



TRI HITA
CONSULTING



Final Report

Decarbonisation Analysis and Roadmap

PT Indonesia Steel Tube Works (ISTW)

Conducted by:
Tri Hita Consulting
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IMPRINT

Report on Decarbonisation Review and Strategy

This report was developed by Tri Hita Consulting for PT Indonesia Steel Tube Works (ISTW). This analysis evaluates ISTW's current decarbonisation initiatives and identifies areas for improvement through a detailed review of existing strategies, plant efficiency, and data management practices. The findings are based on comprehensive interviews conducted with internal personnel, and walk-through energy efficiency audits at ISTW plants in Cikarang, Jakarta and Semarang. Recommendations for future decarbonisation strategies are also provided, based on the assessment of current performance.

For more information, please visit: ISTW Website

www.istw.co.id

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DISCLOSURE

Sections of this report, specifically the initial research on decarbonisation strategy, were assisted by AI, Google's Gemini 2.5 Pro version. All AI-generated content was thoroughly reviewed, edited, and verified by the human authors for accuracy, relevance, and originality. The authors take full responsibility for the content presented herein.

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GLOSSARY & ABBREVIATIONS

CBAM	Carbon Border Adjustment Mechanism
CNG	Compressed Natural Gas
EAf	Electric Arc Furnace
ENDC	Indonesia's Nationally Determined Contribution
GHG	Greenhouse Gas
GHP	Green Hydrogen Plant
IESR	Institute for Essential Services Reform
ISTW	PT Indonesia Steel Tube Works
PPA	Power Purchase Agreement
REC	Renewable Energy Certificates
SLL	Sustainability-Linked Loan
VSD	Variable Speed Drive
WRI	World Resources Institute

1. INTRODUCTION

PT Indonesia Steel Tube Works (ISTW) has been manufacturing steel tubes and pipes since 1971, offering a range of various types and sizes. As a manufacturing industry, ISTW is aware of the greenhouse gas (GHG) emissions produced by its operational activities and recognises the importance of decarbonising its production. Therefore, ISTW aims to establish a decarbonisation roadmap to reduce its GHG emissions, in alignment with Indonesia's Nationally Determined Contribution (ENDC) target, which strives to reduce GHG emissions by 31.89% without international assistance and 43.20% with international assistance compared to the business-as-usual scenario in 2030.

Tri Hita Consulting has been hired to conduct a review of ISTW's current decarbonisation initiatives and develop an initial decarbonisation roadmap to address areas for improvement and establish both short- and long-term targets. As part of this process, Tri Hita Consulting visited ISTW plants in Jakarta, Cikarang (West Java), and Semarang (Central Java) to conduct energy audits and gather precise operational data.

2. PUSH FOR DECARBONISATION

2.1. Market Trends

The iron & steel industry has become one of the centres of industrial decarbonisation in recent years. Despite its vital role, the sector is one of the largest contributors to global CO₂ emissions, responsible for 7–9% of total global emissions in 2024¹.

In response, governments worldwide are implementing decarbonisation policies, including carbon taxation for iron and steel products. In 2024, ISTW's established export markets primarily include Malaysia, Vietnam and the Philippines. However, the European and US market presents an opportunity as a potential expansion for ISTW's exports, in which case it is important to pay attention and prepare for relevant global regulations on green steel.

The regulations include the latest wave of tariffs imposed by the US on imported goods, the clean energy and low-carbon technology transition, which can potentially involve costly capital investment, and Europe's Carbon Border Adjustment Mechanism (CBAM)². Set to take effect in 2027³, CBAM will impose carbon tariffs on certain imported products, including iron and steel, which might potentially hinder steel exports from non-EU countries, including those from ISTW, if adequate preparations are not made. ISTW needs to have proper decarbonisation strategies implemented, possibly accompanied by a green or low-carbon steel certification to secure the potential export market in the EU.

Another significant trend to note is that ISTW's main shareholders are also heading towards carbon neutrality. Two of ISTW's biggest shareholders,

¹ World Steel Association. 2025. [World Steel in Figures 2024](#)

² European Commission. 2025. [Carbon Border Adjustment Mechanism](#).

³ International Carbon Action Partnership. 2025. [EU adopts simplifications of CBAM rules ahead of the compliance phase starting in 2026](#)

Metal One Corporation⁴ and Maruichi Steel Tube⁵, have both committed to achieving net-zero emissions by 2050. Although ISTW is not obligated to adopt its shareholders' goals, these commitments provide a valuable benchmark for ISTW as it develops its own net-zero strategy.

2.2. National Regulations

ISTW's strategic decision to decarbonise its operations must integrate immediate compliance with Indonesia's carbon governance framework. In addition to the Enhanced NDC, the Indonesian government has in collaboration with World Resources Institute (WRI) Indonesia dan Institute for Essential Services Reform (IESR) published a National Decarbonisation Roadmap for Industries⁶. This roadmap illustrates the pathway to Net-Zero Emissions through various means of technology adoptions, financing mechanisms, and regulations.

For the iron and steel sector, the roadmap targets a 34% emissions reduction by 2035 and net-zero emissions by 2050, relative to the 2023 business-as-usual baseline. While this target is not yet a formal national mandate, ISTW can become a pioneering contributor to this national objective.

⁴ Metal One Corporation. [Carbon Neutrality](#).

⁵ Maruichi Steel Tube. [Initiatives to Achieve Carbon Neutrality](#).

⁶ Kemenperin RI, WRI Indonesia, dan IESR. 2025. [Peta Jalan Dekarbonisasi 9 Subsektor Industri](#).

3. ISTW'S PRODUCTION PROCESS AND ENERGY UTILISATION

This chapter provides an overview of ISTW's production processes, as well as a comprehensive description of processes, production, and energy consumption in each plants.

3.1. Overview of ISTW Plants

PT Indonesia Steel Tube Works (ISTW) specialises in the production of steel pipes and tubes for a variety of applications. Aside from general construction, ISTW also manufactures round, galvanised, oval, square, and rectangular pipes and tubes. Instead of primary steelmaking using a furnace, ISTW focuses on downstream processing, transforming mother coils into finished products. The main energy sources used for production come from electricity, except for galvanised processing in Semarang, which uses Compressed Natural Gas (CNG).

A summary of the main characteristics of each ISTW plant⁷ is shown in **Table 1**.

Table 1. Main Characteristics of ISTW Plants

Plant	Start operation	Production Capacity (tonnes/month)	Main Products	Main Energy Sources
Jakarta 1 (J1)	1990	3000	Long pipes	Electricity
Jakarta 2 (J2)	1998		Short pipes Heat-treated bent pipes	Electricity
Cikarang	2013	3000	Long pipes Short pipes	Electricity
Semarang	1973	2000	Long pipes Short pipes Galvanised pipes	Electricity CNG (since 2024)

⁷ This information is collected during the walk-through audit

To evaluate the energy efficiency of ISTW in operating their business, the **energy intensity index** plays a crucial role, indicating the amount of energy consumed per tonne of steel produced. The next sections will detail ISTW's processes in each plant, including the energy consumption and production output, which determine their energy intensity.

3.2. Jakarta

ISTW's primary product in Jakarta is long steel pipes, representing 55% of the total production of J1 & J2. Long pipes are produced in J1, which are then either sent to the customer or to the J2 plant for further recutting and heat treatment. As a result of the walk-through audit conducted at ISTW's plants in August 2025, a detailed representation of the production process in ISTW's Jakarta plants is shown in **Figure 1**.

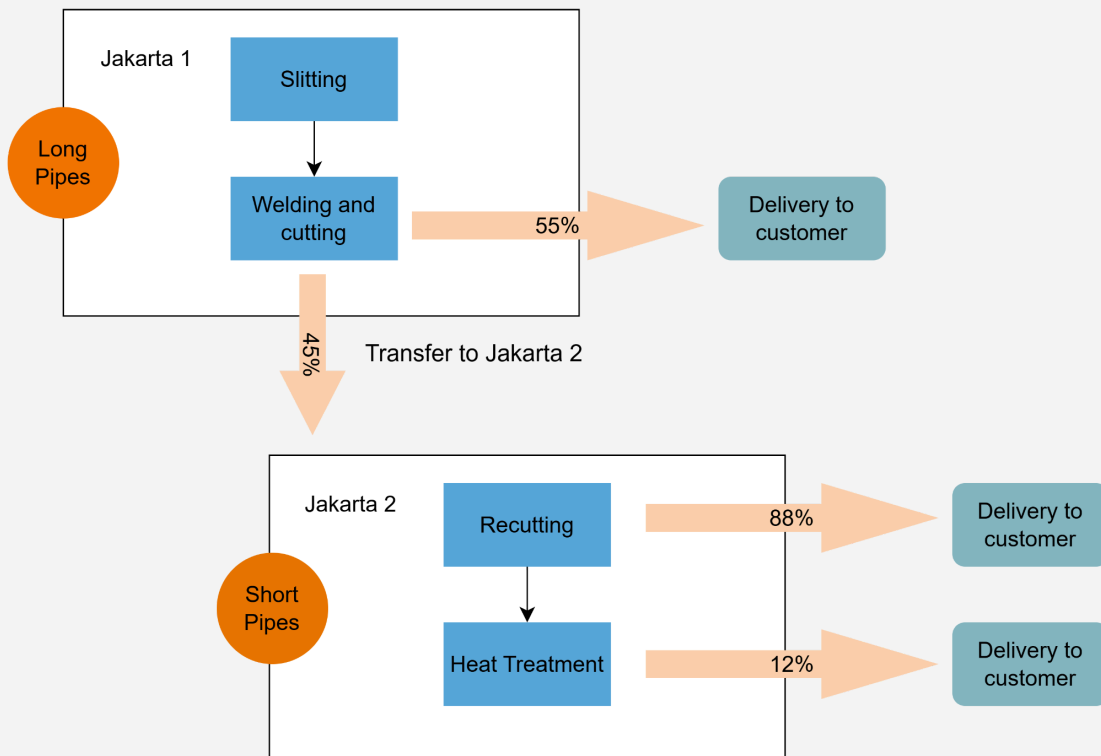


Figure 1. Production Process in ISTW's Jakarta Plant

In 2024, the energy intensity of Jakarta plants (J1 & J2) amounted to 0.66 GJ/tonne. There is a slight decrease in electricity consumption from 24,543.9 GJ in 2023 to 23,959.0 GJ in 2024, which is primarily attributed to reduced operation of the mill machinery. Aligning with this, production output also shows a decline, from 40,888.0 tonnes to 40,173.2 tonnes, resulting in a similar energy intensity with the previous year (0.64 GJ/tonne in 2023).

In addition to reduced electricity consumption and production, the slight decline in energy intensity was also affected by reduced fuel consumption. Fuel consumption for transportation (cars and forklifts) and backup generators represents a significant portion of total energy consumption in Jakarta. In 2024, transportation activities consumed 2,095.1 GJ of Pertamina and diesel, a 10% decrease from the previous year.

Figure 2 shows the **electricity consumption** per production post in Jakarta plants. In J1, mills account for nearly 50% of electricity consumption, followed by compressors at 36% and cooling towers at 10%. Meanwhile, in J2, most electricity demand comes from the recutting process, amounting to 60%, followed by air compressors at 20% and heat treatment at 13%.

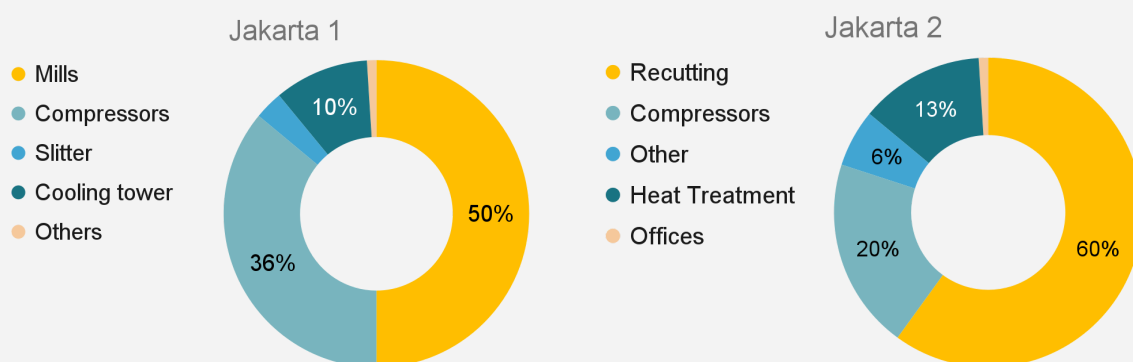


Figure 2. Electricity Consumption Per Post in J1 & J2

Despite consuming lower electricity compared to other processes, heat treatment is identified as the most intensive process in the Jakarta plant's production. Long pipe production has the lowest electricity intensity, averaging 73 kWh/tonne, while recutting and heat treatment processes

average 260 kWh/tonne and 402 kWh/tonne, respectively. Based on total production, the overall electricity intensity at the Jakarta plant averages 157 kWh/tonne.

Combined GHG emissions from the Jakarta plants in 2024 amounted to 40,411.9 tCO₂-e (see **Figure 3**). The J1 plant emitted 143.7 tCO₂-e Scope 1 emissions, indicating minimal direct fuel combustion, but high Scope 2 emissions, amounting to 2,462.1 tCO₂-e. A significant portion of J1's emissions (89.5%) comes from Scope 3, amounting to 34,205.4 tCO₂-e, which are mainly from overseas sourcing of mother coils. The J2 plant also emitted minimal Scope 1 emissions, amounting to 7.9 tCO₂-e, and relatively high Scope 2 emissions, amounting to 3,328.0 tCO₂-e. There are no reported Scope 3 emissions from J2 as logistics are handled at J1.

It could be concluded that Jakarta plants' operation demonstrates a high reliance on electricity rather than on fuel combustion, as evidenced by significantly higher Scope 2 emissions than Scope 1 GHG emissions.

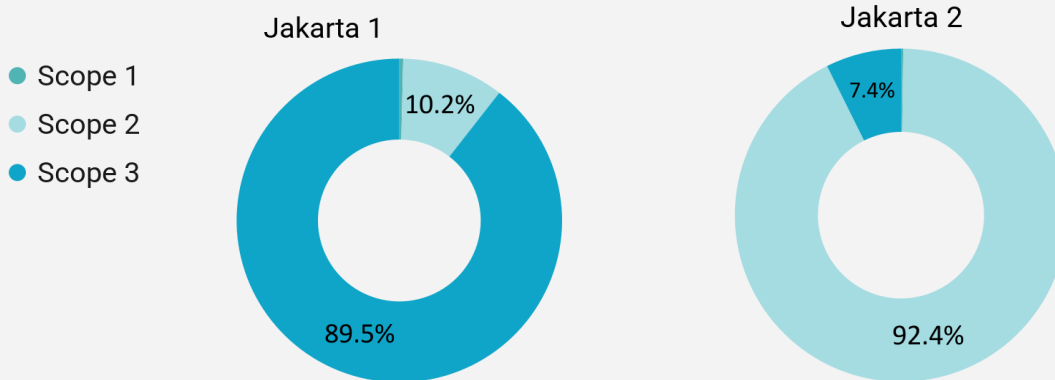


Figure 3. Distribution of Jakarta plants' emissions by Scope

3.3. Cikarang

The Cikarang plant is ISTW's newest plant, with the highest annual production compared to other plants. All long steel pipes produced in Cikarang get recut into short pipes before being sent to customers (See **Figure 4**).

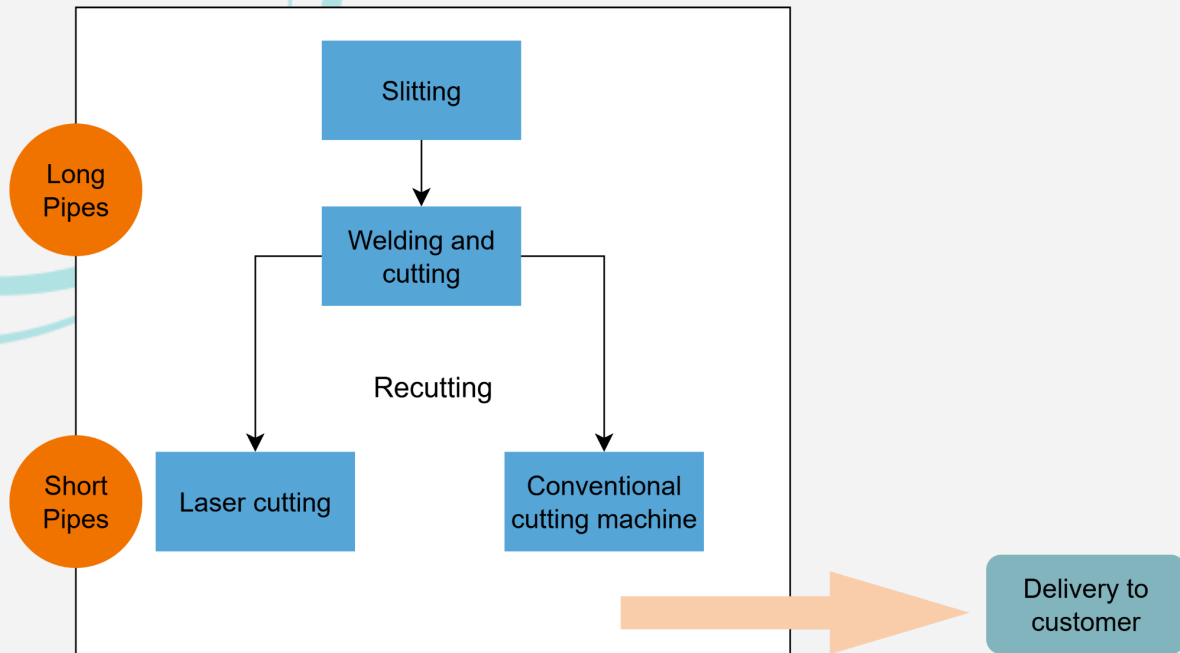


Figure 4. Steel pipe production process in ISTW's Cikarang plant

In 2024, Cikarang diversified its electricity sources by renting and utilising rooftop solar, making it the first ISTW plant to adopt renewable electricity. Under this scheme, ISTW procured electricity monthly from the solar PV. However, ISTW does not control the generated electricity, which remains under the lessor's ownership.

Cikarang energy intensity in Cikarang amounted to 0.37 GJ/tonne in 2024, which is quite similar to last year's (0.36 GJ/tonne). This consistency is attributed to a similar declining trend of energy consumption and production. Energy consumption experienced a decrease from 18,622.7 GJ in 2023 to 17,619.2 GJ in 2024, mainly due to reduced car mobility, despite an increase in diesel consumption for forklifts. Production also saw a significant decline, from 52,391.0 tonnes in 2023 to 47,668.2 tonnes in 2024.

A detailed breakdown of electricity demand at the Cikarang plant highlights that the recutting process accounts for most of the electricity demand in Cikarang. **Figure 5** shows the electricity consumption per production post in the Cikarang plant, mainly represented by the compressors (29%), cutting machines (28%), and mills (28%).

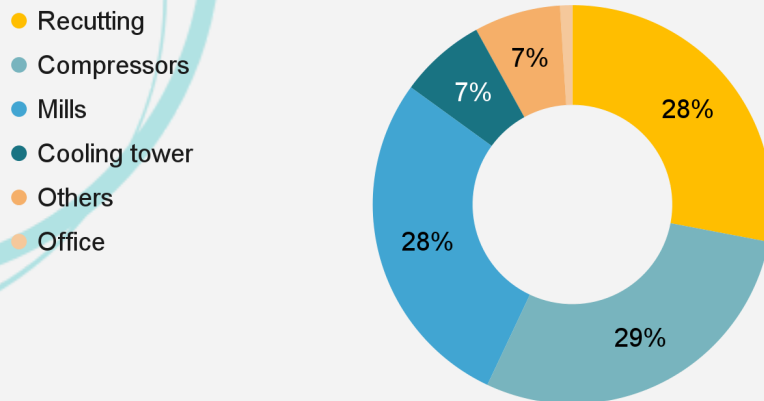


Figure 5. Electricity Consumption Per Post in Cikarang Plant

Compared to Jakarta, the recutting process in Cikarang is much more efficient, averaging at 116 kWh/tonne, likely due to the newer equipment in Cikarang. Meanwhile, the long pipe production is slightly less efficient at 78 kWh/tonne. Based on overall production, electricity intensity in the Cikarang plant averages at 96 kWh/tonne.

GHG emissions from the Cikarang plant in 2024 amounted to 35,198.1 tCO₂-e (see **Figure 6**), with Scope 2 emissions significantly higher at 3,859.3 tCO₂-e compared to Scope 1 emissions at 79.6 tCO₂-e. A significant portion of Cikarang's emissions comes from Scope 3, amounting to 31,259.3 tCO₂-e, which are mainly from sourcing mother coils. The small amount of Scope 1 emissions indicates a minor contribution of fuel combustion, which aligns with the general findings that ISTW's operations and primary reliance on electricity as an energy source.

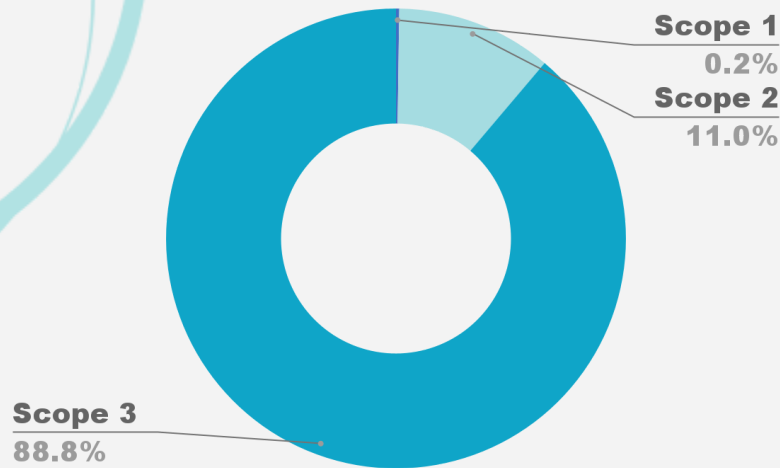


Figure 6. Distribution of Cikarang Plant's Emissions by Scope

3.4. Semarang

In ISTW's Semarang plant, the primary product is galvanised pipes. Of the total long pipes produced, 25% are directly sold to customers (See **Figure 7**). Another 59% undergo a galvanisation process. The remaining 16% of the total production consists of short pipes, which are created through a recutting process.

Differently with other ISTW plants, fuel consumption plays a significant part in Semarang's energy use, due to the galvanisation process that relies on fuel combustion instead of electricity. Galvanisation is an energy-intensive process which involves hot-dip galvanising to create corrosion-resistant steel⁸. Since 2024, Semarang has started using Compressed Natural Gas (CNG) for this process, replacing biodiesel use in the previous year.

⁸ World Steel Association. 2023. [Hot Dip Galvanised Coil](#).

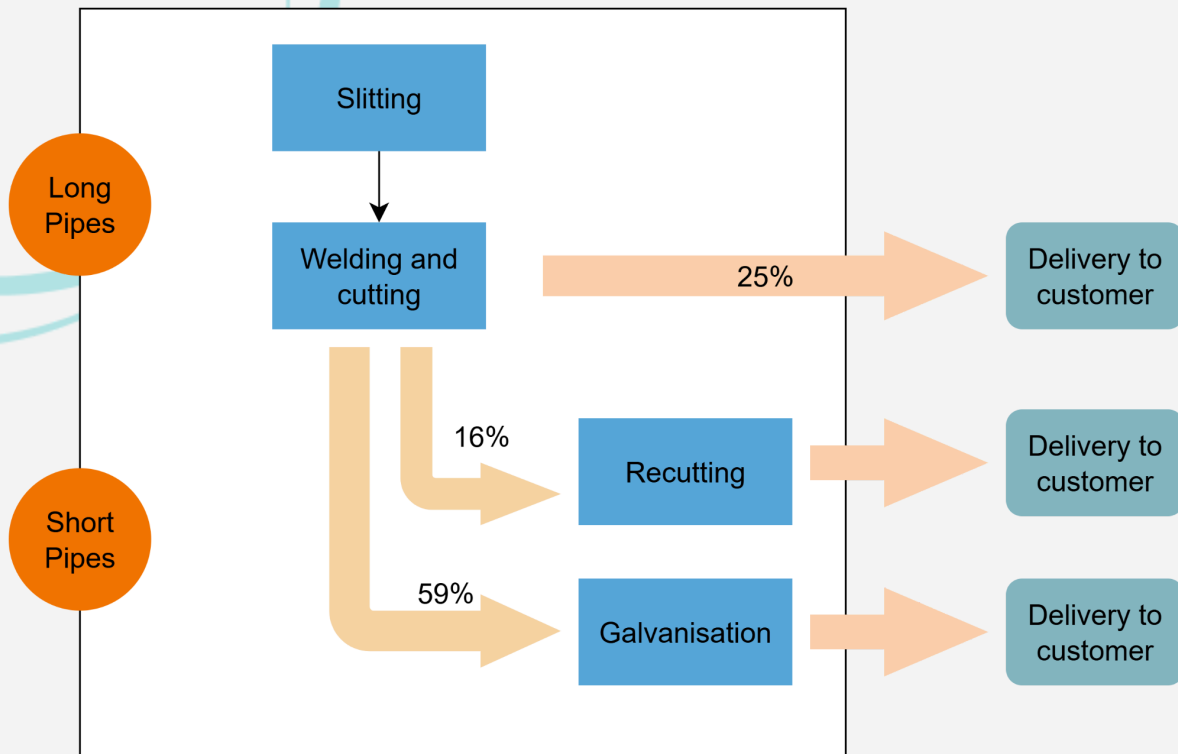


Figure 7. Production Process in ISTW's Semarang plant

In 2024, ISTW observed a reduction in demand for galvanised pipe, which directly affected Semarang's energy use. In 2024, energy consumption dropped to 24,120.4 GJ from 33,138.7 GJ in the previous year, corresponding with a decline in production output from 19,055.4 tonnes to 15,305.0 tonnes over the same period.

However, the overall energy intensity in Semarang decreased significantly from 1.74 GJ/tonne in 2023 to 1.58 GJ/tonne in 2024, indicating improved efficiency. This can be attributed to a major reduction (96%) in mobile fuel combustion. In 2024, Semarang only use Pertamina for mobile combustion, while in 2023 there was a specific consumption of biodiesel.

In terms of electricity consumption, pipe production is the main user of total consumption. **Figure 8** shows the electricity consumption per production post in the Semarang plant, mainly represented by the welding machines (25%), compressors (22%), and cooling towers (16%).

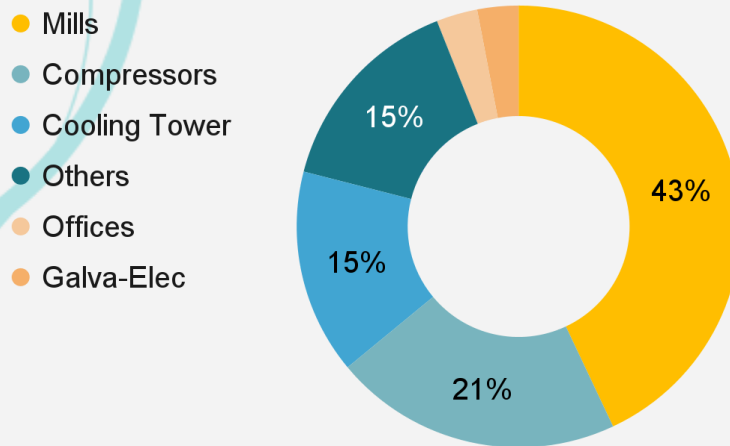


Figure 8. Electricity Consumption Per Post in Semarang Plant

Production in Semarang is notably less efficient than in Jakarta and Cikarang, particularly in long pipe production. With an average electricity intensity of 174 kWh/tonne, Semarang's long pipe production process per tonne of product consumes over twice the electricity of other plants. Despite the recutting process having a much lower electricity intensity of 16 kWh/tonne, the overall production in Semarang still results in a relatively high average intensity of 147 kWh/tonne.

Unlike Cikarang and Jakarta plants, the Semarang plant does not exhibit a reliance on electricity, but rather similar levels of Scope 1 and Scope 2 emissions. This difference is attributed to the galvanised steel processing methods employed at the Semarang plant (See **Table 1**).

In 2024, total GHG emissions recorded in the Semarang plant amounted to 19,667.0 tCO₂-e (**Figure 9**). A significant portion of these emissions is attributed to Scope 3 Category 1, at 18,237.1 tCO₂-e, from coil sourcing. Scope 1 emissions contributed 1,047.7 tCO₂-e, while Scope 2 emissions are relatively low compared to other plants at 1,368.7 tCO₂-e, indicating a lower reliance on electricity.

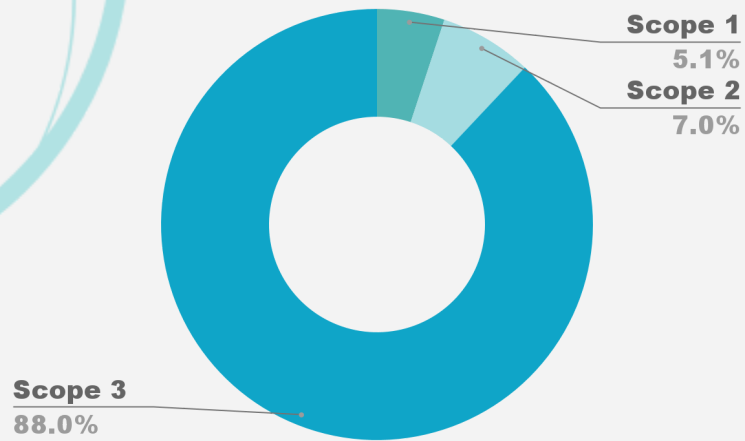


Figure 9. Distribution of Semarang plant's emissions by Scope

4. FINDINGS

This chapter compares and analyses the processes across ISTW's plants, identifying areas for improvement. It also describes and assesses the effectiveness of current decarbonisation initiatives implemented by ISTW.

4.1 Electricity Efficiency

The audit results reveal significant fluctuations in electricity consumption across sites. These variations suggest either a lack of process standardisation or differences in equipment efficiency. **Figure 10** below illustrates a comparison of electricity efficiency between processes in ISTW's plants.

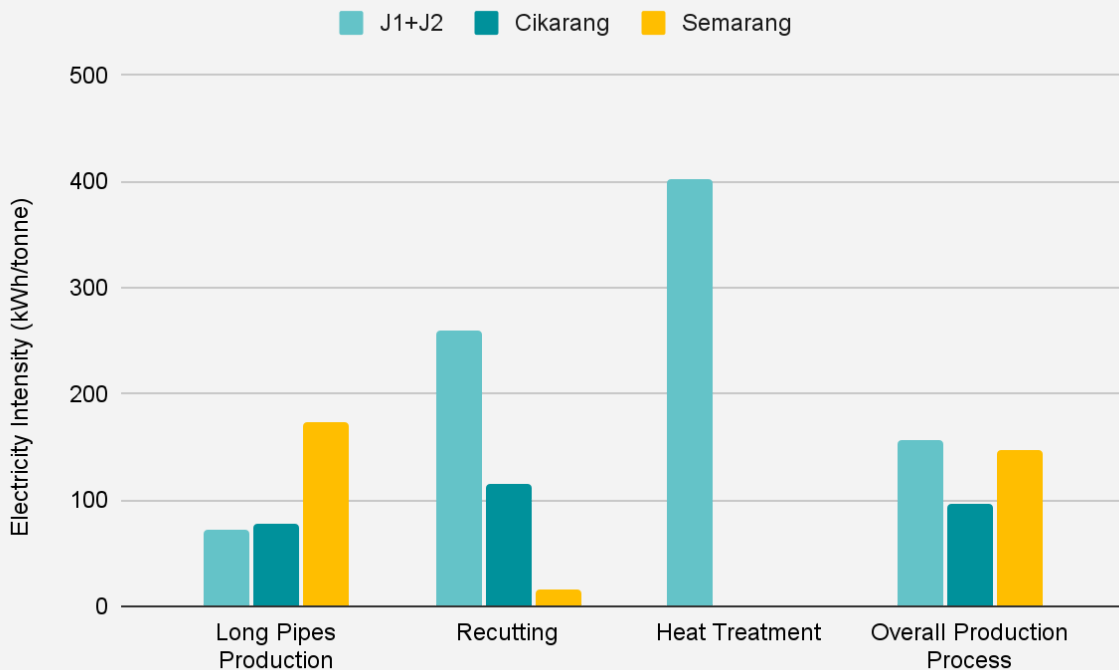


Figure 10. Comparison of electricity efficiency between ISTW processes

The graph above shows that the heat treatment process in Jakarta consumes the highest amount of electricity per tonne produced, while the recutting process in Semarang consumes the least. However, the overall production process in Semarang is on a similar level of electricity intensity to Jakarta, due to its intensive long pipe production process. Meanwhile,

the Cikarang plant showcases the lowest electricity consumption per tonne of pipe produced overall. This observation is consistent with the newer equipment of the Cikarang plant, which boasts the best efficiency.

This finding shows that there are several hotspots for efficiency improvements in ISTW's processes, particularly in **heat treatment and recutting processes** at Jakarta plants, and in the **long pipe production** process at the Semarang plant.

It is important to note that aside from electricity, significant energy consumption from fossil fuel use also occurs in Semarang due to the galvanisation process, which represents around 35% of Semarang's energy consumption. The next section will assess broader energy and emissions intensity across ISTW plants.

4.2 Energy Intensity and Emissions Intensity

ISTW began conducting an inventory of its GHG emissions in the reporting year 2023, establishing a baseline for its emissions. Based on ISTW's latest GHG inventory report, ISTW's energy intensity had a slight reduction from 0.70 GJ/tonne in 2023 to 0.65 GJ/tonne in 2024 (see **Figure 11**). This reduction is mainly attributable to decreased machine operation and lower overall production.

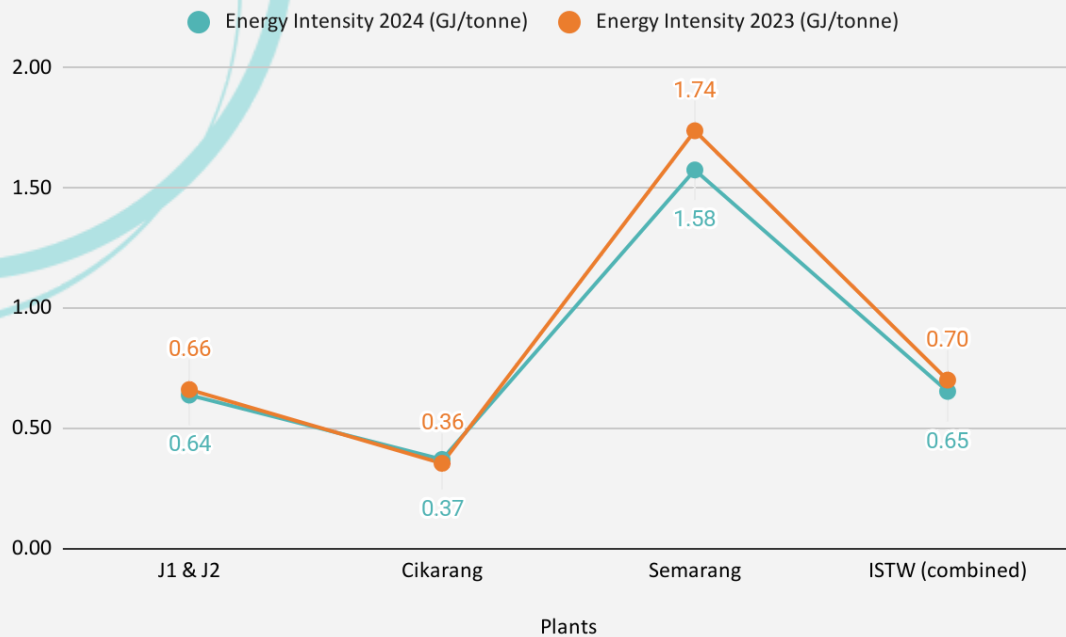


Figure 11. Energy Intensity Index of ISTW, 2023 - 2024

Energy intensity in both the Jakarta and Cikarang plants showed only minor changes between 2023 and 2024. This can be attributed to the similar trend of production and energy consumption in both plants, all of which show a slight reduction.

One significant change is observed in the Semarang plant, which experienced a decline due to the elimination of biodiesel from mobile combustion. However, it is important to note that Semarang has the biggest energy intensity across all ISTW plants. With nearly identical energy consumption to the Jakarta plants, Semarang's production output is less than 40% of Jakarta's; this makes energy efficiency a major concern in the Semarang plant.

Meanwhile, ISTW's emissions intensity (see **Figure 12**) stayed relatively stable from 2023 to 2024. At the Jakarta plants, an increase in J2's electricity consumption was offset by a more significant decrease at J1, resulting in reduced emissions. Furthermore, a decrease in fuel consumption due to less mobility contributed to the emissions reduction, dropping from 150.08 kgCO₂-e/tonne to 147.90 kgCO₂-e/tonne. Meanwhile,

the Cikarang plant experienced a very small decrease in emission intensity from 82.97 kgCO₂-e/tonne to 82.63 kgCO₂-e/tonne.

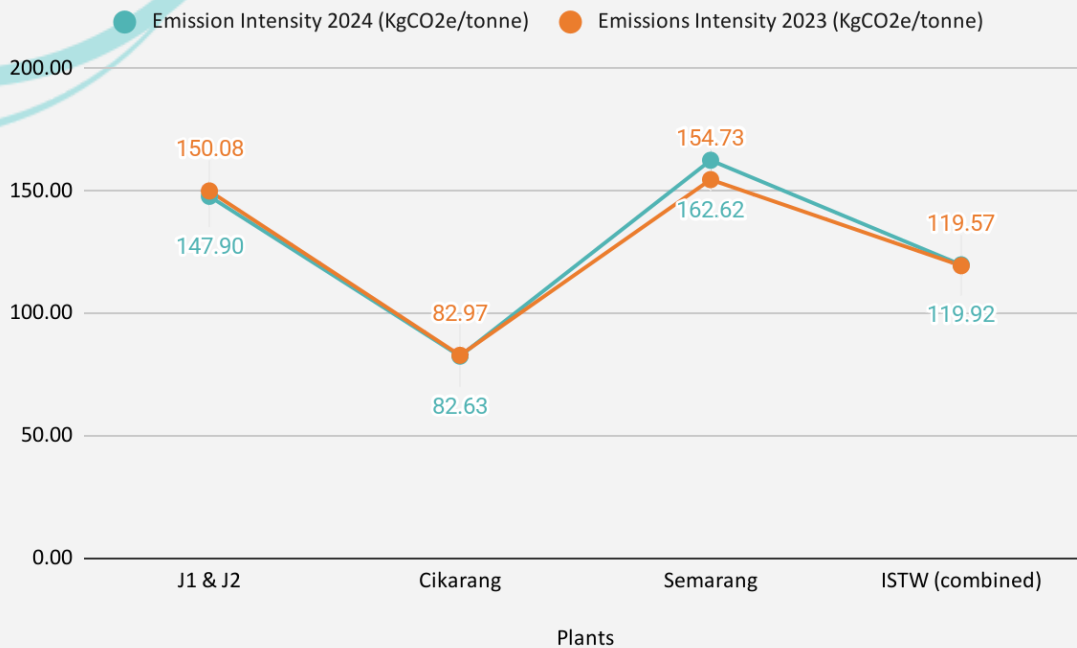


Figure 12. Emissions Intensity Index of ISTW, 2023 – 2024

Semarang saw its emission intensity rise from 154.5 kgCO₂-e/tonne to 162.62 kgCO₂-e/tonne, primarily due to fuel switching to CNG. Despite having higher energy content, making it more energy efficient than Biodiesel, CNG also has a bigger emission factor.

In conclusion, J1 & J2 and Cikarang show only small changes over the past year, showing low improvement in their operational efficiency, while Semarang show a decrease in energy intensity. However, Semarang still exhibits higher energy intensity than other plants. Given these results, the **Semarang plant should be prioritised for decarbonisation efforts** as it is the most inefficient of all ISTW's plants.

4.3 Current decarbonisation initiatives

ISTW is already taking several steps to reduce its GHG emissions and improve overall environmental performance (**Table 2**).

Table 2. Current Decarbonisation Initiatives in ISTW by Plants

No	Initiative	J1	J2	CKR	SMG	Emission Savings (tCO ₂ -e)
1	Compressor replacement with inverters	✓	✓	✓	✓	598.0
2	Lighting switch to LED	✓	✓	✓	✓	490.2
3	Rooftop solar installation	✗	✗	✓	✗	380.0
4	Fuel switch to CNG	✗	✗	✗	✓	-25.9
5	Tree planting and nursery	✓	✓	✓	✓	102.9

The most significant potential emissions savings, estimated at **598.0 tCO₂-e**, came from replacing compressors with inverters. This calculated amount is the estimated saving potential, as the replacement was still ongoing in 2024 and had not yet resulted in actual emission reductions.

Meanwhile, the fuel switch from Biodiesel (B30) to CNG has the least emissions savings. In fact, the emission from the galvanisation process **slightly increased** from **990.0 tCO₂-e** in 2023 to **1,015.9 tCO₂-e** in 2024. This is because, despite having higher energy content⁹ compared to B30, CNG's emission factor of CNG is also higher than that of Biodiesel, making the emission reduction from this fuel switch insignificant.

Figure 13 illustrates the carbon removal and avoidance from ISTW's decarbonisation initiatives throughout 2024. Assumptions used in this calculation are detailed in Annex 1.

⁹ BRIN. 2025. [Indonesia's country-specific CO₂ emission factor based on gas fuels for greenhouse gas inventory in the energy sector](#).

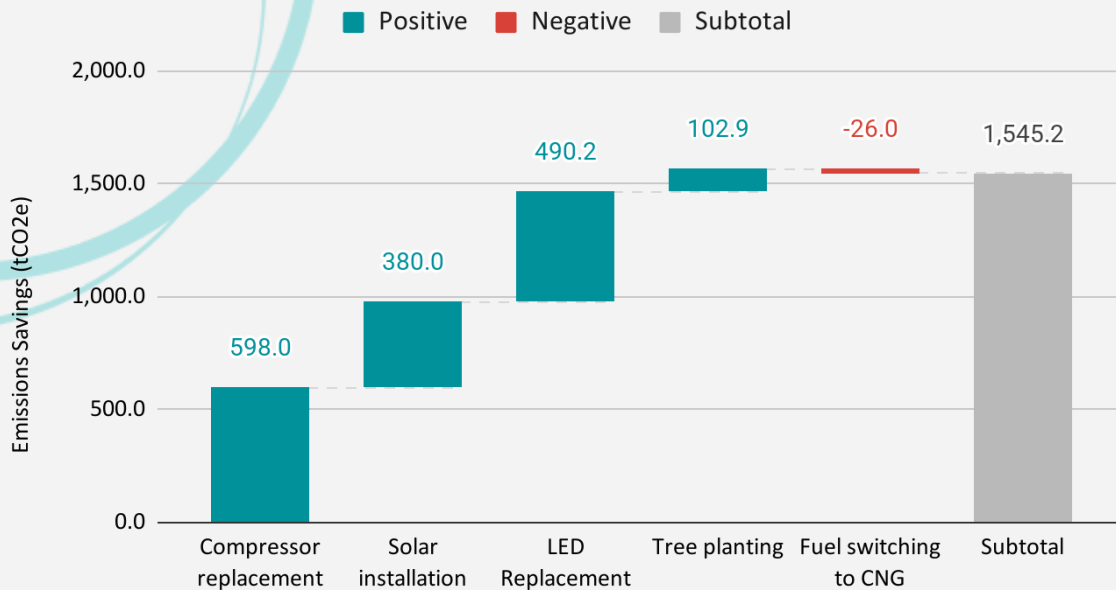


Figure 13. ISTW's Carbon Removal and Avoidance in 2024

The combined saving potential of the existing decarbonisation initiatives comes to an estimated **1,545.2 tCO₂-e**, which represents approximately **7.3%** of its operational (Scope 1 & 2) emissions. It is important to note that these figures are largely estimated and may not be highly accurate due to inconsistencies in data.

In addition to the aforementioned initiatives, in 2025, ISTW started purchasing Renewable Energy Certificates (REC) from PLN. By purchasing RECs, ISTW has ensured that a certain percentage of its purchased electricity comes from renewable sources. In total, ISTW had purchased 4,844 units of REC in the period of January to June of 2025, combined for four plants. It is estimated that this REC purchase avoided up to 4,311 tCO₂-e of electricity emissions.

It is important to note that reducing electricity consumption by limiting unnecessary usage and improving efficiency is most cost-effective in the long run. Therefore, it should be considered before switching to green energy via the supply of REC, as elaborated in Section 5.2.

Figure 14 illustrates the cost-effectiveness of these initiatives, though it's important to note that significant labour and operational costs may not be included. Additionally, for capital investments with long useful lives, such as LED lights and inverters, the annual depreciated value is used in the graph.

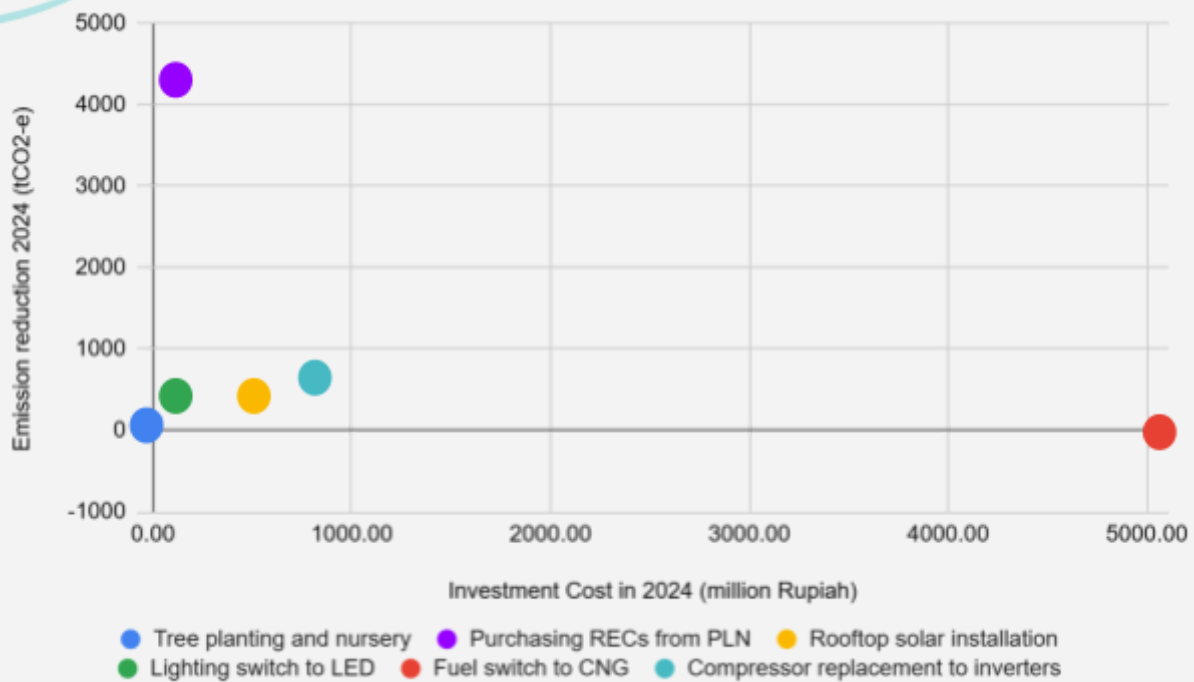


Figure 14. Emission Reduction vs Cost for ISTW's Existing Decarbonisation Initiative

Based on this comparison, even though the tree planting and nursery program appears to be the most cost-efficient, since seedlings are sourced internally¹⁰. However, due to limited land for plantation, efficiency measures such as LED and compressors, combined with renewables, seem more effective in the long term. The fuel switch from biodiesel to CNG proved to be the most inefficient, with a relatively high investment cost and the resulting increased emissions compared to the previous year.

¹⁰ This information is obtained from ISTW, October 2025.

4.4 Data Uncertainty

Certain datasets exhibit varying levels of uncertainty, which could affect the overall accuracy of the emissions from the decarbonisation initiatives. This will be particularly important if ISTW plans to develop an energy-related KPI for a sustainability-linked loan.

4.4.1 Production Value

Discrepancies (up to twofold) in production output have been observed, which is primarily caused by variations in collected data across different departments. These inconsistencies can lead to uncertainties in the overall assessment, highlighting the need for standardised data collection and robust quality control processes to ensure the accuracy and reliability of future reports.

4.4.2 Emissions for Scope 1, 2, and 3

Data uncertainty stemming from Scope 1, 2, and 3 emissions calculations is described in ISTW's GHG Inventory Report 2024.

4.4.3 Emissions Removal Estimates

Based on the data received from ISTW, the circumference of all trees has increased by exactly 1 cm compared to the 2023 inventory. It is assumed that no measurement was carried on for this inventory and that this growth was arbitrary. Therefore, the values of carbon sequestration of the tree planting should be considered with caution.

Overall, the calculations for GHG emissions avoidance and removal are subject to uncertainty due to the assumptions made and the use of generalised Emission Factors (EF), which may not perfectly reflect on-site operational specifics (e.g., unmeasured operating hours for LED lighting, variable inverter efficiency for compressors, and non-site-specific EFs for galvanisation and grid electricity). These specific assumptions and emission factors considered in this inventory are detailed in the Annex.

5. RECOMMENDATIONS

This chapter describes the recommendations for ISTW's decarbonisation roadmap, including the baseline year and strategies for short, medium, and long-term implementation.

5.1 Case Studies of Other Iron and Steel Companies

To ensure an effective decarbonisation journey, Tri Hita Consulting recommends ISTW to establish a clear, measurable baseline for its decarbonisation target. It is recommended for ISTW to use **2023 as the baseline year** for two key reasons: ISTW began calculating its greenhouse gas (GHG) emissions in 2023, ensuring **data availability**; and the **national alignment** with Indonesia's decarbonisation roadmap for industries, which also designates 2023 as the baseline for the steel industry¹¹.

In Indonesia, several iron and steel companies have started to publicly commit to the Net Zero pledge in the past few years. **Table 3** showcases benchmarks of decarbonisation targets and strategies implemented by other steel companies in Indonesia and Japan. Some reductions are achieved by focusing on technologies like Electric Arc Furnaces (EAF) and the use of low-carbon energy sources such as hydrogen.

It is crucial to acknowledge that due to ISTW's unique production process, which does not incorporate steelmaking processes, some of these strategies may not be directly applicable. As most of ISTW's direct competitors have not yet declared Net Zero strategies, ISTW has a pioneering opportunity and a strategic advantage if it were to do so.

¹¹ Kemenperin RI, WRI Indonesia, dan IESR. 2025. [Peta Jalan Dekarbonisasi 9 Subsektor Industri](#).

Table 3. Benchmarking Decarbonisation Target and Strategies in Other Steel Companies

No	Company Name	Baseline Year	Baseline Emissions (tCO ₂ -e)	Key Targets	Key Strategies
1	PT Gunung Raja Paksi	2021	530,797 (Scope 1 &2)	Net Zero by 2060 ¹²	Fuel switch to natural gas, utilising EAF with DRI/H ₂ , carbon offset projects.
2	PT Krakatau Steel	2019	N/A	~8500 tCO ₂ -e annual reduction ¹³ , 33% by 2030, carbon neutral by 2060	Energy efficiency & electrification, CCUS, H ₂ -based technology for new plant.
3	PT SPINDO	N/A	N/A	30% reduction by 2030 ¹⁴	Fuel switch to low-carbon energy
4	Maruichi Steel Tube	2013	111,332 (Scope 1 &2)	46% reduction by 2030, Net Zero by 2050 ¹⁵	Fuel switch to low-carbon energy (solar & hydrogen), RE utilisation, carbon credits.
5	Metal One Corporation	2020	136,000 (Scope 1 &2)	50% reduction by 2030, carbon neutral by 2050 ¹⁶	Fuel switch to low-carbon energy (wind), RE utilisation, and scrap utilisation.

5.2 Prioritisation for Decarbonisation Initiatives

A successful GHG emissions management plan or strategy requires a comprehensive approach, with priority given to emissions removal by eliminating major sources of emissions or adopting low-carbon operation alternatives, followed by carbon and energy reductions, and then to substitution/offsetting measures, as shown in **Figure 15** below.

¹² GRP. 2023. [GRP's Net Zero Roadmap: Our Decarbonization Approach](#).

¹³ Krakatau Steel. 2025. [Laporan Tahunan dan Keberlanjutan 2024](#).

¹⁴ SPINDO. 2025. [Laporan Keberlanjutan 2024](#).

¹⁵ Maruichi Steel Tube. [Initiatives to Achieve Carbon Neutrality](#).

¹⁶ Metal One Corporation. [Carbon Neutrality](#).

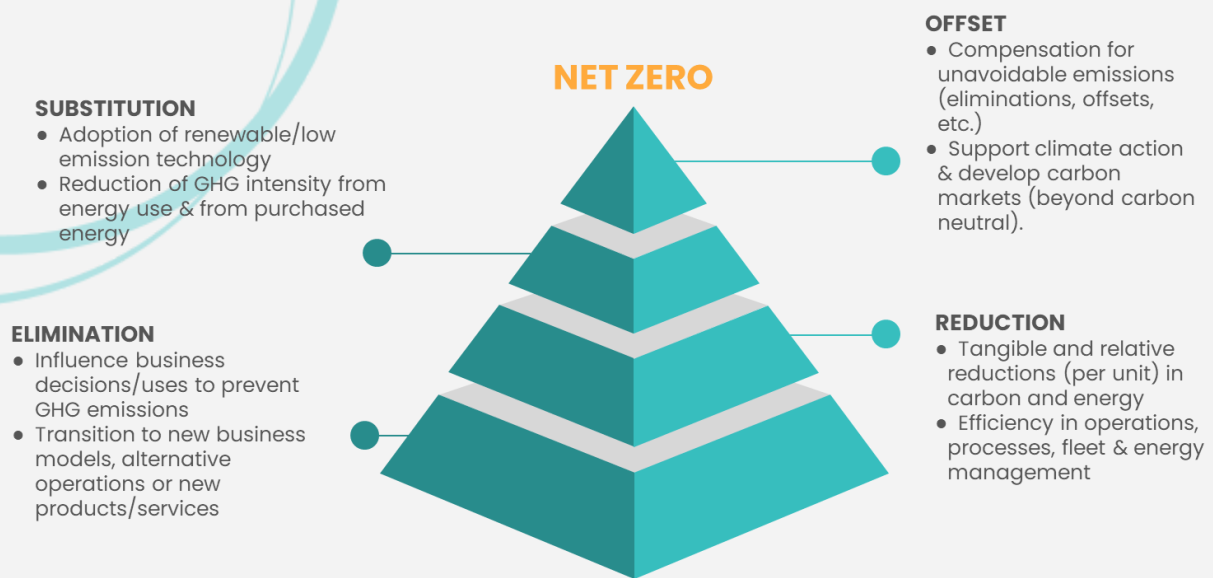


Figure 15. Pyramid of Emission Reduction Initiatives towards Net Zero

The lower levels of the reduction pyramid represent the actions with the lowest cost and highest effectiveness, which should be taken first. The substitution through REC purchases should come as a second stage, and the compensation (or offsetting) through carbon certificates should only be used to remove the final and unavoidable emissions to reach net-zero.

In the next section, this report will elaborate on Tri Hita's recommendations for ISTW's future decarbonisation roadmap.

5.3 Recommended Phased Decarbonisation Roadmap

Building on its current progress and assessment results, Tri Hita listed down some high-priority improvements ISTW should consider in order to further reduce emissions and enhance its environmental performance. By implementing these short-term strategies, along with its current decarbonisation initiatives, ISTW can achieve an annual emissions reduction of **approximately 8–10%**. This reduction **could be further increased by up to 20%** with the expansion of rooftop solar panels across all its operations (**Figure 16**).

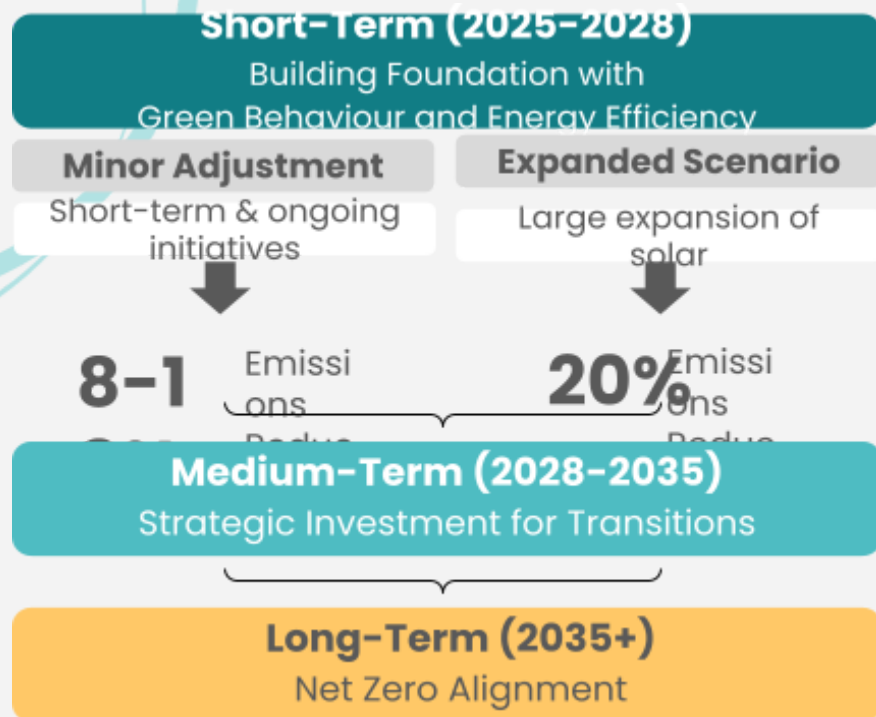


Figure 16. Proposed Decarbonisation Roadmap for PT ISTW

Short-Term Strategy

To establish a strong foundation in decarbonisation, ISTW should initially focus on building a foundation of sustainability in its company. Figure 17 below shows the recommended initiatives, which can be broadly categorised into four main areas: system improvements, energy efficiency improvements, employee culture, and the transition to low-carbon energy.



Figure 17. Short-Term Decarbonisation Strategy Summary

Systems Improvement for Data Management

As a manufacturing company with multiple operations sites, it is crucial for ISTW to establish a clear system and protocol for data management. From the data collection process, it was revealed that several departments maintain separate datasets for the same information, often with conflicting values. This highlights the critical need for a **centralised, online data management system** to streamline these datasets and enhance data accuracy.

A data management system is also crucial in measuring and tracking decarbonisation progress. The urgency for such a system is further amplified by ISTW's intention to apply for a Sustainability-Linked Loan (SLL), which requires debtors to implement a stringent data monitoring for impact reporting¹⁷. Without a robust data management system, ISTW would face significant challenges in consistently reporting its sustainability progress to investors and other key stakeholders.

Energy Efficiency & Optimised Operations

This improvement strategy focuses on physical, measurable improvements to existing plant equipment and systems to improve energy efficiency.

First, it is necessary to address the **inefficiencies in the Semarang plant**, which is due to its reliance on older machinery compared to other plants. ISTW should concentrate on optimising existing machinery in Semarang and consider replacing older equipment **with energy efficiency improvements** as a priority. A lifecycle cost analysis should precede any replacements to ensure their cost-effectiveness¹⁸.

The efficiency audit conducted in August 2025 identified potential adjustments to improve operational efficiency by **standardising the**

¹⁷ MUFG. 2024. [MUFG Sustainable Finance Framework](#).

¹⁸ ISTW GHG Inventory Report 2024

compressed air pressure setting at the plants. Based on the audit, it was revealed that the J2 and Semarang plants operate with a compressed air pressure setting of 7 bars, while the Cikarang plant uses 6 bars for the same processes and machinery. Given Cikarang's demonstrated efficiency, it is recommended to standardise the compressed air pressure setting to 6 bars across all plants. This change is unlikely to affect operations, as it is already successfully implemented at the Cikarang plant with no noticeable troubles, but has the potential to reduce emissions of **up to 150 tCO₂-e** annually. However, it is necessary to conduct due diligence prior to implementation to ensure the actual minimum operating pressure and to monitor critical points of use, taking into account plant-specific technical considerations.

Another finding from the audit is that **most chilled water pumps** across all plants are **operated manually**, with return water temperature well below the threshold. Since the pumps are operated manually, they likely run at a fixed maximum whenever they are turned on, regardless of whether the cooled equipment requires full flow. To address this, it is recommended to retrofit all major chilled water pumps with **inverters or Variable Speed Drives (VSDs)**¹⁹. The retrofit will allow the pump speed to be dynamically regulated, precisely matching the flow to the actual cooling load and eliminating the inefficiencies of manual, fixed-speed operation²⁰. If implemented effectively, this adjustment can save up to **52 tCO₂-e** per year.

Build Energy-Saving Culture

While the previously recommended initiatives focus on systems improvement, both digital and physical, Tri Hita also recommends ISTW to put a focus on **employee culture**.

¹⁹ Energy Institute. 2022. [Variable Speed Drivers](#).

²⁰ Inverter Drive System (IDS). 2025. [The quickest route to energy saving](#).

Achieving energy saving goals requires a workforce that is equipped with the skills and knowledge to do so²¹. ISTW can approach this by implementing regular training and education programs on energy efficiency, or offering informational resources that explain the mechanics of energy consumption in their specific work area (e.g., how the manual operation of chilled water pumps wastes power). A regular performance review, along with incentive and recognition programs, can also help enforce the behavioural adjustments towards an energy-saving culture²².

Fuel Switching & Transition to Renewable Electricity

Lastly, ISTW should also focus on changing the source of energy used for its operations by moving to cleaner alternatives.

Despite high reliance on electricity (see Chapter 3), Cikarang and Jakarta still emit a significant amount of emissions from fossil fuel combustion due to diesel use for forklifts and car mobility. To further enhance the efficiency at these plants, **replacing the fuel** for forklifts with biodiesel or switching to electric forklifts are possible options to decrease energy and emission intensity levels. Meanwhile, emissions from car mobility can be reduced by transitioning to higher-octane fuels (Pertamax 98) or by replacing existing vehicles with EVs.

An important initiative to focus on is **transitioning to renewable electricity sources**. According to interviews with ISTW, there are plans to replicate the rooftop solar initiative in the J2 plant, which is highly encouraged. Our analysis shows that adding 350m² of rooftop solar (~500 MWh/year) annually would significantly cut emissions from electricity use, up to an additional **60 tCO₂-e/year**.

The optimal total installation across all four plants is 1,000 kWp. The Cikarang plant is the most cost-effective setup for solar PV replacement,

²¹ Ly, Bora and Ly, Romy. 2022. [Saving energy in the workplace: evidence from Cambodia](#).

²² Genghini, Licia. 2022. [Green Upskilling: Why Companies Need to Train Employees to Meet the Demand of a Sustainable Economy](#).

due to ISTW's current premium tariff. If ISTW installs rooftop solar panels to their optimal capacity of 1,000 kWp across all plants within a year, along with all other initiatives, emissions could be reduced by an additional **20%**, or an estimated **1,200–1,500 tCO₂-e** per year.

Medium-Term Strategy

Going further in the decarbonisation journey, ISTW should consider making **strategic investments** (Figure 18) to support its transition into a low-carbon iron and steel manufacturer, particularly for energy transition and transitioning to sustainable procurement.

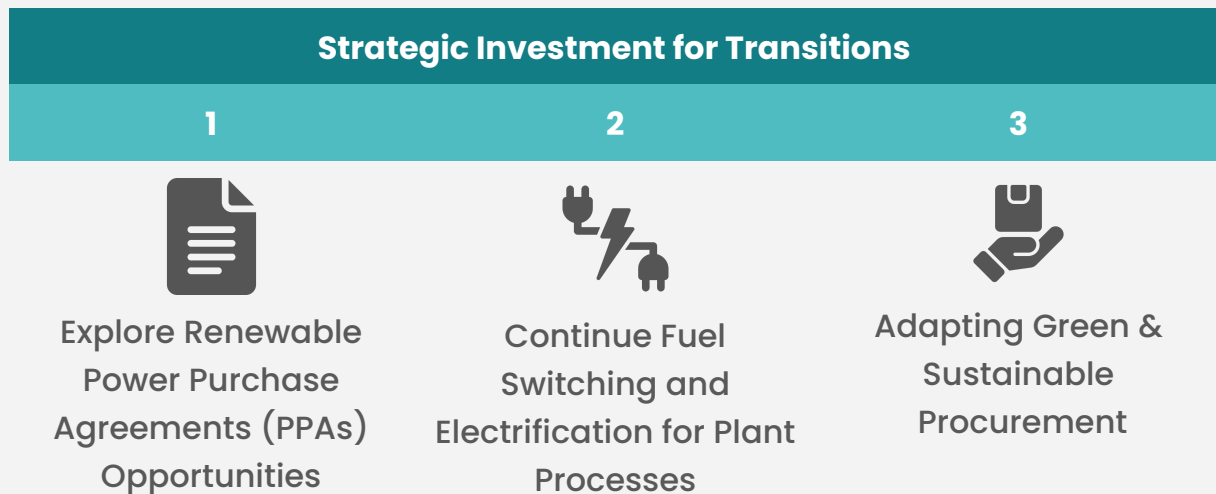


Figure 18. Medium-Term Decarbonisation Strategy Summary

Explore Renewable Power Purchase Agreements (PPAs) Opportunities

For its medium-term strategy, ISTW should prioritise transitioning from REC purchases to securing long-term green energy supplies through Power Purchase Agreements (PPAs) with renewable electricity providers. Given that a significant portion of ISTW's GHG emissions is Scope 2 emissions, which originate from its electricity-intensive manufacturing processes²³, investing in a stable, low-carbon renewable electricity source via PPAs is a highly recommended strategy, especially for a company with substantial and potentially increasing electricity demands.

²³ ISTW GHG Inventory Report 2024

Continue Fuel Switching and Electrification for Plant Processes

Based on the audit results, a significant portion of energy consumption in ISTW is the use of fossil fuel in the Semarang plant. In 2024, ISTW switched from biosolar to CNG, as explained in Section 4.2. To further reduce emissions from the galvanisation process, it is recommended that ISTW systematically phase out fossil fuels by replacing CNG with bio-CNG. Additionally, full electrification of the galvanisation process is a potential option. However, a feasibility study is required before this transition, and it is only highly viable if ISTW secures a stable source of green electricity, thereby shifting Scope 1 emissions to a low-carbon Scope 2 profile.

Adapting Green & Sustainable Procurement

Scope 3 emissions constitute 87% of ISTW's total emissions, according to their 2024 GHG Inventory Report. The majority of these, 83%, are from purchased goods and services, with an additional 4% from upstream and downstream transportation. To reduce these significant Scope 3 emissions, decarbonising the supply chain through sustainable procurement is crucial.

Since the biggest portion of ISTW's emissions comes from purchasing mother coils (see Chapter 3), it is recommended to revise the procurement criteria to prioritise sourcing from low-carbon steel sources. One example would be to source from scrap-based Electric Arc Furnace (EAF) producers, due to the inherently lower emissions of EAF production compared to the traditional BF-BOF processes²⁴.

Furthermore, ISTW should prioritise suppliers who report their emissions. This will ensure accurate data for benchmarking low-emission steel and

²⁴ Global Energy Intelligence and ASEAN Centre for Energy. 2025. [Net Zero Roadmap for Indonesia's Steel Industry](#).

for ISTW's own emission reporting. Sourcing from local suppliers is also beneficial, as demonstrated by the Semarang plant's lower emissions due to local sourcing compared to other plants that source internationally.

Long-Term Strategy



Figure 19. Long-Term Decarbonisation Strategy Summary

Deep structural changes in order to align with global net-zero ambition.

For its long-term strategy, ISTW should establish an NZE roadmap and strategy that encompasses its entire supply chain. Compliance with international standards such as Responsible Steel would also be beneficial to showcase ISTW's commitment to decarbonisation (Figure 19).

A complete phase-out from thermal fossil fuels and fossil-fuel-based electricity to electrification, powered by large-scale renewable Power Purchase Agreements (PPAs), is also recommended. For any remaining needs for fuel or high-heat applications, consider the possibility of utilising green hydrogen as its costs decrease. PLN has launched Indonesia's first Green Hydrogen Plant (GHP), and the steel industry was identified as one of its target customers²⁵. Should government initiatives and market development successfully reduce costs over time, green hydrogen could offer a viable solution for lowering emissions in manufacturing processes.

²⁵ PLN. 2024. [ESG Performance Report 2024](#).

6. CONCLUSION

This report outlines an **initial decarbonisation roadmap** for ISTW. The analysis was conducted by reviewing ISTW's current emission profile and decarbonisation initiatives, alongside a walk-through energy audit at ISTW plants in Jakarta, Cikarang, and Semarang.

Key findings highlight **varying efficiencies across ISTW's plants**. The Semarang plant, despite a reduction in energy intensity due to a fuel switch to CNG, remains the most energy-intensive, making it a priority for future decarbonisation efforts. The Jakarta plants show slight improvements in energy and emissions intensity, while the Cikarang plant, with its newer equipment and rooftop solar installation, demonstrates the lowest electricity consumption per tonne of pipe produced.

Current decarbonisation initiatives, including replacing compressors with inverters, lighting upgrades to LED, rooftop solar installation, fuel switching, and tree planting, show an estimated combined saving potential of **1,545.2 tCO₂-e**, representing approximately **7.3%** of operational emissions.

To further advance its decarbonisation journey, ISTW should set a **clear baseline** and **establish a measurable roadmap**. Tri Hita Consulting recommends 2023 as baseline, due to data availability and national alignment. The recommended decarbonisation roadmap (Section 5.3) outlines strategies for short, medium, and long-term implementation.

Immediate improvements include implementing energy efficiency measures, developing a centralised data management system, establishing an energy-saving culture, as well as exploring fuel switching and renewable electricity options. Continued investment in energy-efficient technologies, optimisation of production processes, and a strategic approach to renewable energy integration will be crucial for ISTW to achieve a decoupling of production compared to its GHG emissions and energy consumption.

ANNEX 1

Methodology Note for Emission Reductions: LED Replacement

Given that the replacement timing of lamps varies, annualised emission savings were calculated using a standardised approach to normalise varying installation dates. The methodology applies the difference in rated power (W) between the conventional and LED lamps, multiplied by the assumed daily operating duration (12 hours/day) and total days in a year (365 days) to estimate annual energy savings (kWh/year) per lamp. The avoided emissions (tCO₂-e/year) are then obtained by multiplying the annual energy savings by the grid emission factor for Jamali (0.89 kg CO₂-e/kWh). This approach provides a consistent basis for estimating the annualised GHG reductions regardless of the actual replacement month.

ANNEX 2

Emission Factors Considered for This Report

Emission type	Emission source	Overall CO ₂ -e	Unit	Reference
Combustion emissions	Emission gas type	Emission factor		Reference
Stationary combustion	B35	1.7533	kg CO ₂ -e/L	Pertamina Patra Niaga
	Pertamax	2.3073	kg CO ₂ -e/L	IPCC 2006 Methodology
	CNG	60.7712	kg CO ₂ -e/MMBTU	IPCC 2006 Methodology
Mobile combustion	Diesel	2.7309	kg CO ₂ -e/L	Tier 2—ESDM (Indonesia)
	Pertamax	2.1500	kg CO ₂ -e/L	Tier 2—ESDM (Indonesia)
	B35	1.7779	kg CO ₂ -e/L	Pertamina Patra Niaga
	B100	2.2261	kg CO ₂ -e/L	IPCC 2006 Methodology
Grid electricity	Emission source	Emission factors		Reference
Grid electricity from PLN	Electricity	0.870	kg CO ₂ -e/kWh	Tier 2—2019 emission factors per grid (Jamali) published by ESDM

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