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Analysis of Energy Consumption and Carbon Emissions in Indonesia

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Abstract

The development process that uses excessive fossil energy in industrial activities impacts increasing carbon emissions in Indonesia. The purpose of this study is to determine how the relationship between energy consumption (EN), economic growth (GDP), carbon emissions (CO2), and human development (HDI) in Indonesia in the Maqashid Syariah review. Using the Vector Error Correction Model (VECM) approach, it is found that in the long run, carbon emissions negatively affect energy consumption. Meanwhile, economic growth and human development positively affect energy consumption. Energy consumption and economic growth positively affect human development in the short term. Meanwhile, carbon emissions hurt HDI, while HDI has a positive effect on carbon emissions. Meanwhile, the Granger causality test results show that HDI has a unidirectional causality relationship with Indonesia's energy consumption, economic growth, and carbon emissions. This result indicates that energy consumption in Indonesia has not provided protection and benefits for the community by Maqashid Sharia, which prioritizes the principle of sustainable development.

INTRODUCTION

Indonesia's energy consumption increases every year as the population grows. Based on data from the Ministry of Energy and Mineral Resources, in 2021, Indonesia's total energy consumption reached 909.24 million barrels of oil equivalent (BOE) which includes the use of various types of energy sources such as electricity, coal, natural gas, gasoline, diesel, biodiesel, briquettes, LPG, biogas, and biomass (Kusnandar, 2021). The massive industrialization process is one factor that increases energy consumption in Indonesia. Increased energy consumption will also impact environmental conditions in Indonesia, especially carbon emissions in big cities such as Jakarta, which is often listed as the worst polluted city in the world (Fajrian, 2022b). This condition is inseparable from the process of human development that demands the use of energy to fulfill their needs.

Various studies have been conducted to see the link between energy consumption and human development, such as those undertaken by Acheampong et al., (2021) and Ouedraogo, (2013). Meanwhile, several studies examine the relationship between carbon emissions and human development (Niu et al., 2013). Some literature explicitly explains the link between energy consumption and life expectancy (Murthy et al., 2021; Z. Wang et al., 2020). Some literature examines the relationship between energy consumption and education (Khoshbakht et al., 2018; Sart et al., 2022; S. Wang et al., 2020). This literature has explained how energy is linked to human development to achieve shared prosperity.

The relationship between energy consumption and economic growth was first studied by (Kraft & Kraft, 1978), after which many similar studies emerged (Bélaïd & Abderrahmani, 2013). Still, there was no consensus on the findings. Meanwhile, Khoshbakht et al., (2018) study using panel data on several regions found that economic growth positively impacts energy consumption and is statistically significant. Research conducted by Sheinbaum-Pardo et al., (2012) in 1990-2008 on decomposed energy consumption and CO2 emissions for the Mexican manufacturing industry, using the LMDI method, found essential changes in structure effects that drive emission reductions for ten manufacturing industry subsectors. Energy intensity and carbon index effects are negative in all subsectors except cement and others. Meanwhile, Muhammad, (2019) show that carbon emissions have a direct and significant influence on energy consumption in three regions; This is also in line with the findings of Saidi & Hammami, (2015), who found that CO2 emissions positively and significantly affect energy consumption.

Alkhathlan & Javid, (2013) examined the relationship between energy consumption, carbon emissions, and economic growth in Saudi Arabia. He concluded that higher energy consumption is the leading cause of global warming, indirectly reducing human development. In another study, Kaewnern et al., (2023) examined the impact of human capital on carbon emissions in ten countries with high HDI. The results showed that human capital reduces carbon emissions. Tran et al., (2019) who examined the link between human development and carbon emissions in the world and developing countries. However, research conducted by Zulham et al., (2021) found that low HDI hurts environmental degradation in Aceh—low HDI results in a lack of public concern for maintaining ecological sustainability.

Based on previous studies, it can be seen how the economic development process has a positive and negative impact, especially on environmental issues. Islam itself has its view on achieving welfare. The conceptual model of human welfare in Islam has been developed by integrating the view of tawhid, the philosophical insight of sa'adah, with a list of goals from the five traditions of maqashid sharia: religion (Din), self (Nafs), intelligence ('Aql), offspring (Nasl), and property (Mal), each of which corresponds to spiritual, physical and psychological, intellectual, family and social, and material well-being (Kader, 2021). In the review of Islamic economics, economic development must pay attention to the maqashid aspect of sharia. Economic growth is carried out not only for the welfare of society for worldly life alone but also for achieving falah or success in the hereafter.

An-Nasl (offspring) is not limited to preserving offspring in marriage alone. But it is also related to environmental sustainability for future children and grandchildren. Islam strongly emphasizes the importance of maintaining and protecting the environment. In the Al-Quran and Sunnah, various teachings emphasize the importance of humans being leaders on Earth who always pay attention to natural conditions. Allah SWT says in the Quran:

"And He made you successors (Khalifah) on earth, and He exalted some of you over others to be tested by what He has given you. Verily, your Lord is swift in His punishment and is Forgiving, Merciful." (*QS. Al-An'am:165*). In Surah Al-An'am:141 Allah SWT allows humans to utilize natural resources to fulfill their needs as long as they do not exceed the limits set by the sharia.

The above verse emphasizes that humans are custodians (Khalifah) of the Earth and are responsible for caring for it. This responsibility includes protecting the environment from damage and ensuring natural resources are used sustainably and responsibly. In addition, Islamic teachings also emphasize the need to show compassion and mercy towards all living things, including animals and plants. Prophet Muhammad (PBUH) said: "If a Muslim plants a tree or sows a seed, then a bird, or a person or an animal eats from it, it is considered a charitable gift (sadaqah) for him" (*Shahih Bukhari - Muslim*). This hadith emphasizes the importance of planting and preserving trees and other vegetation and ensuring all living things have access to the resources they need to survive.

Based on research conducted by (Tran et al., 2019) and Alkhathlan & Javid, (2013), this research tries to continue the previous research by linking energy consumption with sustainable development based on the principle of An-Nasl or the protection of offspring. This study examines the relationship between energy consumption, economic growth, human development, and carbon emissions in Indonesia using the Maqashid Syariah approach. As a country with the largest Muslim population in the world, it is appropriate for Indonesia to pay attention to aspects of environmental protection (An-Nasl) as an integral part of advancing the welfare and prosperity of individuals and society as a whole following the principles of Maqashid Sharia. This research is expected to provide another view of energy consumption that pays attention to aspects of sustainable development that are reflected in the Maqashid Syariah principle.

RESEARCH METHODS

The focus of this study is Indonesia, as conducted by Bashir et al., (2019) using secondary data obtained from the World Development Indicators (WDI) obtained from the World Bank. Due to data limitations, this study uses data from 1990-2019. This study uses the VECM model in analyzing secondary time series data as well as research conducted by Ayinde et al., (2019); Jian et al., (2019); Rahman & Vu, (2021). The variables in this study are GDP per capita (GDP) as an indicator of economic growth, per capita energy consumption (EN), carbon emissions (CO2), and human development (HDI). To avoid heteroscedasticity, all data in this study were transformed into natural logarithms.

The empirical model in this study refers to Rahman & Vu, (2021), which is as follows:

$$Et = f(Ct, Gt, Ht) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Then the mode is transformed into the natural logarithm form so that it becomes:

$$lnEt = a0 + aC\ lnCt + aG\ lnGt + aH\ lnHt + \mu t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where Et is per capita energy consumption (EN), Ct is carbon emissions (CO2), Gt is economic growth (GDP), and Ht is the human development index (HDI). The VAR / VECM model is considered the most appropriate in research using multivariate time series data because this model can estimate the short/long-term relationship between one variable and another using time series data for each variable (Ren et al., 2020). Engle and Granger first popularized the VECM analysis method to correct short-term imbalances in the long run. So that VECM can be used to see the short-term and long-term relationship of time series data. VECM is a Vector Auto Regression (VAR) analysis designed to be used on non-stationary data known to have a cointegration relationship; in other words, VECM can be a restricted form of VAR. The stages of VECM analysis are as follows:

The first procedure is to conduct a stationarity test to determine the appropriate VAR or VECM model. The next step is to determine the optimal lag length, which can be measured by several parameters, including AIC (Akaike Information Criterion), SIC (Schwarz Information Criterion), and LR (Likelihood Ratio). Determination of the optimal lag length is obtained from the VAR equation with the smallest AIC, SC, or LR value. The next step is to conduct a VAR Model Stability Test. The next step is to conduct a cointegration test. This test is performed to determine the existence of cointegration or long-term relationships among all variables in the equation model. After the cointegration test confirms one or more cointegrating relationships among the variables in the model, the vector error correction model (VECM) will be applied to the Granger causality test in the last step (Nugraha & Osman, 2019). The final step is to analyze the Impulse Response Function (IRF) and Variance Decomposition (VD). Maqashid Sharia principles, especially An-Nasl (protection of offspring), will be elaborated with the research results descriptively based on previous sources.

RESULT AND DISCUSSION

Based on the 2021 World Air Quality Report, Indonesia ranks as the 17th country with the worst air pollution globally, with the highest PM2.5 concentration reaching 34.3 micrograms per cubic meter (μg/m3) (Fajrian, 2022a). The escalating energy consumption in various economic activities is Indonesia's primary cause of air pollution. Using secondary data from 1990 to 2019 obtained from the World Bank, this study aims to determine the causes of air pollution in Indonesia using Vector Auto Regression (VAR) Analysis.

The results of this study first begin by looking at stationarity testing of each variable used. If all variables are stationary at the level, then the model used is VAR. However, if none of the variables are stationary at the level, then the appropriate model to use is VECM. Based on the test results obtained, it shows that none of the variables are stationary at the level. Therefore it is necessary to test stationarity in the first difference. Table 1 shows that the ADF test on the first difference shows that all data are stationary (t-statistic > test critical value) at α = 5% with a confidence level of 95 percent.

Table 1. Unit Root Test

Series	Prob. (level)	Prob. (First Different)
D(LNCO2)	0.4608	0.0009
D(LNEN)	0.2366	0.0031
D(LNGDP)	0.965	0.0058
D(LNHDI)	0.1328	0.0246

The second step in this study is to test the optimal number of lags based on the most minor or minimum Likelihood Ratio (LR), Final Prediction Error (FPE), Akaike Information Crition (AIC), Schwarz Information Crition (SC), and Hannan Quin Crition (HQ) values. The results of determining the optimal lag of this research model are shown in Table 2. The LR, FPE, AIC, and HQ values indicate that the optimal lag in this study is at the second lag.

Table.2 Lag Optimum Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	183.9448	NA	3.08e-11	-12.85320	-12.66289	-12.79502
1	320.3579	224.1073	5.75e-15	-21.45414	-20.50256*	-21.16323
2	345.1003	33.57888*	3.33e-15*	-22.07859*	-20.36576	-21.55496*

The third step is to conduct a stability test to determine whether the resulting lag is the maximum stable VAR lag. A stable VAR model can be seen from the value of the inverse roots of its characteristic AR polynomial. A VAR system is said to be stationary if all its roots have a modulus smaller than one and are located inside the unit circle. The modulus value shown in Table 3 on the model ranges from 0.340472 - 0.987064. Based on these results, it can be concluded that the VAR model is stable in length, so the FEVD test can be carried out on this model, producing valid output.

Tabel 3. Stability Test

Root	Modulus
0.987064	0.987064
0.852866 - 0.238102i	0.885479
0.852866 + 0.238102i	0.885479
0.396602 - 0.512487i	0.648025
0.396602 + 0.512487i	0.648025
0.021599 - 0.510905i	0.511361
0.021599 + 0.510905i	0.511361
-0.340472	0.340472

After conducting the stability test, the next step is to conduct cointegration testing, which is essential to see the long-term relationship of EN, GDP, CO2, and HDI variables in this study. The stationary test results show that not all data are stationary at the level, so estimation is carried out using the VECM model. VECM model, it is necessary to conduct cointegration testing first to determine the long-term relationship between variables. With the cointegration test, it can be seen that the balance of the data, in the long run, is close to zero.

Table 4 shows that at the 5% significance level, there are three cointegration equations. The Johansen test results are used to determine the VAR or VECM model. Because cointegration is found in this study, the model used is VECM. Cointegration testing through the Johansen Cointegration Test shows a long-term relationship or cointegrated in the four variables, EN, GDP, HDI, and CO2, from 1990-2019. Thus, in this study, VECM analysis was applied.

Table 4. Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.851953	89.37888	55.24578	0.0000
At most, 1 *	0.598049	37.80277	35.01090	0.0245
At most 2	0.269317	13.19427	18.39771	0.2293
At most, 3 *	0.160460	4.722323	3.841466	0.0298

The estimation results of the VECM equation, in the long run, show that CO2 or carbon emissions harm energy consumption; any increase in CO2 will reduce energy consumption by 0.388215 percent. Meanwhile, GDP or economic growth has a positive effect on energy consumption. Any increase in economic growth will increase energy consumption by 1.326473 percent. HDI variable also has a positive impact on energy consumption. Any increase in HDI will increase energy consumption by 5.481802 percent.

Table 5. Long Run VECM Estimation

Cointegrating Eq:	CointEq1
LNCO2(-1)	-0.388215
	(0.15174)
	[-2.55838]
LNGDP(-1)	1.326473
	(0.15411)
	[8.60744]
LNHDI(-1)	5.481802
	(1.32995)
	[4.12183]
C	-19.10614

The short-term VECM estimation shows that energy consumption positively affects HDI at lag 1. Any increase in energy consumption will increase HDI by 0.380931. Furthermore, CO2 carbon emissions harm HDI. Any increase in carbon emissions will decrease HDI by -0.271902. In the short term, GDP has a positive effect on HDI. Every increase in GDP will affect HDI by 0.097640. Next, HDI positively affects energy consumption with a coefficient of 6.967589. HDI also positively affects CO2 or carbon emissions in the short term. Every increase in HDI has a positive effect on CO2 by 7.806984.

Table 6. Short Run VECM Estimation

Error Correction:	D(LNEN)	D(LNCO2)	D(LNGDP)	D(LNHDI)
CointEq1	-0.451625	-0.490378	-0.336190	0.018868
	(0.15720)	(0.21513)	(0.15396)	(0.02239)
	[-2.87288]	**[-2.27942]**	**[-2.18366]**	[0.84283]
D(LNEN(-1))	0.628212	0.778716	0.586339	0.380931
	(0.83234)	(1.13906)	(0.81515)	(0.11853)
	[0.75476]	[0.68365]	[0.71930]	**[3.21388]**
D(LNEN(-2))	0.509697	1.087051	-0.303520	0.075486
	(0.68002)	(0.93062)	(0.66598)	(0.09684)
	[0.74953]	[1.16810]	[-0.45575]	[0.77952]
D(LNCO2(-1))	-0.427550	-0.642394	-0.523707	-0.271902
	(0.59902)	(0.81977)	(0.58665)	(0.08530)
	[-0.71374]	[-0.78363]	[-0.89270]	**[-3.18751]**
D(LNCO2(-2))	-0.352366	-0.813227	0.279103	-0.107611
	(0.54220)	(0.74201)	(0.53101)	(0.07721)
	[-0.64988]	[-1.09598]	[0.52561]	[-1.39372]
D(LNGDP(-1))	-0.528463	-0.489184	0.311601	-0.073685
	(0.32254)	(0.44140)	(0.31588)	(0.04593)
	[-1.63843]	[-1.10826]	[0.98645]	[-1.60427]
D(LNGDP(-2))	0.002463	-0.068261	0.081351	0.097640
	(0.32668)	(0.44706)	(0.31993)	(0.04652)
	[0.00754]	[-0.15269]	[0.25428]	**[2.09890]**
D(LNHDI(-1))	6.967589	7.806984	1.119495	-0.321046
	(2.56575)	(3.51124)	(2.51277)	(0.36537)
	[2.71561]	**[2.22342]**	[0.44552]	[-0.87869]
D(LNHDI(-2))	2.076023	2.850664	0.396212	-0.614540
	(2.66083)	(3.64136)	(2.60588)	(0.37891)
	[0.78022]	[0.78286]	[0.15205]	[-1.62187]
	[-1.40723]	[-1.04163]	[-0.18663]	[3.41157]

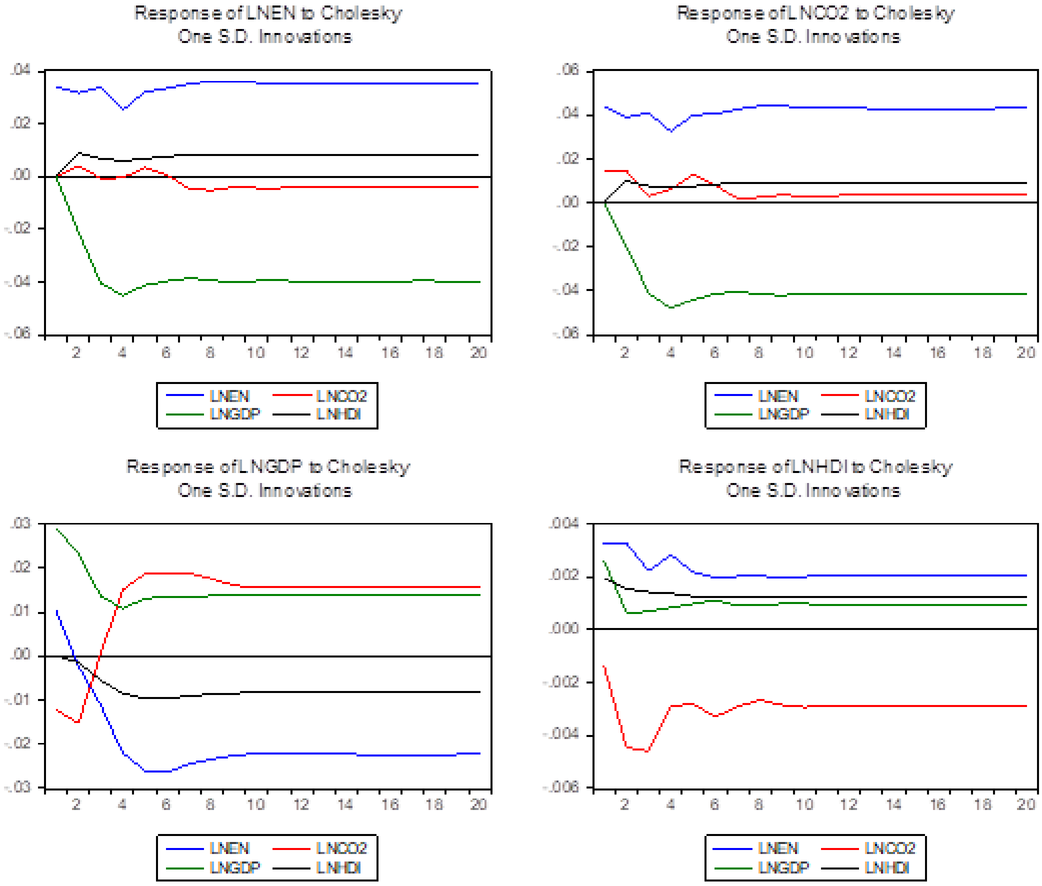
After estimating the VECM model, the next step is to conduct a Granger causality test. The results of the Granger causality test in Table 5 show a unidirectional causality relationship between the human development index (HDI) and economic growth (GDP) at the 5% confidence level. At the 10% confidence level, there is a unidirectional causality relationship between the human development index (HDI) and energy consumption (EN) and a unidirectional relationship between the human development index (HDI) and the level of carbon emissions (CO2). This Granger causality test results indicate that the human development factor plays a crucial role in economic growth, energy consumption, and carbon emission levels.

Table 7. Granger Causality Test

Null Hypothesis:	Obs	F-Statistic	Prob.
LNCO2 does not Granger Cause LNEN	28	0.92385	0.4112
LNEN does not Granger Cause LNCO2		0.45577	0.6396
LNGDP does not Granger Cause LNEN	28	1.02422	0.3749
LNEN does not Granger Cause LNGDP		0.42667	0.6577
LNHDI does not Granger Cause LNEN	28	2.72427	0.0867
LNEN does not Granger Cause LNHDI		0.03790	0.9629
LNGDP does not Granger Cause LNCO2	28	0.32108	0.7286
LNCO2 does not Granger Cause LNGDP		1.12120	0.3431
LNHDI does not Granger Cause LNCO2	28	3.15411	0.0616
LNCO2 does not Granger Cause LNHDI		0.42311	0.6600
LNHDI does not Granger Cause LNGDP	28	3.84234	0.0363
LNGDP does not Granger Cause LNHDI		0.50129	0.6122

The next step is to analyze the Impulse Response Function (IRF). Figure 8 below shows how the response between variables in specific periods. IRF analysis with energy consumption as the response indicates that the highest answer is from energy consumption itself and starts to stabilize in period 11. The subsequent reaction is followed by HDI, which stabilizes in period 9. Then carbon emissions or CO2 began to show stability in period 10. Finally, GDP began to respond stably in period 8. IRF analysis with CO2 as the response indicates that in the next 20 years, the highest response is the response of CO2 to energy consumption and begins to stabilize in the 15th period. Then followed by the reaction of CO2 to HDI, which began to stabilize in the 11th period. The following IRF analysis with HDI as the response showed the highest response of HDI to energy consumption and began to stabilize in period 11. Then, HDI's response to itself started to stabilize in period 11. Furthermore, HDI's response to GDP began to stabilize in period 11. Finally, HDI's response to CO2 stabilized in period 16.

Graphics 1. Impulse Response Function (IRF)



Finally, the IRF analysis with GDP as the response shows the highest response to CO2, which began to stabilize in period 14. Next is the response of GDP to itself which began to stabilize in period 18. Next is the response of GDP to HDI, which began to stabilize in period 13—finally, the response of GDP to energy consumption began to stabilize in period 18.

Table 8. Variance Decomposition EN

Period	S.E.	LNEN	LNCO2	LNGDP	LNHDI
1	0.033891	100.0000	0.000000	0.000000	0.000000
2	0.051909	80.12057	0.610128	16.37021	2.899092
3	0.074289	59.73033	0.304563	37.72313	2.241982
4	0.090599	47.97288	0.207338	49.88789	1.931887
5	0.104830	45.21119	0.262497	52.67330	1.853015
6	0.117164	44.32538	0.212603	53.55551	1.906500
7	0.128564	44.26774	0.310526	53.43471	1.987024
8	0.139586	44.23379	0.393698	53.32374	2.048774
9	0.149882	44.21282	0.409890	53.28972	2.087569
10	0.159290	44.12138	0.433719	53.33094	2.113954

The last step in this research analysis is to analyze Variance decomposition (VD). This analysis determines the contribution of a variable GDP, HDI, and CO2 to changes in EN in the successive few periods. VD analysis in Table 8 shows that the variable expected to contribute most to energy consumption in the next ten years is energy consumption itself, followed by GDP with an average of 42.35892 percent, followed by HDI and CO2, respectively.

Table 9. Variance Decomposition CO2

Period	S.E.	LNEN	LNCO2	LNGDP	LNHDI
1	0.046380	90.46954	9.530458	0.000000	0.000000
2	0.066135	79.09993	9.697745	8.882958	2.319367
3	0.088282	65.93927	5.552665	26.42223	2.085833
4	0.106101	55.14468	4.205097	38.77801	1.872210
5	0.122569	52.02257	4.287919	41.89156	1.797946
6	0.136058	51.10811	3.831274	43.20093	1.859684
7	0.148464	51.19402	3.232816	43.62244	1.950722
8	0.160684	51.23424	2.783736	43.96301	2.019013
9	0.172094	51.23388	2.470461	44.23253	2.063129
10	0.182475	51.18715	2.220363	44.49669	2.095794

The contribution of GDP, HDI, and EN variables to changes in CO2 in the following few periods is shown in Table 8; VD analysis shows that the variable that is expected to have the most significant contribution to CO2 in the next ten years is energy consumption with an average of 59.86334 percent and followed by GDP with an average of 33.5490358 percent and then followed in order by CO2 itself and HDI.

Table 10. Variance Decomposition GDP

Period	S.E.	LNEN	LNCO2	LNGDP	LNHDI
1	0.033191	9.678913	13.59996	76.72113	0.000000
2	0.043389	5.943180	20.29141	73.65778	0.107632
3	0.047151	10.66722	17.19509	70.67680	1.460888
4	0.055913	23.12431	19.48153	54.02721	3.366954
5	0.066519	31.77545	21.69477	42.00892	4.520855
6	0.075867	36.52634	22.89939	35.48492	5.089353
7	0.083569	38.75385	23.99704	31.85469	5.394422
8	0.090034	40.17470	24.48792	29.74646	5.590916
9	0.095605	41.25530	24.52252	28.47668	5.745512
10	0.100663	42.06748	24.51442	27.54667	5.871434

The contribution of CO2, HDI, and EN variables to changes in GDP in the following few periods is shown in Table 9; VD analysis shows that the variable that is expected to have the most significant contribution to GDP in the next ten years is GDP itself with an average of 47.020126 percent and followed by EN with an average of 27.9966743 percent and then followed in order by CO2 itself and HDI.

Table 11. Variance Decomposition HDI

Period	S.E.	LNEN	LNCO2	LNGDP	LNHDI
1	0.004826	45.85321	8.009537	29.51472	16.62253
2	0.007540	37.77633	38.44121	12.80437	10.97809
3	0.009252	30.91401	50.39512	9.051952	9.638923
4	0.010233	33.01450	49.25407	8.077005	9.654426

5	0.010956	32.78006	49.63303	7.831245	9.755662
6	0.011728	31.43526	51.24904	7.733149	9.582557
7	0.012350	31.05210	51.83041	7.516753	9.600728
8	0.012884	31.03604	51.87991	7.393883	9.690164
9	0.013435	30.69140	52.25702	7.340107	9.711479
10	0.013988	30.39204	52.63439	7.262408	9.711161

The contribution of CO2, GDP, and EN variables to changes in HDI in the following few periods is shown in Table 10. The results of the VD analysis show that the variable estimated to have the most significant contribution to HDI in the next ten years is CO2, with an average of 45.5583737 percent, followed by EN, with an average of 33.494495 percent; This is followed an order by HDI itself and GDP. These results show that CO2 emissions significantly improve the quality of human life in the future. If there is no balanced and wise policy, it will negatively impact human survival. This condition follows the findings of Bedir & Yilmaz, (2016), which found that there is a nexus when environmental conservation policies are carried out or not on the economy and human living standards.

DISCUSSION

The estimation results above show that in the long run, any increase in carbon emissions makes people realize that excessive energy consumption hurts environmental conditions; This aligns with research conducted by Sheinbaum-Pardo et al., (2012). Therefore, the government and stakeholders must immediately strive to create an economic climate that encourages technological innovation that can reduce the use of fossil energy to zero percent. The government must gradually establish regulations requiring economic actors to switch to alternative energy. In addition, improvements to public transportation are also needed to reduce the use of fossil fuel-based private vehicles. Incentivizing the public through subsidies for public transportation and electric vehicles is expected to reduce air pollution. The policies taken are expected to lead to changes in people's behavior that pay more attention to environmental conditions; This means that people are beginning to understand that the protection of offspring (Hifdzul Nasl), which includes the environment and everything in it, is essential for the life of their successors in the future.

In addition, economic growth positively impacts energy consumption in the long run. Economic growth encourages the production of goods and services to support the community's needs due to increased income. High economic growth for economic actors is utilized to expand business along with the increase in people's income. Therefore, energy consumption rises to meet the increased production of goods and services; This is in line with the findings of Khoshbakht et al., (2018), who found that economic growth positively affects energy consumption.

Meanwhile, the long-term estimation results show that HDI also positively affects energy consumption in Indonesia; This means that with the increase in the quality of human life, energy consumption will also increase. When the quality of life improves, the community will try to maintain and further enhance the quality of life; This is the nature of humans who are never satisfied. Therefore, when the HDI increases, renewable energy should be provided so that energy consumption does not cause environmental damage.

The estimation results explain that energy consumption has a role in improving the quality of life in the short term. With the fulfillment of energy needs, it can produce goods and services to create welfare. The following finding shows that CO2 carbon emissions harm human development. Carbon emissions cause environmental damage, especially air pollution. This results in a decline in the quality of human life. This result confirms Alkhathlan & Javid, (2013) findings that greenhouse gas emissions support global warming. Another finding in this study is that in the short term, GDP positively impacts HDI, meaning increased income increases welfare.

Furthermore, HDI has a positive effect on energy consumption, which means that when someone has reached a certain level of welfare, they will increase their consumption. Then HDI also has a positive effect on CO2. In the short term, the increase in HDI positively impacts CO2. In a short time, the rise in HDI positively impacts CO2. This short-term funding is differs from Tran et al., (2019) but in line with Zulham et al., (2021). Pursuing high HDI requires development efforts in several sectors that need energy. Indirectly this will increase CO2.

These findings indicate that in Islamic consumption, there are limits that should concern all of us. At some point, consumption is needed to improve the quality of human life. But we must know when to restrain ourselves so that consumption is not excessive. When consumption exceeds reasonable limits, it ends up causing new problems for humanity. As explained earlier, consumption in Islam must be by the principles of Maqashid Sharia. When energy consumption is done correctly, it can improve the quality of life. But if it continues to increase, it will bring new human problems.

CONCLUSION

The results show that carbon emissions hurt energy consumption in the long run. Meanwhile, GDP and HDI have a positive impact on energy consumption. In the short term, energy consumption improves the quality of human life. Increasing GDP also has a positive effect on HDI. On the other hand, carbon emissions and HDI affect each other. Carbon emissions hurt HDI, but HDI positively impacts carbon emissions. These two things indicate how people's consumption behavior is not to the principles of Islamic economics. These findings prove that Indonesia's energy consumption and CO2 emissions are closely related to human behavior, which is never satisfied with its achievements. When they have reached a certain level of welfare, humans do not stop to continue improving their welfare level; This contradicts Maqashid Sharia, which states that genuine interest is when the benefit of all human beings is achieved, to ensure the achievement of benefits for humanity, it is necessary to have a policy from the government to develop the use of environmentally friendly energy; This emphasizes Nugraha & Osman (2019) findings which conclude that energy conservation and mitigation policies must be accompanied by the application of energy-saving technologies and become a top priority in sustainable development planning in Indonesia.

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