

Renewable Energy Consumption in Industrial Clusters for Economic Growth- A Comparative Case in Indonesia and Vietnam

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ABSTRACT

The aim of following study was to examine the relationship between renewable energy consumption in industrial cluster and economic growth with a comparative case in Vietnam and in Indonesia. This study has used quantitative research design for assessing the renewable energy consumption and its link with economic growth in Vietnam and Indonesia for the period of 2010-2020. The independent variable in this study was energy consumption whereas; dependent variable was economic growth in countries above .The data is analysed through E-views using autoregressive distributed lag co-integration approach for long-run relationship, and long-run and short-run coefficients, Augmented Dickey Fuller testing. The findings have revealed that economic growth and energy consumption has association with each other. Within the given historic data, energy consumption has the ability to predict economic growth in both nations. This study also provides the guideline to the policymakers that they should develop the policies related to the energy consumption that enhance the economic growth of the country.

Keywords: Energy Consumption, industrial clusters, Economic Growth, Gross Domestic Product, CO2 Emissions, comparative case study

1. Introduction

In 2022, despite many challenges, the renewable energy industry in Vietnam has achieved new milestones. In addition, many events, research activities, and knowledge exchanges on this field have been conducted in the context of the need to continue to seek solutions and policies to promote further development. From the experience, it can be seen that the prospects and development goals are huge, but we need to

have breakthrough solutions to make renewable energy an important source of supply in the future...

Next, **Hoang Thanh Hanh et al (2020)** also mentioned that explored the relationship of CO2 emissions and utilization of energy sources per capita as indicators of utilization of energy sources. The indicators for financial stability were real domestic credit to the private sector where the financial information of different financial institutions operating in Indonesia has been collected. The prosperity in the economy indicator for Indonesia was Gross Domestic Product (GDP) per capita and also the labour force that works within different sectors operating in the country. Using descriptive statistics, Unit root analysis, and the autoregressive distributed lag (ARDL) techniques, a panel data analysis was conducted. The results of showed that there is long term relationship between utilization of energy sources, financial stability and prosperity in the economy indictors of Indonesia.

Hence authors chooses this topic

“Renewable Energy consumption and economic growth- a comparative case in Indonesia and Vietnam”

2. Previous studies

We see in below figure:

Figure 1 - Related studies

Isik et al. (2018)	Another study by Isik et al. (2018) studied economic growth and consumption of energy in context of USA, Germany, China, Turkey, Italy, Spain and France
Inglesi-Lotz (2016)	Similarly, another study conducted by Inglesi-Lotz (2016) examined the sample of OECD regarding the same topic. The results revealed that consuming renewable energy is more beneficial than conventional forms of energy not only for the environmental context but for the economic context as well.
Bhattacharya et al. (2016)	the research conducted by Bhattacharya et al. (2016) had examined a sample of 38 countries with regards to both variables economic growth and along with the consumption of energy. Similarly, the results of the study found that energy consumption in the long-run had a positive and significant influence on economic growth of about half of the countries considered in sample.
World energy council (2022)	an urgent problem is to ensure the technologically and economically sound diversification of energy sources. This diversification is determined by the current and future needs for energy sources, the availability and accessibility of various energy sources, the development of scientific and technological progress, and R&D in the field of extraction and processing of fossil energy sources. It also considers the use of renewable energy sources in energy production, opportunities to achieve sustainable development goals, and the implementation of the energy trilemma.

(source: author synthesis)

3. Methodology and data

The following paper has utilized quantitative research design for assessing the energy consumption and its link with economic growth in case of Vietnam and Indonesia. The method of data collection was secondary therefore, time-series data for energy consumption and economic growth of Indonesia. In furtherance, the analysis has been conducted on E-views

4. Main findings

4.1 Overview

- First of all, In 2022, despite facing many challenges, the renewable energy industry in Vietnam has achieved new milestones. In addition, many events, research activities, and knowledge exchanges on this industry have been conducted in the context of the need to continue to seek solutions and policies to promote further development. From the reality, it shows that the prospects and development goals are very large, but we need to have breakthrough solutions to make renewable energy an important source of supply in the future... Synthesis, analysis, identification of difficulties and challenges by experts from Vietnam Energy Magazine on this industry.

Ten notable events of Vietnam's energy sector in 2022
Ten notable events of Vietnam's energy sector in 2022

Vietnam develops offshore wind power: Potential, challenges and action plan
Vietnam develops offshore wind power: Potential, challenges and action plan

1. Achievements in 2022 and memorable events in renewable energy:

In 2022, renewable energy (including hydropower, wind power, solar power, biomass power), although the preferential conditions for the FIT power purchase mechanism (Government's development incentive mechanism) have expired, continues to develop and investment preparation work, project completion... It is estimated that by the end of December 2022, the electricity output of renewable energy (RE) is expected to reach 130 billion kWh, accounting for nearly 48% of the electricity output of Vietnam's power system, in [1], 35% is hydropower and 13% is wind, solar and biomass (see figure 1). The proportion of renewable energy generation has been continuously increasing and

growing very rapidly in the power generation structure of Vietnam's power system in the period 2010 - 2022, from 27% in 2010 to more than 48% in 2022, especially with the huge contribution from wind and solar power in the years 2019 - 2022 (see figure 2).

Vietnam Renewable Energy in 2022: Events, Achievements and Challenges

However, it should also be pointed out that: The growth in electricity production output in 2022 compared to 2021 mainly comes from the increase in hydropower output due to favorable hydrometeorological conditions (83% of the increase in renewable energy output compared to 2021 comes from hydropower), wind power has a relatively large contribution to the increase in electricity generation output (estimated at 8.8 billion kWh in 2022 compared to 3.3 billion kWh in 2021 of wind power).

In the context of wind and solar power facing many difficulties due to the lack of a mechanism to support electricity purchase prices, waste-to-energy in 2022 is a bright spot, with significant development with a power generation capacity of about 60 MW as of November 2022 compared to 7.5 MW in 2021, including:

- The Seraphin Waste-to-Energy Plant Project started construction on March 30, 2022, at Xuan Son Solid Waste Treatment Area, Son Tay, Hanoi. This is the second waste-to-energy project in Hanoi, and also the first project using mechanical grate technology to both burn waste and generate electricity, invested by a Vietnamese enterprise. The 37 MW Seraphin Waste-to-Energy Plant is one of the important projects of the capital Hanoi, with a capacity to process 1,500 tons of dry waste/day, with an investment capital of VND 3,500 billion. With that capacity, the Plant will help reduce the landfill rate of the Capital from 100% to 3%. The PPA contract has been signed.
- Soc Son Waste-to-Energy Plant, with a capacity of processing 4,000 tons of dry waste per day, with a total expected capacity of 75 MW, will start operating unit 1 with a capacity of 15 MW on July 25, 2022, after many delays.

In addition, a series of small-capacity waste-to-energy plants have started construction, or are preparing to put into operation in Bac Ninh, Ho Chi Minh City, Hai Phong, Dong Nai, etc.

Biomass power will also be promoted in 2022, including projects that have started construction and completed investment procedures in the year such as: Hau Giang Biomass Power 20 MW, Tra Vinh Biomass Power 25 MW, and a series of other biomass power projects proposed for construction in Quang Binh, Yen Bai, Dak Lak, Thanh Hoa.

One of the highlights of 2022 is the Vietnam - Denmark Sustainable Energy Summit, where 14 memorandums of understanding were signed between Danish and Vietnamese businesses, witnessed by the Crown Prince and Crown Princess of Denmark, Deputy Minister of Industry and Trade Dang Hoang An and representatives of Vietnamese ministries and sectors. Offshore wind energy and energy efficiency play an important role in supporting Vietnam's efforts in the transition to a low-carbon economy. These are also two areas where Danish businesses have leading solutions and technologies that have been proven in practice. Vietnam and Denmark share the same vision for developing renewable energy. Cooperation between businesses contributes to finding common solutions to bring benefits and prosperity to both countries.

(source: nangluongvietnam.vn)

4.2 Indonesia case

We see that:

Variable	Coefficient	SE	t-Statistic	Prob.*
GDP_	0.326533	0.126101	2.589468	0.0128
GROWTH(-1)				
EC_KWH_PER_	0.120677	0.050335	2.397492	0.0205
CAPITA				
EC_KWH_PER_	-0.199745	0.070142	-2.84773	0.0065
CAPITA(-1)				
EC_KWH_PER_	0.082217	0.048837	1.683514	0.0989
CAPITA(-2)				
CO ₂ _EMISSION_	4.336176	3.315227	1.307957	0.1972
PC				
CO ₂ _EMISSION_	-5.555635	3.44637	-1.61203	0.1137
PC(-1)				
TOTAL_LABOUR_	-248.9432	102.3531	-2.4322	0.0189
FORCE				
TOTAL_LABOUR_	236.2358	96.04858	2.459545	0.0176
FORCE(-1)				
C	106.4496	58.26968	1.826844	0.0741
R-squared	0.378168	F-statistic	3.572896	
Adjusted R-squared	0.272325	Prob(F-statistic)	0.002598	

(source: Nguyen Duy Dat et al, 2020)

After the unit root testing was done and the variables with unit root tests were found so, the next step was to test the auto-correlation so that the future values can be predicted out of it. However, in this case, the lag technique was used in order to predict the values. The current study that has been taken into consideration was time series data and it consists of unit root hence, to determine whether causality exists between the variables or not so, ARDL was applied and used as statistical technique of measurement. The current studies conducted in similar domain has revealed that ARDL is basically a model and a method of predicting the future values based on the log values obtained. However, it is important to mention here that the purpose of developing this ARDL model was to run regression as the data was time series in nature and includes multicollinearity. GDP growth was the dependent variable and the probability value was 0.0128 which is less than the sig value of 5% hence indicating long term relation with energy consumption. Moving to the next variable was energy consumption which has been computed through its two lags. In the first as well as second lag, the probability value is less than sig value of 0.05 which indicates that long term association exists between the variables

(source: Dat , ND et al, 2020)

4.3 Vietnam case

We see process of pyrolysis technology to cut waste tires into oil products

Figure 2 - Input Material Tires



(source: internet)

Figure 3 - Continuous pyrolysis plant



(source: internet)

Figure 4 - Pyrolysis process



(source: internet)

Next we see effectiveness of renewable energy via pyrolysis process as follows:

5. Discussion

Here we will discuss more on managing renewable energy firms in industrial clusters as below:

Butteri et al (2019) stated that individual firms still encounter technical and financial barriers that hinder the installation of renewables. The eco-industrial park approach aims to create synergies among firms thereby enabling them to share and efficiently use natural and economic

resources. It also provides a suitable model to encourage the use of renewable energy sources in the industry sector. Synergies among eco-industrial parks and the adjacent urban areas can lead to the development of optimized energy production plants, so that the excess energy is available to cover some of the energy demands of nearby towns. This study thus provides an overview of the scientific literature on energy synergies within eco-industrial parks, which facilitate the uptake of renewable energy sources at the industrial level, potentially creating urban-industrial energy symbiosis. The literature analysis was conducted by arranging the energy-related content into thematic categories, aimed at exploring energy symbiosis options within eco-industrial parks. It focuses on the urban-industrial energy symbiosis solutions, in terms of design and optimization models, technologies used and organizational strategies.

Moreover, Reducing the negative environmental impacts of industries is a major challenge, both in advanced and emerging economies. Issues of environmental resource efficiency, sustainable processes and energy choices must be considered when promoting sustainable industrial development (N.E Johnson et al, 2017).

6. Conclusion

In case of Indonesia. This paper has used quantitative method of research design along with secondary data. The findings above revealed that economic growth and energy consumption has association with each other. It was also found from this paper that CO₂ emissions impact economic growth whereas, total employment has is an important variable in this study to examine its impact on economic growth.

In case of Vietnam renewable energy sector contributed to reduce environment problems,

We see below figure

Figure 4 - Environment problem caused by tires



(source; internet)

Last but not least, Phuong, NTT et al (2020) stated that Banks have vital roles in financing industries.

Limitation of research

The main limitation of this study was its scope as the study might expand for covering other regions too.

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