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COMPARISON OF OPERATING COST PERFORMANCE BEFORE AND AFTER THE IMPLEMENTATION OF THE FUEL COST EFFICIENCY STRATEGY

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Cost;
Fuel;
CNG;
Line pack;
Efficiency;

Abstract

In this study, a comparison of operating cost performance before and after the implementation of the fuel cost efficiency program at PT Indonesia Power Grati POMU was conducted. In this study, the comparison of operating cost performance before and after the implementation of the fuel cost efficiency program for the variable costs of gas compression service PLTGU Grati, BPP component C and BOPO PLTG Block 2 dominantly uses CNG gas (reaching 55% of total CNG usage) will be tested. tested using the t-paired test and the Wilcoxon test. The data used is secondary data obtained from PLTGU Grati. From the test results, there are differences between the cost of compressing gas services for PLTGU Grati before and after the efficiency program as well as before and after renegotiation of tariffs. In addition, there are also differences in BPP and BOPO with gas fuel at PLTG Block 2 Grati between before and after the fuel cost efficiency program. Fuel cost efficiency program carried out at the PLTGU. . Grati has been able to reduce the use of compressed gas CNG energy by up to 78.49% or USD 3,707,713 within six months, equivalent to Rp. 51,907,976,400,00, as well as reducing the Cost of Generating to 14% and lowering the BOPO ratio by 7.1% so as to reduce the difference in the cost of the C gas component by Rp. 2,186,963,429.00 per month in the period from July to December 2019

Kata Kunci:

Biaya;
Bahan Bakar;
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Line pack;
Efisiensi;

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Abstrak

Pada penelitian ini diuji perbandingan kinerja biaya operasi sebelum dan setelah pelaksanaan program efisiensi biaya bahan bakar untuk variabel biaya jasa *compressing* gas PLTGU Grati, BPP komponen C serta BOPO PLTG Blok 2 yang dominan menggunakan gas CNG (mencapai 55 persen dari total pemakaian CNG) yang akan diuji menggunakan metode uji t-berpasangan (t-paired test) dan uji Wilcoxon test. Data yang digunakan merupakan data sekunder yang didapat dari PLTGU Grati. Dari hasil pengujian terdapat perbedaan antara terhadap biaya jasa *compressing* gas PLTGU Grati sebelum dan setelah program efisiensi serta sebelum serta setelah renegosiasi tarif. Selain itu terdapat juga perbedaan pada BPP dan BOPO dengan bahan bakar gas di PLTG Blok 2 Grati antara sebelum dan setelah program efisiensi biaya bahan bakar. Program efisiensi biaya bahan bakar yang dilakukan di PLTGU. Grati telah mampu menurunkan pemakaian *compressing* gas CNG energi hingga mencapai 78.49 persen atau mencapai USD 3.707.713 dalam waktu enam bulan, setara dengan Rp. 51.907.976.400,00, serta menurunkan Biaya Pokok Pembangkitan hingga 14 persen dan menurunkan rasio BOPO sebesar 7.1 persen sehingga mampu mengurangi selisih biaya komponen C gas sebesar Rp. 2.186.963.429,00 per bulan pada periode bulan Juli sampai dengan Desember 2019.

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INTRODUCTION

The electricity business that has developed recently has made the competition between power plants to be able to sell electricity at the lowest price even stronger. The company's business strategy and operations will have a lot of influence in the competition with other power generation companies. The company's business strategy is a proactive effort made by the company to see market opportunities, determine company targets, direct business and behavior, and then improve company performance (Yan Yan, 2021). In his writings, Yan Yan focuses on two strategies from Miles and Snow Business Strategy Typology, namely as Prospector and Defender. The prospector strategy tends to be carried out by companies with a tendency for higher fixed costs and lower variable costs, while the defender strategy tends to be carried out by companies with a tendency for lower fixed costs and higher variable costs. The Prospector type is characterized by an innovative creative strategy to seek new market share, while the defender strategy type emphasizes cost efficiency in the current production process. Power generation companies have a tendency of relatively low fixed costs and higher variable costs, so that power generation companies tend to be more suitable to implement a defender strategy which focuses more on improving process cost efficiency in order to improve company performance.

Intense business competition between power generation companies has caused PT. Indonesia Power must try to make innovative efforts so that the company can remain competitive and continue to make profits. Fitriyani (2019) said that every company is required to pay attention to the level of efficiency, due to increasing business competition and consumer living standards. Companies that are not able to improve their level of business efficiency will lose competitiveness. The smaller the BOPO ratio, the better, because the company concerned can cover operating expenses with operating income.

Gnonlonfoun, et al (2018) in her journal writing that focuses on various aspects of the business environment and internal conditions that can affect management and decision-making processes in terms of reducing unnecessary costs or implementing cost optimization measures to the detriment, conveys the conclusion of cost optimization within a company is one of the key elements of running a business. Cost audits carried out by specialists can bring several benefits, namely by reducing unwanted costs in business operations thereby providing savings that can be invested in company development. The use of cost optimization tools should be treated as a process of improvement of the company, which in turn should provide more opportunities to increase its value and efficiency. Lowering the company's operational costs, such as production, telecommunications, and administrative costs is often the only option for company operations. In manufacturing companies, optimization of business processes is important. This can be done by developing management and organizational structure. In addition, it can also help increase employee potential through the introduction of more flexible forms of work. Companies that want to improve their business efficiency need support in the field of cost management must take into account cost efficiency. Companies must choose strategic steps in sufficient cost efficiency to achieve goals and future success in the market.

In a journal written by Lee, et al (2021) which discusses the implementation of two strategies simultaneously in companies, namely low cost strategy and Porter focus. They conceptualize the pursuit of cost-efficiency advantage as a low-cost strategy and restrain competition through horizontal differentiation as a focus strategy. Despite previous research on strategies that each of these strategies alone may have a positive impact on firm profitability, they highlight that the mechanisms driving the interaction of these two strategies are, in fact, not additive, consistent with recent analytical work. Using the context of the scheduled passenger airline industry in the United States for two decades, empirically shows that combining a low-cost strategy with a focused strategy will be detrimental to company profitability. So the conclusion is that the company must choose one strategy, namely a low cost strategy or a focused strategy to improve company performance effectively. Studies show that even if a company pursues only one strategy individually, it can benefit from it. But pursuing two generic, low-cost, focused strategies simultaneously will hurt the company's profitability. The bottom line is that while firms pursuing a low-cost strategy already have a cost-efficiency advantage over their rivals for a full customer base, the firm gains nothing by simultaneously limiting competition through focusing on smaller customer segments and thereby providing far-reaching revenue for rivals. Insights into the combination of different generic strategies remind managers not to be misled by the performance gains of both low-cost and individually focused strategies, but to recognize that using both strategies together can seriously harm the company's profitability.

The cost efficiency strategy carried out by the company must always be evaluated and tested to ensure the level of success and its impact on the company. According to David. (2009), strategic evaluation is important because organizations face a dynamic environment where key external and internal factors often change rapidly and dramatically. According to Nian et al. (2016) Levelized Cost Of Electricity (LCOE) is a popular methodology for evaluating the economic competitiveness of power generation technologies. The LCOE approach calculates the average cost of electricity by considering the main costs of components, such as investment, operation, maintenance and fuel. It can be seen that the role of fuel costs is one of the main factors taken into account in the cost of electricity generation.

In order to support cost efficiency efforts that have always been carried out, since 2009 the Grati PLTGU has switched from using fuel oil as the main fuel to using gas as the main fuel and fuel oil as a backup. The switch from using oil fuel to gas fuel will be able to significantly reduce the basic cost of electricity generation, this can be because fuel costs reach 74.1 persen of the total generation cost (based on the Profit and Loss Report of PT Indonesia Power UPJP Perak Grati in June 2019).

By decreasing the Cost of Goods Sold (BPP) or often also called the Cost of Goods Sales (COGS) which is defined as the direct cost to produce goods sold by the company, where this amount includes the cost of materials directly used to make these goods, or those in business. generation is called the basic cost of generation, it will have a chain effect where this is expected to also increase the order of dispatch (sequence of orders to generators from PLN P2B to operate or increase electricity production from each power generating unit) from the Grati generator, so that it will cause production electricity increases. The higher the electricity production, the relatively lower cost of electricity generation per kWh of production. This is because the same cost will be divided by more production results. In addition, an increase in production in general will also cause the power plant load to be maximized and this will have an impact on better thermal efficiency of the generator. Better thermal efficiency will mean the cost of fuel required to generate each kwh will be lower. The application of Economic Dispatch (ED) in the operation of modern power systems has a very important meaning. System demand is allocated economically between different multiarea generators taking all constraints into account. Multi Area Economic Dispatch (MAED) is an important issue in today's power system to allocate power generation through delivery strategy to minimize fuel costs. The simulation results from the research conducted show that the GWO (Grey Wolf Optimizer) technique can produce a qualitative cost solution without any problems. Significant improvement in cost results has been obtained compared to other optimization techniques discussed in the literature (Kumar et al., 2021).

In accordance with the Monthly Operational Plan (ROB) which is routinely issued by PT PLN UIP2B every month, the order of the generation units to operate or increase the amount of production or what is commonly referred to as a merit order is based on system requirements and the Basic Cost of Generation of material cost components. fuel (BPP Component C) from each generator.

Table 1.
Example of Generating Merit Order in the Java-Madura-Bali Electricity System

No	PLTU Batubara	Harga (Rp/Kg)	Nilai Kalor (kcal/kg	Rp/cal	Merit (Rp/kwh)
1	Tanjung Jati 1&2	690	5.616	123	251
2	Tanjong jati 3&4	715	5.606	128	251
3	Paiton 9	500	4271	117	252
4	Rembang	580	4458	130	262
5	PEC 3	630	500	126	268
6	PEC	659	5215	126	270
7	Japow	632	500	125	272
8	CEP	597	4609	130	278
9	Celoukan Bawang	606	4832	126	285
10	Cilacap 3	857	5239	164	291
11	Tanjung Aw ar-aw ar	580	4163	139	293
12	Indramayu	574	4248	135	295
13	Pacitan	648	4751	136	306
14	Palabuan Ratu	665	4628	144	308
15	Paiton	669	4900	137	323
16	Suralaya 8	693	4601	151	327
17	Suralaya 400	701	4848	145	344
18	Lontar	630	4591	137	352
19	Suralaya 600	701	4758	147	356
20	Labuan	643	4570	141	384
21	Cilacap 12	857	5239	164	389

Source: PT PLN P2B Energy Allocation Meeting material, 2022

From the table above, it can be seen that the price of fuel per unit volume also greatly affects the amount of BPP component C (in units of rupiah / kWh) in addition to the technical efficiency of the generator, which will also determine the order of the generator's merit order. Companies measure their cost efficiency by comparing the business costs incurred against the output produced (for a product) or the revenue generated (with a process). Based on data up to June 2019, the cost of fuel or component C of PLTG Block 2 reached Rp. 33,857,123,770.00 while the revenue for component C block 2 only reached Rp. 31,256,624,576.00 and the comparison / ratio of PLTG fuel operating costs with fuel operating income (BOPO komp C) PLTG block 2 obtained 1.08 results which means that the fuel costs incurred are greater than the fuel revenue (component C) is greater as much as 0.08 times or 8% above the income of component C, or equivalent to Rp. 2,500,529,966.00 per month, and this shows a poor performance for plant management. For this reason, it is necessary to make efforts or strategies to reduce fuel costs in order to reduce or eliminate losses from the fuel cost factor.

Since 2013 the PLTGU Grati has operated CNG (Compressed Natural Gas) to increase the flexibility of the operation of PLTG block 2 in meeting the operating pattern of peak system loads. This CNG can play a role in balancing gas absorption when the demand for generator loads in the electricity system is low and is able to balance the gas supply needs for plants when high loads are needed, taking into account the flexibility of plant operation to support the needs in the Jamali electricity system. Based on data on CNG usage of PLTGU Grati in January 2019 it can be seen that Block 2 predominantly uses CNG gas with consumption of around 62% of the total monthly CNG usage of PLTGU Grati.

If evaluating the opportunities that exist by observing the existing operating conditions, there are several factors that can be addressed to increase the efficiency of electricity generation costs so that the best generation costs are obtained. According to Sedarmayanti (2017) there are five principles of efficiency, including the principle of saving, saving means preventing excessive use of objects or materials, so that the cost of the work is not expensive. Taking into account the magnitude in the structure of the generation cost, the efficiency of fuel costs is felt to have a major influence if efficiency can be carried out. In the journal written by Cetiner & Coskun (2021), the CNG filling operation process can be optimized by taking into account various operating factors for factors that vary from month to month and even day, such as; temperature conditions, filling method, gas tanker structure and filling platform, namely the influence of the materials used, the effect of personnel and the rate of filling of machines such as chillers, compressors. After optimization, the number of fillings carried out in 2018 increased by 4.36% compared to 2017. This illustrates that there are opportunities that can be optimized to increase the efficiency of plant operating costs by optimizing the factors that affect CNG operations at PLTGU Grati.

Of the four cost drivers above, taking into account the relevant costs and controlled costs in the Grati PLTGU unit, point 4 has the potential to be minimized by adjusting the pattern of gas absorption to the Grati PLTGU from the Opportunity gas well through the Pertagas EJGP pipeline. By setting this absorption pattern, it is hoped that the ability of the EJGP pipe to store gas at higher pressures or what is commonly referred to as linepacks can be optimized to disrupt the role of CNG currently used so that the fuel cost saving strategy implemented can be successful. In addition, efforts to renegotiate the compressing gas (CNG) service contract will also have the opportunity to reduce fuel costs.

In a previous study, Yue, et.al, (2012) stated that in order to determine the effect of the operation optimization strategy on coal-fired power plants, it was found that there was a decrease in costs when fuel consumption was optimized. The power plant optimization program by analyzing the characteristics of fuel consumption, and determining the operating steps based on that analysis, shows the potential for greater profits in terms of fuel absorption. In a journal entitled electricity restructuring and the relationship between fuel costs and electricity prices for industrial and residential customers, it was found that changes in Granger's coal and natural gas costs affect electricity prices for industrial and commercial customers in states that were not restructured and restructured (Ohler et al. ., 2020). In another study, Demirezen & Fung (2021) conveyed the process of regulating the pattern of operating energy sources in the heating system with the SDFSS (Smart Dual Fuel Switching System) system, which has taken into account the price of time of use (TOU), fuel costs, short-term weather forecasts, and the efficiency and capacity of the equipment to determine the optimal schedule for the hybrid heating system to run more cost effectively, reflecting lower operating costs relative to the furnace or ASHP system. The results of Koç et al., (2020) research found that changes in the pattern and arrangement of operating gas turbine equipment can reduce the cost of production (BPP). For the case of using H2 and natural gas as fuel for gas turbine equipment, the minimum fuel costs are calculated at 0.345 $/kWh and 0.075 $/kWh at 20 bar for a simple gas turbine cycle, while the fuel costs are found to be 0.322 $/kWh and 0.071 $/ kWh at 4 bar for recuperative gas turbine cycle.

This previous research shows the great potential of a power plant operation optimization program, especially on fuel costs, therefore it is hoped that the efficiency strategy obtained from the RCPS diagram above can also reduce the cost of electricity generation and provide more benefits in terms of fuel costs in the PLTGU Free. The fuel cost efficiency program at the Grati PLTGU was carried out starting in early July 2019.

The Grand Theory used for this research is Management. Middle Theory used is Cost Management. According to Deden Mulyana (2011). From the research of Dadar et al. (2021) showed that the optimization of cost efficiency programs with Genetic Algorithm Optimization (GAO) was able to contribute to reducing energy consumption by around 15.4% - 17% per day. Or even if it's only 10% daily efficiency the value will be equivalent to a cost savings of 83,220,000 Riyals (1666.46€) per day. There is a large potential for energy cost efficiency by optimizing energy costs. In Demirezen & Fung's article (2021) the process of regulating the pattern of operating energy sources in the heating system takes into account the price of time of use (TOU), fuel costs, short-term weather forecasts, as well as efficiency and equipment capacity to determine the optimal schedule so that the hybrid heating system can run. more cost effective with the SDFSS system (Smart Dual Fuel Switching System) exhibiting lower operating costs with respect to furnaces or ASHP systems.

Farhad et al. (2005) showed that many instruments and factory parameters are suitable for the intended purpose and tests can be applied to achieve energy savings. Moreover, the results show that the fuel consumption of natural gas and heavy oil has increased by about 10 and 8.3 percent, respectively, relative to the design conditions of these plants and at least half of this increase can be reduced by proper adjustment of operation and control devices and simple. In line with this article, the fuel cost efficiency strategy at PLTGU Grati is also expected to have a positive effect on the company's financial performance and this can be formulated with the following research hypothesis:

H1 : There is a difference in the amount of the cost of using compressed gas (CNG) services before and after the implementation of the fuel cost efficiency strategy.

Lee at.al (2021) presented an empirical study to examine the impact of companies pursuing several generic strategies, namely the low-cost strategy and Porter's focus. They conceptualize pursuing cost-efficiency advantage as a low-cost strategy and restraining competition through horizontal differentiation as a focus strategy. Although they corroborate previous strategy research that each of these strategies alone may have a positive impact on firm profitability, they highlight that the mechanisms driving the interaction of these two strategies are, in fact, not additive.

The results of Diani's research (2015), indicate that changes in the price of fuel oil (BBM) do not have a significant impact on the input costs of broiler farming, broiler production volume, broiler farmer income, and broiler farmer income. Meanwhile, Chao & Hsu (2014) who conducted a study developing a model with a cost function formulated for various stages of cargo transportation operations found that freight rates increase with an increase in fuel prices due to a corresponding increase in fuel surcharges due to fluctuations in fuel prices. Based on this reference, it is deemed necessary to test the results of the two strategies used in the fuel efficiency program at the Grati PLTGU, namely the optimization strategy for the use of CNG and the strategy for renegotiating the tariff for CNG compressing services, whether it will be additive or not, by formulating a hypothesis:

H2 : There is a difference in the amount of the cost of using compressed gas (CNG) services before and after renegotiation of CNG compressing service rates.

Tidball et al. (2010) in his research entitled Cost and Performance Assumptions for Modeling Electricity Generation Technologies found that a 10% increase in equipment costs increased the LCOE value by 1% to 6%. A 7% to 8% cost increase in LCOE with a 10% increase in natural gas costs. In a journal entitled Electricity Restructuring And The Relationship Between Fuel Costs And Electricity Prices For Industrial And Residential Customers, it was stated that changes in Granger's coal and natural gas costs affect electricity prices for industrial and commercial customers in states that were not restructured and restructured. (Ohler et al., 2020).

According to the research results of Dadar et al. (2021) on pump station efficiency research, using Genetic Algorithm Optimization (GAO) to achieve a minimum energy cost showed that optimization with GAO reduces energy cost consumption by about 15-20%. There is a significant potential for reducing energy costs by optimizing energy costs. In this paper, we will examine the significance of the fuel efficiency strategy on the cost of good sold (COGS) or in this case the basic cost of generation from the fuel component (BPP component C) in PLTG Block 2 which predominantly uses CNG as fuel by using units of rupiah per unit. kWh by formulating a hypothesis:

H3 : There is a difference in the basic cost of generation from the gas fuel component (BPP component C gas) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2.

In a study conducted by Scheraga (2004), he examined the relationship between the strategic focus of airline customer service activities and operational efficiency. The empirical investigation used data for thirty-eight airlines for fiscal year 2000—the last full year prior to the events of September 11, 2001. The sample is global and includes major international airlines, with nine from North America, ten from Europe, six from Latin America, two twelve from Asia, and one from the Middle East. Operational efficiency was measured using data envelopment analysis, using the input-oriented model defined by Ali and Seiford. Efficiency measures related to spending strategically focused on operations, passenger service, and ticket sales, promotions, and sales through tobit analysis. The results of the analysis show that promotion has a positive impact on operational efficiency. In another study entitled Changes in the Operational Efficiency of National Oil Companies, Hartley and Medlock III (2013) found evidence that the partial privatization strategy of National Oil Companies (NOCs) was able to increase operational efficiency.

Octanto (2017) in his journal entitled Impact of Office Stationery and Electricity Cost Efficiency on the BOPO Ratio of Bank B Branch S said that the efficiency program carried out by Bank B branch S was effective in reducing ATK (Office Stationery) costs and company electricity costs so that they could reduce the percentage level of the BOPO ratio (Operating Costs to Operating Income Costs) which has a positive effect on the company's net profit. Therefore, in order to test the effect of the fuel cost efficiency strategy at PLTG Block 2 on BOPO, a hypothesis is formulated:

H4 : There is a difference in the ratio of operating costs and operating income for gas fuel (BOPO) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2.

RESEARCH METHODS

This study uses quantitative data in the form of secondary data. This study is a comparative study that will compare the financial performance of the Grati PLTGU company before and after the implementation of the fuel cost efficiency strategy in 2019. The research hypothesis was tested using paired t-test analysis (t-paired test) if the data were normally distributed, but if the data were not with normal distribution, the Wilcoxon test will be used with the help of the Statistical Product and Service Solution (SPSS) computer program. The test results from hypothesis testing are then used as the basis for making conclusions.

The location of this research was carried out at PT Indonesia Power Grati POMU in the period November 2021 to January 2022. The study was conducted for the period of time the object of research was from January 2019 to December 2019. Because of the price of fuel per unit volume also greatly affects the amount of BPP component C (in units of rupiah / kWh) in addition to the technical efficiency of the generator, which will also determine the order of the generator's merit order.

Variable definition is an explanation and theoretical understanding of variables to be observed and measured. Based on the identification of variables, the operational definitions of the variables used in this study are as follows: The variable cost of using compressed gas/CNG services, in dollars (USD), is the daily data on the cost of using compressed gas (CNG) services for all units. PLTGU Grati is based on secondary data obtained from PLTGU Grati in the six months before and after the implementation of the fuel cost efficiency program at PLTGU Grati. The variable cost of the total cost of using compressing gas (CNG) services before and after the renegotiation of the tariff for CNG compressing services is the daily data on CNG usage obtained from the calculation of data on the use of compressed gas (CNG) services for all PLTGU Grati units which is calculated based on the tariff for compressing gas services before and after the renegotiation of the CNG compressing tariff, which is valid for a period of six months after the implementation of the fuel cost efficiency program at the Grati PLTGU.

The Variable Cost of Generating from the gas fuel component of PLTG Block 2 (BPP component C gas), in units of rupiah/kWh, is the amount of the basic cost of generating component C for gas fuel paid by PT PLN to the generator where this becomes income for the generator. The data to be used is secondary data from the monthly Final Billing (JTF) document for PLTGU Grati to PT PLN (Persero) in the period January – December 2019. Variable Ratio of Operating Costs and Operating Income (BOPO) at PT Indonesia Power Grati POMU, is data for calculating Operational Costs and Operating Income of gas fuel (BOPO) which will use data from the monthly financial statements of PLTGU Grati for the gas fuel component (C gas component), as well as monthly C gas component income data in the Final Billing Amount (JTF) document. PLTGU Grati to PT PLN (Persero) in the span of six months before the program implementation (January – June 2019) and after the implementation of the fuel cost efficiency strategy (July – December 2019).

The method of data collection in this study is the non-participant observation method. Based on the type, the data used in this study are as follows: quantitative data. Analysis of the data in this study using descriptive assumption test, classical assumption test, and hypothesis testing in this study depending on the results obtained from the normality test, if the data is normally distributed then a paired t test (t-paired test) is carried out, while if it is not distributed Normal testing will be carried out with the Wilcoxon test (Syaban, 2021:46). To test the hypothesis which states that the independent variable (X) used in this study has a significant effect on the related variable (Y). Testing is done by comparing the level of significance 0.05 then the hypothesis is accepted. On the other hand, if the significance value is 0.05, the hypothesis is rejected.

RESULTS AND DISCUSSION

Table 2.
Descriptive Statistical Results

Variabel		N	Minimum	Maximum	Mean	Std. Deviation
Biaya CNG (USD)	Pre	181	0,00	39007,55	26096,87	13768,09
	Post	181	0,00	27047,99	5612,24	6910,49
Tarif	Pre	181	0,00	38249,68	9102,94	11248,69
	Post	181	0,00	27047,99	5612,24	6910.49
BPP Komponen JTF	Pre		1551,13	1877,83	1738,56	122,29
BBG	Post		1405,13	1577,60	1486.76	67.00
BOPO BBG	Pre		1,00	1,16	1,080	0,06
	Post		0,92	1,05	1,003	0,05

Source : Data processed, 2022

Based on Table 2, it can be explained that the cost of using compressed gas (CNG) services before implementing the fuel cost efficiency strategy with a minimum value of 0.00, a maximum value of 39,007.6 and an average value of 26,096.9. After the implementation of the fuel cost efficiency strategy, the minimum value of 0.00 is the maximum value of 27,047.99 and the average value of 5,612.24.

Based on Table 2, it can be explained that the cost of CNG compressing services before renegotiation with a minimum value of 0.00, a maximum value of 38,249.68 and an average value of 9,102.94. After renegotiating the tariff for CNG compressing services with a minimum value of 0.00, a maximum value of 27047.99 and an average value of 5,162.24.

Based on Table 2, it can be explained that the basic cost of generation from the gas fuel component (BPP component C gas) before the implementation of the fuel cost efficiency strategy at PLTG Block 2 with a minimum value of Rp. 1,551.13 / kWh, a maximum value of Rp. 1,877.83 / kWh, and the average value is IDR 1,738.56 /kWh. After implementing the fuel cost efficiency strategy at PLTG Block 2 with a minimum value of Rp. 1,405.13/kWh, the maximum value of Rp. 1,577.60/kWh and an average value of Rp. 1,486.76/kWh.

Based on Table 2, it can be explained that the ratio of operational costs and operating income (BOPO) before the implementation of the fuel cost efficiency strategy at PLTG Block 2 with a minimum value of 1,000, a maximum value of 1.160 and an average value of 1,080. After the implementation of the fuel cost efficiency strategy at PLTG Block 2 with a minimum value of 0.92, a maximum value of 1.05 and an average value of 1.003.

The next step is to test the classical assumptions on observational data that can be analyzed further. The following are the results of the classical assumption test which includes the normality test to test whether the data used in the study has been normally distributed or not. To see if the data used in the study were normally distributed, it could be seen by using a non-parametric one-sample Kolmogorov-Smirnov test. The results of the Kolmogorov-Smirnov test can be seen in Table 3 as follows:

Table 3.
Normality Test Results Using the Kolmogorov – Smirnov . Method

Variabel		Sig Value	Information
Biaya CNG	Pre	0,000	Tidak normal
	Pos	0,000	Tidak normal
Tarif	Pre	0,000	Tidak normal
	Post	0,000	Tidak normal
BPP KOM C JTF	Pre	0,981	Normal
	Post	0,976	Normal
BOPO	Pre	0,981	Normal
	Post	0,935	Normal

Source : Data processed, 2022

Based on Table 3, it can be seen that the unstandardized residual model has an Asymp.Sig (2-tailed) value of the CNG cost variable (USD) after the fuel cost efficiency program in the observations before and after the value is below 0.05, this means that all data are not distributed. normal. Based on Table 5.2, it can be seen that the unstandardized residual model has an Asymp.Sig (2-tailed) value of the CNG (USD) cost variable before renegotiation of the compressing rate and after the value is below 0.05, this means that all data are not normally distributed. Based on Table 3, it can be seen that the unstandardized residual model has an Asymp.Sig (2-tailed) value for the BPP KOM C JTF variable before and after the value is above 0.05, this means that all data are normally distributed. Based on

Table 3, it can be seen that in the unstandardized residual model, the Asymp.Sig (2-tailed) value of the BOPO variable before and after is above 0.05, this means that all data are normally distributed.

For data that are normally distributed, a paired t-test will be carried out (t-paired test) while for those that are not normally distributed, the Wilcoxon test will be carried out (Syaban, 2021:46). To test the hypothesis which states that the independent variable (X) used in this study has an influence on the related variable (Y). Testing is done by comparing the level of significance if the value of 0.05 is obtained, then the hypothesis is accepted. On the other hand, if the significance value is 0.05, the hypothesis is rejected.

Based on the Normality Test Results in table 3, where there are abnormal and normal results, then for testing the variable the amount of the cost of using compressed gas (CNG) services before and after the implementation of the fuel cost efficiency strategy and the total cost of using compressed gas (CNG) services before and after renegotiation of tariffs for CNG compressing services whose data are not normally distributed will be tested using the Wilcoxon test method. Meanwhile, for the variable cost of generation from the gas fuel component (BPP Component C Gas) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2 and the ratio of fuel operating costs and gas fuel operating income (BOPO) before and after the implementation of the strategy. fuel cost efficiency in PLTG Block 2, each of which consists of data for 6 months according to the research design and normally distributed, will be tested using the paired t-test method.

Table 4
Differences in the Total Cost of Using Compressing Gas (CNG) Services Before and After the Implementation of the Fuel Cost Efficiency Strategy

Total Service Usage Fee Compressing Gas (CNG)	N	Mean	Nilai Sig
Pre	181	26.096,87	0,000
Post	181	5.612,24	

Source : Data processed, 2022

Based on Table 4 it can be seen that the value of sig = 0.000 or less than 0.05, then HO is rejected and H1 is accepted. This means that there is a difference in the total cost of using compressed gas (CNG) services before and after the implementation of the fuel cost efficiency strategy.

Table 5.
Differences in the Total Cost of Compressing Gas (CNG) Services Before and After Renegotiating CNG Compressing Services Tariffs

Rates	N	*Mean*	Nilai Sig
Pre	181	9.102.94	0,000
Post	181	5.612,24	

Source : Data processed, 2022

Based on Table 5., it is known that the value of sig = 0.000 or less than 0.05, then HO is rejected and H2 is accepted. This means that there is a difference in the amount of the cost of using compressed gas (CNG) services before and after the renegotiation of the CNG compressing service tariff.

Table 6.
Differences in Cost of Generating from Gas Fuel Components (BPP Component C Gas) Before and After Implementation of the Fuel Cost Efficiency Strategy at PLTG Block 2

BPP KOM C JTF	N	*Mean*	Nilai Sig
Pre	6	1.738,56	0,007
Post	6	1.486,76	

Source : Data processed, 2022

Based on Table 6, it is known that the value of sig = 0.007 or less than 0.05, then HO is rejected and H3 is accepted. This means that there is a difference in the basic cost of generation from the gas fuel component (BPP component C gas) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2.

Table 7.
Differences in the Ratio of Fuel Operational Costs and Gas Fuel Operating Income (BOPO) Before and After Implementation of the Fuel Cost Efficiency Strategy at PLTG Block 2

BOPO KOM C	N	Mean	Nilai Sig
Pre	6	1,080	0,012
Post	6	1,003	

Source : Data processed, 2022

Based on Table 7, it is known that the value of sig = 0.012 or less than 0.05, then HO is rejected, H4 is accepted. This means that there is a difference in the ratio of operating costs and operating income of gas fuel (BOPO) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2.

Based on the results of data processing, it can be informed that the average value of the total cost of using compressed gas CNG before the implementation of the fuel cost efficiency strategy (pre) was USD 26,096.9 per day and decreased after the implementation of the fuel cost efficiency strategy to USD 5,612.2 per day. day. This condition describes a decrease in the value of USD 20,484.6 per day (equivalent to Rp. 286,784,400.00 per day assuming the rupiah exchange rate is Rp. 14,000.00 per USD). less than 0.05, then HO is rejected and H1 is accepted. This means that there is a difference in the total cost of using compressed gas (CNG) services before and after the implementation of the fuel cost efficiency strategy.

The test results above show that all of the efficiency programs implemented are able to reduce the average daily cost of using compressed gas CNG energy to reach 78.49%. This is in line with previous studies such as the research of Dadar et al. (2021) regarding the success of the pump station energy cost efficiency program which was able to contribute to reducing power consumption by around 15.4% - 17% per day, through operational work by developing a model to reduce energy costs in urban water supply systems showed that optimization of cost efficiency programs with Genetic Algorithm Optimization (GAO). Or even if it's only 10% daily efficiency the value will be equivalent to a cost savings of 83,220,000 Riyals (1,666.46€) per day. In addition, this research is also in line with the results of research on setting the pattern of operating energy sources in the heating system which considers the price of time of use (TOU), fuel costs carried out by Demirezen and Fung (2021) the process of setting the pattern of operating energy sources in the heating system which considers the price. equipment fuel costs to determine the optimal schedule so that the hybrid heating system can run more cost effectively with the SDFSS (Smart Dual Fuel Switching System) system capable of demonstrating lower operating costs.

Farhad et al. (2005) showed that many instruments and factory parameters are suitable for the intended purpose and tests can be applied to achieve energy savings. The results show that fuel consumption of natural gas and heavy oil at least half of the previous increase can be reduced by precise and simple adjustment of operation and control devices. This study also shows that the total cost of using compressed gas (CNG) services is a controlled cost that has been proven to be optimized by implementing a fuel cost efficiency program.

Based on the results of data processing, it can be informed that the average value of the cost of using CNG compressing gas before renegotiating the CNG compressing service tariff (pre) is USD 9,102.9 per day and has decreased after renegotiation of the CNG compressing service rate of USD 5,612.2 per day. This condition describes a decrease in value of USD 3,490.6 per day (equivalent to Rp. 48,868,400.00 per day with the assumption of a rupiah exchange rate of Rp. 14,000.00 per USD) or reaching 17% of the total decrease in the daily cost of compressing gas services for PLTGU. Free. This is confirmed from the results of statistical testing, it is known that the value of sig = 0.000 or less than 0.05, then HO is rejected and H2 is accepted. This means that there is a difference in the amount of the cost of using compressed gas (CNG) services before and after the renegotiation of the CNG compressing service tariff..

The test results above show that the renegotiation of the tariff for compressing gas (CNG) services carried out is able to reduce the average daily cost of using compressed gas CNG energy significantly to reach 38.3% of the average daily cost with data before renegotiation, or reach 17% of the total a decrease in the daily cost of compressing gas for PLTGU Grati, which reached 78.49% of the total cost before the program was implemented. So it can be seen that the two strategies implemented in the fuel cost efficiency program, namely reducing the use of compressing gas services and renegotiating gas compressing service tariffs can be additive to each other. This is different from what was done in contrast to the results of research by Lee et.al (2021) where an empirical study was conducted to examine the impact of companies pursuing several strategies, namely a low-cost strategy and Porter's focus, which empirically turned out to be non-additive.

This study also shows different results from the results of Diani's (2015), where in her research it shows that changes in fuel prices (BBM) do not have a significant impact on the input costs of broiler farming, broiler production volume, broiler breeder acceptance, and income of broiler breeders. However, the results of the research conducted this time are in line with the research of Chao and Hsu (2014) who conducted a study to develop a model with a cost function formulated for various stages of cargo transportation operations which found a correlation between fuel prices and transportation fares where freight rates increased along with the increase in fuel prices. fuel due to a corresponding increase in fuel surcharges due to fluctuations in fuel prices.

Based on the results of data processing, it can be informed that the average value of the basic cost of generation from the gas fuel component (BPP component C gas) before the implementation of the fuel cost efficiency strategy at PLTG Block 2 (pre) is Rp. 1,738.56 /kWh and decreased after the implementation of the fuel cost efficiency strategy at PLTG Block 2 to Rp. 1,486.76/kWh. This condition describes a decrease in the value, it is confirmed from the results of statistical testing, it is known that the value of sig = 0.007 or less than 0.05, then HO is rejected and H3 is accepted. This means that there is a difference in the basic cost of generation from the gas fuel component (BPP component C gas) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2.

If it is seen from the data above that with a decrease in the cost of using CNG compressing services which reached 78.49% at PLTG Block 2 which uses 55% CNG as a fuel source, it was able to provide a decrease in BPP component C JTF of Rp. 242.70/kWh at PLTG Block 2 Grati or equivalent to 14% when compared to BPP component C gas for the period from January to June 2019. This is in accordance with the research of Tidball et al. (2010) in his research entitled Cost and Performance Assumptions for Modeling Electricity Generation Technologies found a link between natural gas costs and LCOE where a 7% to 8% increase in LCOE costs with a 10% increase in natural gas costs. In line with the research of Ohler et al. (2020) in a journal entitled Electricity Restructuring And The Relationship Between Fuel Costs And Electricity Prices For Industrial And Residential Customers, stated that changes in Granger's coal and natural gas costs affect electricity prices for industrial and commercial customers in states that are not restructured and restructured. The study of Chao and Hsu (2014) developed a model with a cost function that was formulated for various stages of cargo transportation operations. The results show a positive relationship between freight rates and fuel prices where freight rates increase with an increase in fuel prices due to a corresponding increase in fuel surcharges.

In this study, the fuel efficiency program for PLTG Block 2 Grati was proven to be able to reduce the BPP of component C gas by up to 14%. Based on the results of data processing, it can be informed that the average value of the ratio of fuel operating costs and gas fuel operating income (BOPO) before the implementation of the fuel cost efficiency strategy at PLTG Block 2 (pre) was 1,080 and decreased after the implementation of the fuel cost efficiency strategy. in PLTG Block 2 is 1.003. This condition describes a decrease in the value of the BOPO ratio, this is confirmed by the results of statistical tests, it is known that the value of sig = 0.012 or less than 0.05, then HO is rejected and H4 is accepted. This means that there is a difference in the ratio of operating costs and operating income (BOPO) before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2.

The test results above show that all the efficiency programs that have been implemented are able to reduce the value of the BOPO ratio by 0.077 or 7.1% and are able to reduce the difference between the costs of component C and the income of component C per month which was originally Rp. 2,600,499,194.00 per month to Rp. 413,535,765.00 per month or a decrease of Rp. 2,186,963,429.00 per month.

This is in line with research conducted by Scheraga (2004) to examine the relationship between the strategic focus of airline customer service activities and operational efficiency. The results of the analysis show that promotion has a positive impact on operational efficiency. In another study entitled Changes in the Operational Efficiency of National Oil Companies, Hartley & Medlock III (2013) found evidence that the partial privatization strategy of National Oil Companies (NOCs) was able to increase operational efficiency. Octanto & Agil Sarastio (2017) conveyed in their research that the efficiency program carried out at Bank B by reducing costs in the company can reduce the percentage level of the BOPO ratio (Operating Costs to Operating Income Costs) which has a positive effect on the company's net profit.

From the discussion, it can be seen that the fuel cost efficiency program carried out at the Grati PLTGU by carrying out a strategy to reduce CNG usage and renegotiating the tariff for compressing gas (CNG) services specifically planned for Grati PLTGU has been able to significantly reduce the average daily cost of using CNG compressed gas. energy significantly up to 78.49% or USD 20,484.6 per day. This is equivalent to USD 614,538 per month or reached USD 3,707,713 within six months, equivalent to Rp. 51,907,976,400,000 using the assumption of Rp. 14.000,00 per dollar. Provide a reduction in BPP component C JTF of Rp. 242.70/kWh or equivalent to 14% at PLTG Block 2 Grati and able to reduce the BOPO ratio by 0.077 or 7.1% so as to reduce the difference between component C costs and component C income per month which was originally Rp. 2,600,499,194.00 per month to Rp. 413,535,765.00 per month or a decrease of Rp. 2,186,963,429.00 per month in the period from July to December 2019.

From the results of the study, it can be seen that the ability of the gas supply pipe line pack can be utilized optimally in addition to anticipating the operational safety factor of the pipeline, it can also be used to destroy the role of CNG in the power generation industry. This can also potentially be applied to power plants as well as other industries that have a similar pattern of gas supply needs. Seeing the enormous savings opportunities that can be obtained by power plants but with limitations on the certainty of the use of gas line packs, there is an opportunity to be able to commercialize the benefits of the ability of the gas supply pipe line pack capabilities by imposing appropriate and appropriate tariffs based on the agreement. The results of this study will be used as a reference if in the future a line pack tariff agreement appears that will provide benefits to both parties, both from the gas transporter and from the customer, in this case the power plant..

Considering that the income calculation uses the same value as the calculation of the cost of generating the fuel price parameter and the calorific value of the fuel when calculating the income for component C, then according to the calculation formula for component C which is the product of the heat rate, fuel price and calorific value of fuel, then it can also be indicated that the fuel cost efficiency program carried out has an influence on the heat rate where the heat rate becomes lower, which is indicated by the declining BOPO ratio after the program is implemented.

In this study, there are limitations where the amount of data for calculating BPP gas and BOPO data that can be used is only monthly data so that data can be used only six months before and after program implementation. In addition, there are several cost parameters including technical and environmental parameters such as the effect of the Grati PLTGU fuel cost efficiency program on technical efficiency / heat rate, reduction in the amount and cost of gas usage for the CNG compressing process, as well as the impact on reducing emissions from the CNG compressing process. presented so that further research can be carried out for these parameters.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the study, it can be concluded as follows, There is a difference in the amount of the cost of using compressed gas (CNG) PLTGU services before and after the implementation of the fuel cost efficiency strategy. There is a difference in the amount of the cost of using compressed gas (CNG) services before and after the renegotiation of the tariff for CNG compressing services. There is a difference in the basic cost of generation from the gas fuel component before and after the implementation of the fuel cost efficiency strategy at PLTG Block 2. at PLTG Block 2. It can also be concluded that the fuel cost efficiency program implemented at PLTGU Grati has an impact on reducing the cost of CNG compressing services reaching 78.49% or reaching USD 3,707,713 within six months, (equivalent to Rp. 51,907,976,400.00 using the assumption of Rp. 14,000 ,00 per dollar). The renegotiation of the tariff for compressing gas (CNG) services carried out was able to significantly reduce the cost of compressing gas services by 38.3%. The implementation of the two fuel cost efficiency strategies are additive to each other and are able to significantly reduce the BPP component C of PLTG Block 2 by 14% and be able to reduce the BOPO ratio by 6.7%.

Research that has been carried out by the fuel cost efficiency program carried out at the Grati PLTGU can also be carried out on power plants that use CNG because it has been proven to significantly reduce CNG costs. The research method that has been carried out is expected to be a reference for the method of analysis of other efficiency programs carried out in other power generating units.. In the next research, it can be done research on several cost parameters including technical and environmental parameters such as the effect of the Grati PLTGU fuel cost efficiency program on technical efficiency / heat rate, reducing the amount and cost of gas consumption for the CNG compressing process, and its impact on reducing emissions from the compressing process. CNG still cannot be presented so that for the next research it can be re-examined for these parameters. The test results are expected to be able to be used as a reference for the study in the preparation of a business plan for a new power plant or industry that uses piped gas fuel supply. For gas transporter companies and their service users, this research can be used as an empirical reference regarding the amount and pattern of the need for the allocation of additional gas reserves needed so that it can be used as an empirical reference for determining appropriate tariffs if in the future linepack service tariffs are applied in transmission pipelines through the implementation of regulatory strategies. pattern of gas absorption and optimization of the capacity of the distribution pipe owned. In addition, there are several cost parameters including technical and environmental parameters such as the effect of the Grati PLTGU fuel cost efficiency program on technical efficiency / heat rate, reduction in the amount and cost of gas usage for the CNG compressing process, as well as the impact on reducing emissions from the CNG compressing process. presented so that further research can be carried out for these parameters.

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