The Influence of Renewable Energy Consumption in Cambodia on The Economic and Environmental Sectors

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Abstract

This study's goal is to determine the consequences of employing renewable energy sources on Cambodia's environmental and economic sectors. We use the World Bank as an additional source for statistical data, namely data from 2000 to 2019. Factors in this study include economic growth and current health expenditure since it demonstrates a link between the two variables over both the long and shortterms, with the dependent variable being the usage of renewable energy. We discover that the factors we anticipate to have varying associations with Cambodia's utilization of renewable energy, in the short term the value of previous years' renewable energy consumption are the dominant factor affecting this year's renewable energy consumption, followed by current health spending. The ARDL test found that when the gross domestic product increases it will give negative sentiment to the value of renewable energy consumption in Cambodia. This is different from other variables such as current health spending, where when there is an increase it will make a positive contribution to the increase in renewable energy consumption.

Keyword : Renewable Energy Consumption, Current Health Expenditure, GDP, Cambodia
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Background

Economic growth looks at how economic activity affects people's income. Widarni, Irawan, Harnani, Rusminingsih, & Alim (2022) define an increase in a nation's capacity to generate goods and services over the long term is referred to as economic growth. The same thing was confirmed by Hamid et al., (2022), who stated that economic growth measures a country's long-term ability to provide goods and services to its residents. For this reason, the existence of energy is very important for a nation because it is part of the main resource in production, distribution, and consumption activities, so that it can be called an economic driver. According to Xue et al., (2022), almost all needs in life require energy, which means that along with the times and the increase in population, energy consumption is also increasing, reflecting an increase in the economy.

Energy is an important issue that has colored the history of environmental debates (Sohail, Majeed, Shaikh, & Andlib, 2022). On the one hand, those who want to preserve the environment argue that the energy consumption necessary for economic growth produces by-products that are harmful to the environment. This stronghold is called the Club of Rome stronghold. They argue that the growth of environmental problems, which are a consequence of economic growth, will always exceed the ability of science and technology to solve them. The use of fossil fuels is

believed to produce byproducts that pollute the environment. Among other things that have been widely documented are the sulfur content and exhaust gases which are detrimental to health. Sulfur content is the cause of acid rain. Greenhouse gases result in climate change. The use of coal as a fuel for power plants results in the accumulation of radioactive content around the power plant site (Wang, Dong, & Wang, 2022).

On the other hand, those who are pro-development argue that poverty reduction can only be achieved through development. Without development, there is no economic growth. Economic growth requires energy. Economic growth is needed for the progress and welfare of mankind. Economic growth is necessary for the development of science and technology. All of these are expected to minimize environmental impact. Along with the discovery of energy-efficient technology, the two sides can finally agree and end the environmental debate. Today, new technologies allow the same amount of energy to move far more goods than the technology used in the years of environmental debate (Mujtaba, Jena, Bekun, & Sahu, 2022).

Energy is an important input in driving economic productivity and minimizing working hours by using energy efficiently, especially in manufacturing and agriculture, and household activities (Djellouli, Abdelli, Elheddad, Ahmed, & Mahmood, 2022). The dominance of the role of energy in economic activity is evidenced by the increase in global energy consumption or countries that are members of organizations such as the OECD and the OIC (Mujtaba, Jena, Bekun, & Sahu, 2022; Assad, Nazari, & Rosen, 2021).

Increasing energy consumption can drive economic growth (Zafar, Saleem, Destek, & Caglar, 2022). Economic growth is a condition in which the country's production of goods and services has increased and standards of living have increased, which is usually interpreted by the level of Gross Domestic Product per Capita (Acquah & Ibrahim, 2020; Widarni & Bawono, 2022). Although, Energy resource usage has a favorable impact on economic growth, when conventional energy is consumed in excess it can cause a crisis that will affect the economy and will contribute to environmental problems, long-term risks include things like climate change, which can have an impact on food and water availability, sea level rise, extreme weather events, and the spread of disease (Shang, Razzaq, Chupradit, An, & Abdul-Samad, 2022). Based on research by Karaaslan & Çamkaya (2022) the primary factor boosting greenhouse gas emissions is energy usage compared to the industrial, transportation, building, agriculture, and land use sectors.

Seeing the high correlation between energy consumption and economic growth, efforts to determine the causal relationship between the two are important in determining the direction of government policy. Kongkuah, Yao, & Yilanci (2022) state that the conflicting views on the relationship between energy use and economic expansion. The first opinion believes that energy is only an intermediate input in the production process. The economy can still grow even though energy resources are limited due to the efficient use of other energy factors and the support of technological advances, including the use of renewable energy. It can be concluded that this flow is in line with the conservation hypothesis and the neutrality hypothesis. According to this hypothesis, limits or limitations on the energy supply won't have a detrimental effect on economic expansion. The second perspective goes on to claim that energy use is a barrier to economic progress. Efficiency in the use of other energy factors and the support of technological advances will not be a substitute for energy in the production process. In addition, capital and labor cannot run to carry out production without the presence of energy. It can be concluded that this flow supports the growth hypothesis, which means that when there are restrictions on energy

supply, economic growth will decrease. This study's goal is to determine the consequences of employing renewable energy sources on Cambodia's environmental and economic sectors.

Research Method

We use the World Bank as an additional source for statistical data, namely data from 2000 to 2019. Two alternative time series models will be used to investigate the following variables. In this study, economic growth is measured using national GDP. Factors in this study include economic growth and current health expenditure since it demonstrates a link between the two variables over both the long and shortterms, with the dependent variable being the usage of renewable energy. This is the econometric model we use:

$REC_t = \beta_0 + \beta_1 REC_{t-1} + \beta_2 REC_{t-2} + \beta_3 CHE_t + \beta_5 CHE_{t-1} + \beta_6 CHE_{t-2} + \beta_7 CHE_{t-3} + \beta_8 GDP_t + \beta_9 GDP_{t-1} + \beta_9 GDP_{t-2} + e_t$

Where the renewable energy consumption is REC, CHE is current health expenditure, GDP is gross domestic product, the error term is e, and time series is t.

Dynamic ARDL was used in the study. Zhang et al. (2021) claim that ARDL is a regression method that includes the lag of both the dependent and independent variables simultaneously. Using this model can analyze long-term relationships when the explanatory variables are a mixture of 1(1) and 1(0).

Table 1. Descriptive variable

Variable	Explanation	Data type
Renewable energy consumption	Export value, which is presented as an average percentage for the base period, or using the year 2000, is the current export value or free on board converted to US dollars.	Percent
GDP	The GDP of a nation gauges the entire market value of all goods and services it generated within a specific time period.	Percent
CHE	Current health spending level reported as a percentage of GDP. The yearly utilization of medical goods and services is taken into consideration in the current estimates of health care costs.	Percent

Result and Discussion

Based on the factors of the study, descriptive data are shown in Table 1.

Table 2. Descriptive data

	CHE	REC	GDP
Mean	6.740021	30.12800	7.742194
Median	6.811348	30.19500	7.227958
Maximum	7.709436	32.53000	13.25009
Minimum	5.635293	27.24000	0.086697
Std. Dev.	0.723076	1.444327	2.574327
Skewness	-0.179080	-0.027932	-0.696391
Kurtosis	1.624616	2.355505	5.755842
Jarque-Bera	1.683300	0.348746	7.945424
Probability	0.430999	0.839983	0.018822
Sum	134.8004	602.5600	154.8439
Sum Sq. Dev.	9.933930	39.63552	125.9160
Observations	20	20	20

Mean, min, max, and standard deviation are used to express the findings of descriptive statistics. CHE Minimum 5.63, CHE Maximum 7.70, and CHE Standard Deviation 0.72. REC Minimum 27.2, REC Maximum 32.53, REC Standard Deviation 1.44, etc. The ARDL model should not be used to forecast the value without first performing a stationary test. By looking at the error component, which also incorporates any possibility for autocorrelation, the ADF algorithm may determine if a series is stationary or not. The results are as follows:

Table 3. Unit Root Test

	Unit Root	ADF Test stat.	Signif.	Be told
Gross Domestic Product (GDP)	Level	-1.431593	0.5451	
	1 DF	-3.051408	0.0490	Stationer
Current Health Expenditure (CHE)	Level	-0.866815	0.7760	
	1 DF	-3.524813	0.0195	Stationer
Renewable Energy Consumption (REC)	Level	-2.453598	0.1416	
	1 DF	-4.440062	0.0046	Stationer

From the table above, it can be concluded that all data variables namely GDP, CHE, and REC are stationary at first difference. We can continue ARDL estimation because all data is stationary.

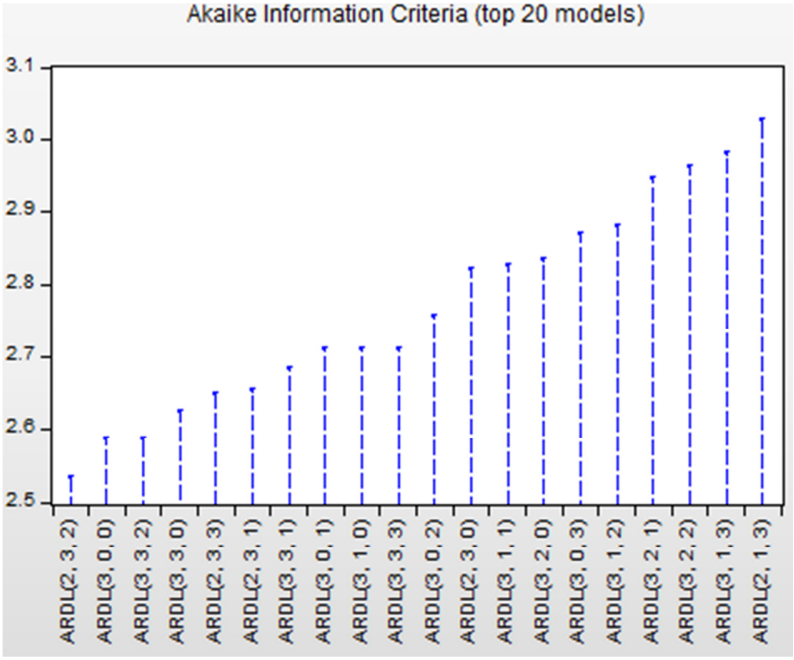

Figure 1. AIC Optimum Lag Test

In order to determine which lag should be utilized in the subsequent test, optimal lag testing is conducted; as observed in the aforementioned image, the best recommendation is the 2,3,2 lag.

Tabel 4. Bounds test

Stat. Test	Worth	Signif. I(0)	Signif. I(1)
F-stat.	14.29166	2.63	3.35
K	2	3.1	3.87
		3.55	4.38
		4.13	5

This shows that the four variables under study— renewable energy consumption, current health expenditure, gross domestic product —are cointegrated throughout time or move in the same direction because the F statistic value is greater than its the significant value.

Tabel 5. Autoregressive Distributed Lag results

	Coeff.	Std. Error	t-Stat.	Prob.*
D(REC(-1))	0.301874	0.188640	-1.600265	0.1607
D(REC(-2))	0.630982	0.190908	-3.305156	0.0163
D(CHE)	2.443645	2.380870	1.026366	0.3443
D(CHE(-1))	-3.660010	1.619516	-2.259940	0.0646
D(CHE(-2))	-0.382654	1.375838	-0.278124	0.7903

D(CHE(-3))	-3.580429	1.298683	-2.756968	0.0330
D(GDP)	-0.100780	0.151661	-0.664506	0.5311
D(GDP(-1))	-0.197729	0.107841	-1.833519	0.1164
D(GDP(-2))	-0.138733	0.107433	-1.291349	0.2441
C	0.841211	0.481651	1.746516	0.1313
R-sq.	0.868264	F-stat.		4.393974
Adj R-sq.	0.670661	Prob.		0.042742

The R-squared value of the ARDL model is 0.86, which means that each of the independent variables—current health expenditure and gross domestic product—could explain 86% of the variance in the REC. This demonstrates how well the research paradigm was used in this study. Then this is reinforced by the value of the f-stat and its probability which shows a value of 0.042742, which means it is significant because the probability value is less than 0.5 percent.

Judging from the ARDL estimation results, because the relationship between the REC and REC variables (-2) shows a t-statistic of 3.305156 which is greater than the coefficient of 0.630982, this means that the factor of REC two years earlier is a factor that influences the current of REC. Furthermore, the relationship between the REC and CHE(-3) variables shows a t-statistic value of -2.756968 which is greater than the coefficient value of -3.580429, this means that the CHE factor three years earlier is a factor influencing the current consumption of renewable energy. This shows that in Cambodia the influence of REC in previous years is still one of the strong factors affecting this year's renewable energy consumption. Other variables such as current health spending have a significant inverse relationship with renewable energy consumption, while economic growth as represented by GDP values also has a significant inverse relationship with REC in Cambodia.

Table 6. Model test results

	Coef.	Std. Error	t-Stat.	Prob.
C	0.841211	0.481651	1.746516	0.1313
D(REC(-1))*	-1.932856	0.271887	-7.109033	0.0004
D(CHE(-1))	-5.179448	3.945109	-1.312878	0.2372
D(GDP(-1))	-0.437242	0.235469	-1.856899	0.1127
D(REC(-1), 2)	0.630982	0.190908	3.305156	0.0163
D(CHE, 2)	2.443645	2.380870	1.026366	0.3443
D(CHE(-1), 2)	3.963083	1.971122	2.010572	0.0911
D(CHE(-2), 2)	3.580429	1.298683	2.756968	0.0330
D(GDP, 2)	-0.100780	0.151661	-0.664506	0.5311
D(GDP(-1), 2)	0.138733	0.107433	1.291349	0.2441

In order to be able to carry out an economic analysis of the effect of REC in Cambodia, it is not enough to only be based on short-term information, it is necessary to analyze its long-term effects. From the long-term ARDL estimation results as shown in Table 5, it can be seen that the

previous year's REC variable had a probability of 0.0004. Then followed by CHE which has a probability of 0.0330. This implies that in long term, the REC variable of the previous year plays a greater role in increasing the REC in the long term, followed by the CHE variable.

Conclusion

We discover that the factors we anticipate to have varying associations with Cambodia's utilization of renewable energy, in the short term the value of previous years' renewable energy consumption are the dominant factor affecting this year's renewable energy consumption, followed by current health spending. The ARDL test found that when the gross domestic product increases it will give negative sentiment to the value of renewable energy consumption in Cambodia. This is different from other variables such as current health spending, where when there is an increase it will make a positive contribution to the increase in renewable energy consumption.

References

Acquah, A. M., & Ibrahim, M. (2020). Foreign direct investment, economic growth and financial sector development in Africa. Journal of Sustainable Finance & Investment, 10 (4), 315-334.

Assad, M., Nazari, M., & Rosen, M. (2021). Design and Performance Optimization of Renewable Energy Systems. Academic Press 1 (1), 1-15. https://doi.org/10.1016/B978-0-12-821602-6.00001-8.

Djellouli, N., Abdelli, L., Elheddad, M., Ahmed, R., & Mahmood, H. (2022). The effects of non-renewable energy, renewable energy, economic growth, and foreign direct investment on the sustainability of African countries. Renewable Energy, 183 (1), 676-686.

Hamid, I., Alam, M. S., Murshed, M., Jena, P. K., Sha, N., & Alam, M. N. (2022). The roles of foreign direct investments, economic growth, and capital investments in decarbonizing the economy of Oman. Environmental Science and Pollution Research, 29 (15), 22122-22138.

Karaaslan, A., & Çamkaya, S. (2022). The relationship between CO2 emissions, economic growth, health expenditure, and renewable and non-renewable energy consumption: Empirical evidence from Turkey. Renewable Energy, 190 (1), 457-466. https://doi.org/10.1016/j.renene.2022.03.139.

Kongkuah, M., Yao, H., & Yilanci, V. (2022). The relationship between energy consumption, economic growth, and CO2 emissions in China: the role of urbanisation and international trade. Environment, Development and Sustainability, 24 (4), 4684-4708.

Mujtaba, A., Jena, P. K., Bekun, F. V., & Sahu, P. K. (2022). Symmetric and asymmetric impact of economic growth, capital formation, renewable and non-renewable energy consumption on environment in OECD countries. Renewable and Sustainable Energy Reviews 160 (1), 145-161.

Shang, Y., Razzaq, A., Chupradit, S., An, N., & Abdul-Samad, Z. (2022). The role of renewable energy consumption and health expenditures in improving load capacity factor in ASEAN countries: Exploring new paradigm using advance panel models. Renewable Energy, 191 (1), 715-722. https://doi.org/10.1016/j.renene.2022.04.013.

Sohail, M. T., Majeed, M. T., Shaikh, P. A., & Andlib, Z. (2022). Environmental costs of political instability in Pakistan: policy options for clean energy consumption and environment. Environmental Science and Pollution Research, 29 (17), 25184-25193.

Wang, Q., Dong, Z. L., & Wang, L. (2022). Renewable energy and economic growth: new insight from country risks. . Energy, 238 (1), 122-132.

Widarni, E. L., Irawan, C. B., Harnani, S., Rusminingsih, D., & Alim, M. B. (2022). Human capital and internet literacy impact on economic growth in Indonesia. Journal of Management, Economics, and Industrial Organization, 6 (3), 101-112.

Widarni, E., & Bawono, S. (2022). Technology Investment, Consumption, and Economic Growth in Poverty Eradication Efforts in Indonesia. Emerald Publishing Limited, Bingley, 217-223. https://doi.org/10.1108/978-1-80262-431-120221013.

Xue, C., Shahbaz, M., Ahmed, Z., Ahmad, M., & Sinha, A. (2022). Clean energy consumption, economic growth, and environmental sustainability: What is the role of economic policy uncertainty? Renewable Energy, 184 (1), 899-907.

Zafar, M. W., Saleem, M. M., Destek, M. A., & Caglar, A. E. (2022). The dynamic linkage between remittances, export diversification, education, renewable energy consumption, economic growth, and CO2 emissions in top remittance-receiving countries. Sustainable Development, 30 (1), 165-175.

Zhang, L., Godil, D., Bibi, M., Khan, M., Sarwat, S., & Anser, M. (2021). Caring for the environment: How human capital, natural resources, and economic growth interact with environmental degradation in Pakistan? A dynamic ARDL approach. Science of The Total Environment, 774, 56-72.