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Between Coal Power Generation and Renewable Energy; Review of Investment Aspects

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Abstract
This paper aims to analyze the growth of steam power plants and renewable energy reviewed with investment. This research uses a descriptive quantitative method with secondary data, namely the report of the Ministry of Energy and Mineral Resources and the Electricity Supply Business Plan. The results of this study found that the total renewable energy capacity and renewable energy investment did not increase significantly, temporarily. Total coal-fired power plant capacity, electrical energy consumption and coal sales for electricity production increased significantly.
Keywords: Coal, Renewable Energy

INTRODUCTION

Energy has an important role in meeting human needs. In addition, energy also has a role in increasing economic activities and national resilience. According to Law No.30 of 2007 concerning Energy, it is stated that energy is the ability to perform work that can be in the form of heat, light, mechanics, chemistry, and electromagnetics. Energy is divided into two, namely non-renewable energy sources and renewable energy sources. Non-renewable energy sources are energy sources produced from energy sources that will run out if exploited continuously. Based on Article 1 of Law No.30 of 2007, non-renewable energy includes nuclear, hydrogen, coal bed methane, liquified coal, and gasified coal while renewable energy includes geothermal, wind, bioenergy, sunlight, streams and waterfalls, as well as movement and temperature differences of layers, sea. large, exports of energy resources play a vital role in the national economy, the domestic economy is very sensitive to fluctuations in energy prices on the world market, and the demand for final energy in the country is growing rapidly, while the utilization of renewable energy resources is still very small and not optimal (Boedoyo, 2015).

Energy has a fairly vital role for human life. Energy is used as lighting, means of transportation, photosynthesis, communication tools, sports equipment, body drive and so on. Before being used for needs, the previous energy is converted first into electric power. According to Law No.30 of 2009 concerning Electricity, electric power is a form of secondary energy that is generated, transmitted, and distributed for all kinds of purposes, but does not include electricity used for communication, electronics, or gestures. The need of the Indonesian people for electricity is increasing is increasing every year. Until 2021, electricity consumption in Indonesia reached 257,634 Mwh. Growth in electricity consumption was also followed by growth in electricity production in Indonesia where in 2021 PLN's electricity production reached 289,470.57 Mwh.

Table 1. Power Generation Capacity

Types of Power Plants	PLN Installed Capacity (in MW)		
	2018	2019	2020
Water	5.436	5.447	5.513

Steam	32.026	33.095	32.920
Gas	5.467	4.998	5.174
Steam Gas	11.249	12.056	11.993
Geothermal	1.986	1.986	1.979
Diesel	6.384	5.009	5.388
Gas Engines	866	1.920	1.749
Micro Hydro	152	170	204
Sun	14	18	18
Other	146	143	296
Installed Capacity	**63.747**	**64.843**	**65.236**

In 2018-2020, installed capacity in Indonesia continued to increase. In 2018, the installed electricity capacity reached 63,747MW, then in 2019, the installed electricity capacity reached 64,846MW, in 2020, the installed electricity capacity reached 65,236MW. Steam power became the dominant power plant. In 2018, steam power reached 50.24% of installed capacity, in 2019 it increased to 51.04% and in 2019 steam power capacity decreased to 50.46%. In addition to the use of non-renewable energy, power plants also use renewable energy as their primary energy source. The renewable energy that is generally used to convert into electricity includes water, geothermal, wind, solar power, and so on. Decarbonization causes the energy transition to have a global impact on the energy and electricity sectors while regulations and implementation tend to lag behind with the pace of change (Ahsan, 2021). However, the use of renewable energy as a source of electricity is still relatively low. Until 2020, renewable energy used as a primary energy source in new power plants reached 19.5%. (Al Faqir, 2020).

The government strongly encourages the use of renewable energy in all industrial sectors. This is due to the limited non-renewable energy so that a diversity of energy resources is needed so that energy availability is guaranteed and the creation of national energy independence and security. In addition, non-renewable energy is considered the main cause of global warming. In the power generation industry, there are several policies to encourage the use of renewable energy which is regulated in Article 6 of Law No.30 of 2009 that the use of primary energy sources to ensure the provision of sustainable electricity must be implemented by prioritizing new and renewable energy sources. This policy is further emphasized through Presidential Regulation of the Republic of Indonesia No.112 of 2022 concerning the Acceleration of Renewable Energy Development for the Provision of Electricity. The government is committed to achieving the new renewable energy mix target that has been set at 23% (Al Faqir. 2020). In the 2021-2030 RUPTL, electricity growth has been planned as seen in the table of plant growth plans and energy plans sold in the next 10 years as follows:

Table 2. Power Generation Capacity

Power Plant	Capacity (in MW)
PLTA PLTM/H	10.391
PLTB	597
PLT Bio	590
PLTP	3.355
PLTS	4.600
PLT EBT Base	1.010
Energy Storge System	300

Investments made by foreigners can cause poor air quality to occur (Widiastuti et al., 2020). The policies made by the government require investors to also change their investment patterns that previously invested in industries that use non-renewable energy to industries that use renewable energy in the use of primary energy sources. It is also the case with

investments in the power generation industry that investments in industries that use renewable energy are starting to be chosen by investors. The increase in investment also has an impact on increasing electricity production sourced from renewable energy sources.

RESEARCH METHODS

This research is a research that is a search with quantitative descriptive data, Where this study will look at secondary data from the last few years and coal production which then the data will be described. The data source in this study is a secondary data source obtained from the report of the Ministry of Energy and Mineral Resources. Other data that support the research are taken from the Electricity Supply Business Plan.

RESULTS OF RESEARCH AND DISCUSSION

Research Results

Coal sales continue to fluctuate from year to year. Most of the coal sales are used for electricity needs in steam power plants (PLTU). In 2021, coal supply for electricity needs reached 84.28 of total sales. This is due to the increase in lysric generating capacity also every year. In 2014, the steam power capacity reached 25,104.23 MW but in 2021, the capacity was much larger reaching 37,036.36 MW. Of course, increasing capacity will increase the need for raw materials in the form of coal.

Table 3. Coal Sales

Year	Total Coal Sales (in Tons)	Coal Sales for Power Plants (in Tons)
2014	76.180.001	63.054.000
2015	86.814.099	70.080.000
2016	90.550.000	75.400.000
2017	97.030.000	83.000.000
2018	115.080.000	91.140.000
2019	138.418.192	98.550.260
2020	131.886.643	104.829.892
2021	133.043.362	112.133.733
Trend	**9.345.962,18****	**7.082.123,46****

This research shows that coal sales have increased significantly over the past 8 years, where the average increase reached 9.35 million tons per year. Coal sales for power plants also continue to increase significantly where the average increase reaches 7.08 million tons per year. The comparison of power generation capacity between coal and renewable energy can be seen as follows:

Table 4. Electricity Capacity, Electricity Consumption and Investment Value

Year	PLTU Power Plant Capacity	PLTU Power Plant Capacity	National Listic Consumption	Renewable Energy Investment
2014	25.104,23	6.679	65.909	611
2015	26.447,58	8.526	64.079	2.235
2016	28.351,97	9.015	68.145	1.610
2017	30.768,07	9.409	72.238	1.960
2018	31.587,17	7.142	93.537	1.530
2019	34.737,17	7.626	94.281	1.710
2020	36.667,86	7.753	88.372	1.360
2021	37.036,36	8.435	99.467	1.550
Trend	**1.840,49****	**23,73**	**5.429,5****	**24,62**

Significant increase in coal power plant capacity which reaches 1,840.49 MW per year. However, the increase in electricity capacity in renewable energy power plants has only increased by an average of 23.73MW per year. This increase is certainly not significant. Meanwhile, national electricity consumption continues to increase significantly with an average increase of 5,429.5 MW per year. The increase in renewable energy investment also showed insignificant improvements, meaning that the increase only reached an average of 24.62 million USD per year.

Table 5. Investment value of the Energy Sector in 2017-2021

Year	Quarter	Foreign Investors (in USD)	Domestic investors (in USD)	Total Investment (in USD)
2017	1	706.758.50	7.294.004.20	8.000.762.70
	2	989.589.60	5.830.094.00	6.819.683.60
	3	989.819.30	8.807.074.70	9.796.894.00
	4	1.555.281.70	3.469.300.90	5.024.582.60
2018	1	859.553.40	7..769.739.00	8.629.292.40
	2	897.998.90	8.774.831.50	9.672.830.40
	3	1.220.079.20	12.284.684.90	13.504.764.10
	4	1.406.184.60	8.435.612.30	9.841.796.90
2019	1	1.526.379.60	10.290.676.20	11.817.055.80
	2	1.350.542.30	3.397.699.50	4.748.241.80
	3	1.553.991.50	15.787.373.20	17.341.364.70
	4	1.490.255.70	7.688.406.10	9.178.661.80
2020	1	868.643.50	5.528.031.90	6.396.675.40
	2	1.463.109.60	9.395.770.80	10.858.880.40
	3	916.080.40	11.251.398.20	12.167.478.60
	4	1.366.112.30	9.343.597.90	10.709.710.20
2021	1	597.849.10	11.470.516.60	12.068.365.70
	2	847.983.00	11.677.199.70	12.525.182.70
	3	496.951.70	7.864.517.00	8.361.468.70
	4	995.800.00	7.715.476.30	8.711.276.30
Trend		**-9.484,03**	**149.687,93**	**140.203,9**

Discussion

This research found that the need for national electricity consumption has continued to increase in the last 8 years, where electricity capacity is needed that can supply electricity to consumers. One of the electric power that can be used is pltu energy which uses coal as the main raw material for producing electricity. Total sales of coal used for power generation also continue to increase significantly where your power plant is the main support for the increasing electricity generation.

Investment activities in the last 5 years, investment both from foreign and domestic in the energy sector has fluctuated. However, this study found that there was no significant trend of investment activities in the energy sector. Investment tends not to experience significant changes caused by the presence of renewable energy. The facts in the field found that the increase in renewable energy investment also did not experience a significant increase in, where there is very little influence.

Meanwhile, the need for energy also cannot be supported by the existence of renewable energy. The increase in renewable energy capacity is also not meaningful every year. It has not even been able to reach half of the annual electricity capacity and needs. As a result, electrical energy currently still relies on coal-fired power plants as the main support.

CONCLUSION

Based on the results of previously conducted tests, the researchers concluded the following: Total renewable energy capacity did not increase significantly; Total coal-fired power plant capacity increased significantly; National electrical energy consumption increased significantly; Sales of coal for electricity production increased significantly; Renewable energy investment has not increased significantly.

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