energy can encourage human development by providing energy sources as a substitute for fossil energy which is starting to run out. In addition, the effects caused by fossil fuels can be minimized by using new and renewable energy. The consumption of new and renewable energy makes it easier for the Indonesian people to fulfill energy. Coupled with the increasing number of investments in new and renewable energy, the costs incurred for energy access are getting cheaper. All of this will undoubtedly reduce public expenditure in the energy sector and reduce the health risks posed by fossil energy to improve the human development process in Indonesia. In other words, it can be concluded that renewable energy positively affects the Human Development Index in Indonesia in the short and long term. These results are in accordance with research conducted by Pirlogea (2012) on the effect of fossil energy and new renewable energy on human development in 6 countries. The results indicate that fossil energy use has a negative impact on human development in Romania and Bulgaria. Meanwhile, using new and renewable energy has a positive and significant impact on human development in Poland, Ireland, Portugal, and the Netherlands.

IV. CONCLUSION

The results of this study conclude that national GDP growth significantly affected carbon dioxide gas emissions from 1999-2019. Government policies must keep paying attention to carbon dioxide gas emissions by establishing environmentally friendly sustainable development policies.

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