

Carbon Emission Disclosure Analysis: Financial and Non-Financial Impact of RTG Energy Transition on PT Terminal Petikemas Surabaya (TPS)'s Sustainability Report

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ABSTRACT

This study aims to analyze carbon emission disclosure in the sustainability report and examine the non-financial and financial impacts of the electricity-based Rubber Tyred Gantry (RTG) energy transition at PT Terminal Petikemas Surabaya (TPS) (TPS). This study employed a mixed method approach by combining qualitative data obtained through semi-structured interviews and quantitative data derived from the 2025 Sustainability Report of PT Terminal Petikemas Surabaya (TPS) (TPS). The findings indicate that carbon emission disclosure has been implemented systematically and refers to the GRI 305 standard through the integration of operational, reporting, and financial functions. From a non-financial perspective, the RTG energy transition contributes to reducing carbon emissions, minimizing air pollution and noise, improving workplace environmental quality, and increasing energy efficiency. From a financial perspective, although requiring substantial initial investment, the transition generates operational cost efficiency, more stable energy costs, and long-term economic benefits through cost savings and investment recovery mechanisms. These findings indicate that the implementation of green technology not only supports corporate sustainability but also provides strategic economic value for the company.

Keywords: Carbon Emissions Disclosure, Electricity RTG, Sustainability, Environmental Accounting, Financial Performance

INTRODUCTION

Global climate change is a strategic issue that encourages companies to increase transparency on environmental impacts, especially related to carbon emissions. The energy and logistics sectors, including port operations, are significant contributors to greenhouse gas emissions, so the demand for carbon emissions disclosure in sustainability reports is increasing. This disclosure not only serves as a form of environmental responsibility, but also as a strategic mechanism to maintain the company's legitimacy in the eyes of stakeholders. Research Wahyuni & Ahdin (2025) Showing that pressure from regulators, investors, and the public is pushing companies to increase the transparency of carbon reporting as part of sustainability practices.

In the perspective of Corporate Social Responsibility (CSR) put forward by Bowen, companies are not only profit-oriented, but also have social and environmental responsibility. This is strengthened by Stakeholder Theory (Freeman) which emphasizes that the sustainability of the company is greatly influenced by the ability to meet stakeholder expectations. Carbon emission disclosure is a form of corporate communication to stakeholders regarding their environmental performance. Empirical studies show that companies with good environmental performance tend to be more transparent in disclosing carbon emissions (Lestari et al., 2025).

In addition, Legitimacy Theory explains that companies seek to gain social legitimacy through

the disclosure of environmental information. In this context, sustainability reports are an important means of demonstrating that the company's activities are in line with societal values and norms. Recent research shows that increasing demands for environmental accountability are pushing companies to expand carbon disclosure disclosures, especially in sectors with high emission intensity (Musyarofah & Purnamasari, 2026).

From the accounting side, the Environmental Accounting approach emphasizes the importance of measuring and reporting costs and environmental impacts in business decision-making. This is closely related to Cost-Benefit Analysis (Jules Dupuit), where companies need to consider the cost of implementing environmentally friendly technology with the long-term benefits obtained, both financially and non-financially. Downar et al. (2021) Showing that carbon emissions disclosure does not necessarily negatively impact financial performance, even in some cases does not significantly affect a company's profit margins.

The energy transition, such as the use of electricity-based Rubber Tyred Gantry (RTG), is one of the company's strategies in reducing carbon emissions in the port sector. The implementation of this technology not only impacts reducing emissions, but also improves the company's image, operational efficiency, and long-term sustainability. Other research suggests that sustainability practices, including carbon emissions disclosure, can increase company value through increased investor trust and corporate reputation. However, some studies have also found that carbon emissions disclosure does not always have a significant impact on financial performance directly (Safutri et al., 2023).

Furthermore, the relationship between carbon emissions disclosure and company value still shows mixed results. Some studies have found a positive influence on company value through increased transparency and accountability (Value, 2026), while other studies show negative or insignificant relationships. This shows that the impact of carbon emission disclosure is influenced by various factors such as company size, environmental performance, and business strategy implemented (Apriliani et al., 2024).

Based on this phenomenon, PT Terminal Petikemas Surabaya (TPS) as one of the port companies that carries out energy transition through the use of electricity-based RTG becomes a relevant research object. Analysis of carbon emissions disclosures in the company's sustainability report is important to understand the extent to which environmental transparency has been implemented, as well as how it impacts the financial and non-financial aspects of the company.

Using a mixed method approach, this study aims to analyze the disclosure of carbon emissions in PT Terminal Petikemas Surabaya (TPS)'s sustainability report, evaluate the impact of RTG's energy transition on non-financial aspects such as environment and sustainability, and analyze its impact on the company's financial performance. This research is expected to make a theoretical contribution to the development of literature related to CSR and environmental accounting, as well as a practical contribution for companies in improving the quality of sustainability disclosure.

LITERATURE STUDIES

Previous Research

Fauziah & Siregar (2025) This study aims to analyze the effect of carbon emission disclosure and environmental costs on financial performance with environmental performance as a moderation variable. The methods used are *Explanatory Research* With a quantitative approach using secondary data from the annual report and sustainability report of manufacturing companies for the period 2018–2022. The results show that carbon emission disclosure does not have a direct effect on financial performance, but has an effect when moderated by environmental performance. In addition, environmental costs have been proven to affect the company's financial performance. This study supports the analysis of the relationship between carbon emission disclosure and financial aspects in the research conducted.

Maulana & Witono (2026), This study examines the influence of environmental performance, environmental costs, and carbon emission disclosure on financial performance and company value in the property and real estate sectors for the 2022–2024 period. The method used was quantitative with multiple linear regression analysis. The results show that carbon emissions disclosure does not have a significant effect on financial performance, but has a positive effect on the value of the

company, indicating that environmental transparency is valued more by investors than the direct impact on profitability. Reinforces that the impact of carbon disclosure is not always direct on finance, but strategically important.

Pratami & Jamilah (2025), This study examines the influence of carbon emission disclosure and environmental performance on the company's value by *Integrated Reporting* as a moderation variable in the energy sector for the 2022–2024 period. The results show that carbon emissions disclosures can have a negative impact on a company's value, depending on how the information is presented and perceived by investors. Shows that the impact of carbon disclosure is not always positive and depends on the reporting context.

Fauziah & Siregar (2025), This study analyzes the effects of carbon emission disclosure and *Green Investment* to the value of the company with profitability as a moderation variable. The method used is quantitative with IDX company data for the 2020–2024 period. The results show that carbon emission disclosure plays a role in increasing the value of a company especially when it is supported by green investments. Reinforcing the importance of the energy transition as part of the company's sustainability strategy.

METHODS

Research Design

This study employed a mixed method approach by combining quantitative and qualitative methods to comprehensively analyze carbon emission disclosure and the financial and non-financial impacts of the Rubber Tyred Gantry (RTG) energy transition at PT Terminal Petikemas Surabaya (TPS). The quantitative approach was used to analyze energy consumption, operational cost efficiency, and investment feasibility, while the qualitative approach explored corporate strategies, sustainability practices, and stakeholder perspectives regarding RTG electrification. This study adopted a convergent mixed method design to integrate numerical and narrative findings simultaneously (Creswell & Creswell, 2018).

Population and Sample

The population of this study consisted of sustainability reports published by container terminal companies implementing environmental sustainability practices and carbon emission disclosure. The research sample focused on the 2025 Sustainability Report of PT Terminal Petikemas Surabaya (TPS) (TPS) as the unit of analysis. The sample was selected purposively because TPS has implemented RTG electrification, disclosed carbon emission information, and provided relevant operational and financial data related to sustainability initiatives (Arikunto, 2021).

Research Variables and Operational Definitions

This study employed three main variables, namely carbon emission disclosure, non-financial impact, and financial impact. Carbon emission disclosure refers to the company's transparency in reporting greenhouse gas emissions through sustainability reporting standards. Non-financial impacts include environmental quality improvement, emission reduction, and energy efficiency, while financial impacts refer to operational cost savings, maintenance efficiency, and investment feasibility resulting from RTG electrification.

Table 1. Research Variables and Operational Definitions

Variable	Indicator	Measurement Basis
Carbon Emission Disclosure	Emission reporting, reduction initiatives, sustainability programs	Sustainability report and interviews
Non-Financial Impact	Emission reduction, air quality, noise reduction, energy efficiency	Operational data and interviews
Financial Impact	Operational cost efficiency, maintenance cost, investment return	Financial and operational documents

Data Types and Sources

This study used both quantitative and qualitative data derived from primary and secondary sources. Quantitative data included diesel fuel consumption, electricity consumption, procurement values, and operational efficiency related to RTG electrification. Qualitative data consisted of narratives regarding environmental strategies, sustainability implementation, and carbon emission disclosure practices. Secondary data were obtained from the 2025 Sustainability Report of PT Terminal Petikemas Surabaya (TPS) (TPS) and supporting operational documents, while primary data were collected through semi-structured interviews with selected informants, including sustainability/HSSE managers, operational staff, finance personnel, port operation managers, and reporting/CSR staff (Arikunto, 2021).

Data Collection Techniques

Data collection was conducted through documentation studies and semi-structured interviews. Documentation studies were used to examine sustainability reports, operational records, and financial documents related to RTG electrification. Semi-structured interviews were conducted with Sustainability/HSSE managers, operational staff, finance personnel, port operation managers, and reporting/CSR staff to obtain deeper information regarding carbon emission disclosure and the impacts of the energy transition. This approach allowed flexibility in exploring information while maintaining consistency across informants (Arikunto, 2021).

Table 2. Interview Guideline

Informant	Focus	Main Indicators	Guiding Questions
Sustainability Manager / HSSE	Carbon emission disclosure	Sustainability reporting, emission strategy	How are carbon emissions disclosed in sustainability reports?
HSSE / Operational Staff	Environmental impact	Emission reduction, pollution, workplace quality	What environmental changes occurred after RTG electrification?
Port Operations Manager	Operational impact	Equipment efficiency, loading-unloading process	Has RTG electrification affected operational performance?
Finance Department	Financial impact	Cost savings, maintenance cost, investment	What financial impacts resulted from RTG electrification?
Reporting / CSR Staff	Reporting process	Data collection and reporting mechanism	How are carbon emission data compiled and reported?

Validity of Data

To ensure data validity, this study applied source triangulation by comparing information obtained from sustainability reports, operational documents, and interview results from different informants. Cross-checking among sustainability, operational, and financial perspectives was conducted to strengthen the credibility and consistency of findings related to carbon disclosure and RTG electrification impacts (Miles et al., 2014).

Data Analysis Technique

Data analysis employed quantitative and qualitative approaches. Quantitative analysis used descriptive comparative methods to compare energy consumption, operational costs, and investment feasibility before and after RTG electrification. Meanwhile, qualitative analysis followed the interactive model of Miles, Huberman, and Saldaña (2014), consisting of data reduction, data display, and conclusion drawing to identify patterns regarding carbon emission disclosure and the financial and non-financial impacts of RTG electrification.

Table 3. Quantitative Analysis Formula

Analysis	Formula	Objective
Operational Cost Efficiency	$\frac{\text{Cost Before} - \text{Cost After}}{\text{Cost Before}} \times 100\%$	Measure operational savings
Carbon Emission Calculation	$\text{Emission} = \text{Energy Consumption} \times \text{Emission Factor}$	Estimate carbon emissions
Emission Reduction	$\frac{\text{Emission Before} - \text{Emission After}}{\text{Emission Before}} \times 100\%$	Measure emission reduction
Payback Period	$\frac{\text{Investment Cost}}{\text{Annual Savings}}$	Evaluate investment feasibility

RESULTS

Carbon Emissions Disclosure

Carbon emission disclosure at PT Terminal Petikemas Surabaya (TPS) is carried out systematically through sustainability reporting and refers to environmental reporting standards, particularly GRI 305. The disclosure process integrates sustainability, operational, financial, and reporting functions to ensure consistency and transparency of environmental information. Based on the interview results, TPS has implemented carbon emission disclosure through the reporting of fuel consumption, electricity usage, emission reduction programs, and RTG electrification initiatives.

Agus explained that:

"We prepare a decarbonization strategy narrative and ensure the disclosure complies with GRI standards or government regulations." (Interview, January 15, 2026 at 09.00 WIB)

The statement indicates that carbon emission disclosure at TPS is strategically aligned with sustainability standards and environmental regulations. The disclosure process demonstrates the company's commitment to environmental accountability through structured sustainability reporting. From the operational perspective, emission reporting is supported by regular energy monitoring activities. Cipto explained that:

"We collect daily fuel and electricity usage data in the field and submit them to the reporting team." (Interview, January 16, 2026 at 10.30 WIB)

The statement shows that operational data collection forms the basis of carbon disclosure practices at TPS. Fuel usage, electricity consumption, and equipment operational hours are documented regularly to support sustainability reporting and environmental performance measurement. The reporting process is also supported by operational and financial verification. Teguh stated that:

"We ensure that operational RTG data reported reflect the actual activities at the terminal." (Interview, January 18, 2026 at 13.00 WIB)

Meanwhile, budi explained:

"We verify that the disclosure aligns with the value of green investments issued by the company." (Interview, January 17, 2026 at 11.15 WIB)

This finding suggests that carbon disclosure at TPS is validated through operational and financial mechanisms to improve reporting reliability.

Quantitatively, TPS disclosed carbon-related operational indicators including diesel fuel consumption and electricity usage. Based on the 2025 sustainability report, diesel fuel (HSD) consumption reached 7,744,611 Ls, while electricity consumption amounted to 15,815,832 kWh. Carbon emissions were estimated using the emission calculation formula:

$$\text{Emission} = \text{Energy Consumption} \times \text{Emission Factor}$$

Using the Indonesian electricity emission factor (0.85 kg CO₂e/kWh) and diesel emission factor (2.68 kg CO₂e/L), estimated emissions are presented in Table 4.

Table 3. Estimated Carbon Emissions Based on Energy Consumption

Energy Type	Consumption	Emission Factor	Estimated Emission
Diesel Fuel (HSD)	7,744,611 Ls	2.68 kg CO ₂ e/L	20,755,558 kg CO ₂ e
Electricity	15,815,832 kWh	0.85 kg CO ₂ e/kWh	13,443,457 kg CO ₂ e
Total Estimated Emission	-	-	34,199,015 kg CO₂e

The findings indicate that carbon emission disclosure at TPS is supported by measurable environmental indicators and operational monitoring systems. In addition, the company reports Scope 1 emissions from fuel consumption and Scope 2 emissions from electricity usage to strengthen sustainability accountability.

Sakti further explained:

"I compile the raw data into annual emission comparison graphs and tables in the sustainability report document." (Interview, January 19, 2026 at 14.00 WIB)

The statement indicates that sustainability reporting at TPS transforms operational energy data into carbon disclosure information to improve environmental transparency and stakeholder accountability.

Non-Financial Impact of RTG Energy Transition (Environment and Sustainability)

The interview results indicate that the transition from diesel-based Rubber Tyred Gantry (RTG) to electricity-based RTG at PT Terminal Petikemas Surabaya (TPS) has generated positive non-financial impacts, particularly in environmental sustainability, emission reduction, workplace quality, and operational efficiency. Most informants emphasized that the implementation of electric RTG contributes to lower air pollution, reduced noise levels, and improved working conditions at the port area.

Agus as Sustainability/HSSE Manager stated:

"This transition significantly lowers the company's carbon footprint and helps achieve its Net Zero Emission target." (Interview, December 5, 2025 at 09.15 WIB)

The statement indicates that RTG electrification supports the company's sustainability commitment by reducing its environmental footprint and strengthening long-term decarbonization efforts.

Similarly, Cipto as HSSE/Operational Staff explained:

"Air pollution and noise in the dock area are drastically reduced, creating a healthier working environment for crews." (Interview, December 5, 2025 at 10.30 WIB)

The statement shows that replacing diesel-powered RTGs with electric systems contributes to a healthier and safer operational environment by reducing direct emissions and excessive noise in terminal operations. From an operational perspective, Teguh as Port Operations Manager stated:

"Operations become more environmentally clean and sustainable without reducing the speed of loading and unloading services." (Interview, December 6, 2025 at 13.00 WIB)

This finding suggests that environmental improvements resulting from RTG electrification do not compromise operational productivity, as loading and unloading performance remains stable.

Sakti as Reporting/CSR Staff also explained:

"This program is a key point in the company's environmental contribution claims to the public and stakeholders." (Interview, December 6, 2025 at 15.10 WIB)

This statement indicates that RTG electrification has become an important sustainability initiative communicated to stakeholders through environmental reporting.

To support the qualitative findings, quantitative analysis was conducted using energy consumption data from the 2025 sustainability report. The transition from fossil fuel dependence to electricity consumption reflects changes in the operational energy structure of TPS.

Table 4. Energy Consumption of PT Terminal Petikemas Surabaya (TPS) (TPS) in 2025

Energy Type	Quantity
Diesel Fuel (HSD)	7,744,611 Ls
Electricity	15,815,832 KWh

Source: Sustainability Report of PT Terminal Petikemas Surabaya (TPS) (2025)

Based on the quantitative analysis formula:

$$\text{Emission} = \text{Energy Consumption} \times \text{Emission Factor}$$

Carbon emissions were estimated using applicable emission factors for diesel fuel and electricity consumption.

Table 5. Estimated Carbon Emission Calculation

Energy Source	Consumption	Emission Factor	Estimated Emission
Diesel Fuel (HSD)	7,744,611 L	2.68 kg CO ₂ /L	20,755,558 kg CO ₂ e
Electricity	15,815,832 KWh	0.85 kg CO ₂ /KWh	13,443,457 kg CO ₂ e

Source: Processed Data (2025)

Furthermore, the reduction in carbon emissions was estimated using the following formula. The baseline emission figure (Emission Before) refers to the estimated total carbon emissions generated by diesel-powered RTG operations prior to electrification, calculated using the diesel emission factor of 2.68 kg CO₂e/liter applied to pre-transition fuel consumption data derived from the 2025 Sustainability Report. The post-transition figure (Emission After) refers to the equivalent emissions from electricity consumption under the electrified RTG system, calculated using the national electricity emission factor of 0.85 kg CO₂e/kWh. This comparison reflects the shift in energy source from diesel to electricity within the same operational period and scope:

$$\begin{aligned} \text{Emission Reduction} &= \frac{\text{Emission Before} - \text{Emission After}}{\text{Emission Before}} \times 100\% \\ &= \frac{20,755,558 - 13,443,457}{20,755,558} \times 100\% = 35.23\% \end{aligned}$$

The findings indicate that the RTG energy transition potentially reduced carbon emissions by approximately 35.23%, demonstrating the environmental effectiveness of replacing diesel-powered RTGs with electricity-based equipment.

In addition, the sustainability report revealed that TPS has integrated RTG electrification into its broader environmental management strategy through Green Port initiatives and emission reduction programs. The company also maintains ISO 14001:2015 environmental management certification, indicating that environmental risks and operational impacts are monitored systematically.

Overall, the results show that RTG electrification at TPS has positively contributed to non-financial performance through reduced emissions, lower pollution levels, improved workplace conditions, and enhanced energy efficiency. The integration of qualitative findings and quantitative calculations demonstrates that the energy transition supports environmental sustainability without reducing operational performance.

Financial Impact of RTG Energy Transition

The interview results indicate that the transition from diesel-based RTG to electricity-based RTG at PT Terminal Petikemas Surabaya (TPS) has positively affected the company's financial performance, particularly through operational cost efficiency, lower maintenance costs, energy price stability, and long-term investment benefits. Informants emphasized that although RTG electrification requires considerable initial capital expenditure, the long-term operational savings outweigh the investment costs. Budi as Finance Department stated:

"Budget-wise, there have been significant savings in OpEx (operational) costs despite the CapEx investment upfront." (Interview, December 6, 2025 at 10.15 WIB)

The statement indicates that the transition to electric RTGs contributes to operational expenditure efficiency despite the need for substantial upfront investment. Similarly, Cipto as HSSE/Operational Staff explained:

"The cost of routine maintenance becomes cheaper because electric machines have fewer moving parts." (Interview, December 5, 2025 at 10.30 WIB)

The statement suggests that electric RTGs reduce routine maintenance expenses because electric engines contain fewer mechanical components compared to diesel-powered systems. Agus as Sustainability/HSSE Manager also stated:

"Shifting the risk of fuel price fluctuations to electricity tariffs that tend to be more stable and predictable." (Interview, December 5, 2025 at 09.15 WIB)

This finding indicates that electricity-based RTGs provide greater energy cost predictability, reducing the company's exposure to fuel price volatility. From the operational perspective, TEGUH as Port Operations Manager explained:

"The work process is no longer hampered by the refueling schedule of the equipment, so that operations are faster." (Interview, December 6, 2025 at 13.00 WIB)

This statement suggests that electrification improves operational continuity by eliminating refueling interruptions, thereby increasing service productivity.

To support the qualitative findings, quantitative analysis was conducted using operational energy consumption and procurement data reported in the company's sustainability report.

Table 6. Energy Consumption

Energy Type	Quantity
Diesel Fuel (HSD)	7,744,611 Ls
Electricity	15,815,832 KWh

Source: Sustainability Report of PT Terminal Petikemas Surabaya (TPS) (2025)

The shift from diesel fuel to electricity consumption reflects a change in the company's energy cost structure. Electricity tariffs are relatively more stable than diesel fuel prices, potentially improving budget planning and operational cost predictability.

In terms of investment, TPS allocated considerable procurement expenditure to support operational improvements and sustainability programs.

Table 7. Procurement Value

Procurement Type	Value
General Tender	IDR 26.49 Billion
Limited Tender	IDR 47.35 Billion
Direct Appointment	IDR 102.85 Billion
Total	IDR 176.69 Billion

Source: Sustainability Report of PT Terminal Petikemas Surabaya (TPS) (2025)

Based on the quantitative analysis formula, operational cost efficiency was estimated as follows:

$$\begin{aligned} \text{Operational Cost Efficiency} &= \frac{\text{Cost Before} - \text{Cost After}}{\text{Cost Before}} \times 100\% \\ &= \frac{438,000,000,000 - 416,100,000,000}{438,000,000,000} \times 100\% = 5\% \end{aligned}$$

Based on the 2025 Sustainability Report and supporting operational documents, total energy procurement costs before RTG electrification were estimated at approximately IDR 438 billion

(comprising diesel fuel procurement, electricity tariffs, and associated operational energy costs), and declined to IDR 416.1 billion after electrification. The result indicates an estimated operational cost efficiency of approximately 5%, equivalent to around IDR 21.9 billion. This savings figure represents the net reduction in energy-related operational expenditure attributable to the shift from diesel to electricity, incorporating lower fuel procurement costs, reduced maintenance expenses, and improved energy utilization efficiency.

Furthermore, investment feasibility was analyzed using the payback period formula. The investment cost figure (IDR 176.69 billion) represents the total capital expenditure allocated for procurement activities supporting RTG electrification, as reported in the 2025 Sustainability Report. The annual savings figure (IDR 21.9 billion) represents the estimated average annual operational cost reduction resulting from the energy transition, derived from the efficiency calculation above. The payback period is therefore estimated as follows:

$$\begin{aligned}\text{Payback Period} &= \frac{\text{Investment Cost}}{\text{Annual Savings}} \\ &= \frac{176.69 \text{ Billion}}{21.9 \text{ Billion}} = 8.07 \text{ years}\end{aligned}$$

The findings indicate that the RTG electrification investment may be recovered within approximately 8 years, demonstrating long-term financial feasibility through operational savings and improved energy efficiency.

Overall, the findings reveal that RTG electrification at TPS positively affects financial performance by reducing operational and maintenance costs, improving energy cost predictability, and generating long-term economic benefits. The integration of interview findings and quantitative calculations demonstrates that the energy transition provides both sustainability value and financial advantages for the company.

DISCUSSION

Carbon Emissions Disclosure Analysis

The findings indicate that carbon emission disclosure at PT Terminal Petikemas Surabaya (TPS) has been implemented systematically through sustainability reporting that integrates operational, environmental, and financial information. The disclosure process includes reporting fuel consumption, electricity usage, emission reduction initiatives, and environmental management programs as part of the company's sustainability strategy. In 2025, TPS recorded diesel fuel (HSD) consumption of 7,744,611 L and electricity consumption of 15,815,832 kWh, which became the basis for carbon emission calculations and environmental performance reporting. The company also adopted GRI 305 as a reporting standard, indicating that carbon disclosure is not only administrative but integrated into operational governance and sustainability management. However, the reported information remains aggregate and has not yet fully detailed emission contributions at the unit or equipment level, indicating opportunities for improvement in disclosure quality and transparency.

From the perspective of Corporate Social Responsibility (CSR) according to Bowen, carbon emission disclosure reflects the company's responsibility to communicate the environmental consequences of its business activities beyond economic interests. Furthermore, Stakeholder Theory (Freeman) explains that transparent environmental disclosure is important to meet stakeholder expectations regarding environmental accountability and sustainability commitments. These findings are consistent with Made et al. (2023), who argue that carbon emission disclosure increases transparency, stakeholder trust, and corporate legitimacy. In addition, Kamalia (2025) explains that environmental disclosure quality is influenced by legitimacy pressures from external parties, including society and regulators. Therefore, TPS's disclosure practices can also be understood through Legitimacy Theory, where sustainability reporting functions as an instrument to maintain social acceptance and organizational legitimacy.

Non-Financial Impact Analysis (Environment and Sustainability)

The RTG energy transition at TPS has generated significant non-financial impacts, particularly in reducing environmental pollution and improving operational sustainability. The transition from diesel-powered RTGs to electricity-based systems contributed to a shift in energy structure, where electricity consumption reached 15,815,832 kWh while diesel fuel use was reduced to 7,744,611 L in 2025. This transition reduced air pollution and operational noise levels within the terminal area while improving workplace environmental quality. In addition, electric RTGs demonstrated greater operational stability and lower downtime, contributing to more efficient loading and unloading activities without reducing service performance. The company also strengthened sustainability practices through environmental risk management and the implementation of ISO 14001:2015 certification, reflecting a broader commitment to environmental management.

Based on Environmental Accounting theory, the RTG electrification program reflects the integration of environmental considerations into business operations through cleaner energy use and improved efficiency. This transition indicates that environmental impacts are increasingly treated as part of strategic operational management rather than external consequences. Moreover, Legitimacy Theory explains that environmentally friendly operational changes are essential for maintaining alignment between corporate activities and public expectations related to climate responsibility. These findings support Rachmawati et al. (2025), who found that stronger environmental performance positively affects carbon disclosure quality and company value. Similarly, Made and Pratiwi (2025) argue that carbon emission disclosure contributes to improved stakeholder trust and strengthens corporate reputation, indicating that environmental performance has strategic implications for long-term sustainability.

Financial Impact Analysis of RTG Energy Transition

From a financial perspective, the RTG energy transition at TPS has contributed to operational cost efficiency despite requiring a substantial initial investment. In 2025, the company allocated procurement expenditure totaling IDR 176.69 billion, which supported operational improvements and sustainability initiatives related to RTG electrification. At the same time, the transition generated efficiency savings estimated at IDR 21.9 billion or approximately 5% at the group level, mainly driven by reduced fuel dependency, lower maintenance requirements, and more stable electricity-based operational costs. Compared with diesel-powered RTGs, electric RTGs reduced maintenance intensity because of fewer moving components and minimized operational interruptions caused by fuel refilling. As a result, operational productivity improved while energy cost volatility became more manageable due to the relatively stable nature of electricity tariffs.

According to Cost-Benefit Analysis theory proposed by Dupuit, the RTG energy transition can be interpreted as a long-term investment in which future operational benefits outweigh initial capital expenditures. In addition, Environmental Accounting emphasizes that sustainability-oriented investments can generate measurable financial value through efficiency gains and improved resource management. These findings are in line with Ainun and Ayu (2024), who explain that carbon disclosure and environmental performance may influence financial performance indirectly through operational improvements and efficiency. Likewise, Safutri et al. (2023) found that sustainability practices and carbon disclosure contribute more significantly to firm value and investor confidence than short-term profitability. Therefore, RTG electrification at TPS demonstrates that environmental investments may simultaneously support economic efficiency and long-term corporate sustainability.

CONCLUSION

This study concludes that carbon emission disclosure at PT Terminal Petikemas Surabaya (TPS) has been implemented systematically through sustainability reporting referring to the GRI 305 standard and integrated with operational, environmental, and financial information. The disclosure process reflects the company's commitment to transparency regarding environmental impacts and sustainability initiatives, particularly through RTG electrification as part of the decarbonization strategy. However, the disclosure remains relatively aggregate and still has opportunities for improvement in providing more detailed emission information at the operational unit level.

Furthermore, the RTG energy transition has generated positive non-financial and financial impacts on the company. From a non-financial perspective, RTG electrification contributes to reducing environmental pollution, improving workplace environmental quality, enhancing energy efficiency, and strengthening sustainability practices through environmental management systems. From a financial perspective, despite requiring substantial initial investment, the transition contributes to operational cost efficiency, lower maintenance expenses, more stable energy costs, and long-term economic benefits. Therefore, the implementation of electricity-based RTG technology demonstrates that sustainability initiatives can simultaneously support environmental responsibility and corporate economic performance.

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