

PT Pamapersada Nusantara District SMMS, Central Borneo

Is the first Indonesia mining contractor company with ISO 50001:2018 certification. Contribute to the nation to reduce greenhouse gas emissions through energy management that focuses on (1) Operator Behavior Based Energy Saving, (2) Road Infrastructure & Fleet Management System, and (3) Machine Efficiency Improvement.



Figure 1. PAMA SMMS Energy Team

| Case Study Snapshot | |
|--|---|
| Industry | Mining |
| Product/Service | Overburden Removal, Coal Getting & Coal Hauling |
| Location | District SMMS, Central Borneo |
| Energy performance improvement percentage (over the improvement period) | 13% improvement over 2 years |
| Total energy cost savings (over the improvement period) | USD 12.241.971,19 |
| Cost to implement Energy Management System (EnMS) | USD 823.000 |
| Total energy savings (over the improvement period) | 318.483 GJ |
| Total CO₂-e emission reduction (over the improvement period) | 13.922 metric tons |

Organization Profile / Business Case

As one of PT Astra International Tbk. Subsidiary, PT.Pamapersada Nusantara District SMMS (PAMA SMMS) located at Central Borneo. PAMA SMMS operates in the coal mining concession of PT. Suprabari Mapanindo Minerals. The difference is that the coal produced is a type of coking coal which is used for metal smelting, not thermal coal for power generation. So that the mining services carried out by PAMA SMMS generate less greenhouse gases. PAMA SMMS production was increase from 22,2 million Bench Cubic Metre (BCM) in 2020 to 27,8 BCM millon in 2021 for overburden (OB) Product. Coal Production also increase from 2,2 million ton in 2020 to 2,9 million ton in 2021. In overall site PAMA is produced coal amount of 89 million ton and overburden amount of 792 million BCM. Pama holding the biggest Indonesia’s market share in the industry by 49% in 2021.

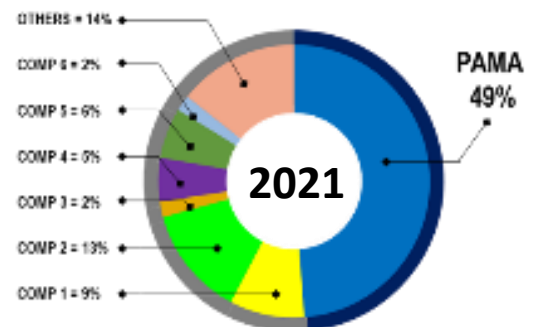


Figure 2. 2021 Indonesia’s Coal Mining Market Share

External Needs & Expectation Business Driver

Coal commodity prices are still volatile and demand for coal exports which still depend on various aspects, are drivers for energy efficiency through the implementation of energy management. Newcastle Coal Index Increases by 59 since January 2022 to 441.13/Ton Coal Price Index continues to reach its highest point on March 8, 2022 This upgrade was triggered by the crisis international energy and coal supply continues to dwindle continue. Requests from India,

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2022

INDONESIA

Japan and European Union countries is expected to still increase because they are moving fast to secure supplies especially coal Indonesia because Indonesia is one of the main suppliers. **The Indonesian government** has clear and strict rules regarding energy management. Especially for large industries that use a minimum of 6,000 Tons of Oil equivalent energy. PAMA SMMS strives to comply these regulatory obligations as stated in Government Regulation Number 70 of 2009 about Energy Conservation and more specific in Minister of Energy and Mineral Resources Regulation Number 14 of 2012. PAMA SMMS also strive to support government to reduce Greenhouse Gases (GHG) Emissions as stated in Nationally Determined Contribution (NDC) of Indonesia.



Figure 3. Newcastle Coal Price Index 2021 - 2022



Figure 4. Astra 2030 Sustainable Aspiration

Internal Needs & Expectation Business Driver

PT Astra International Tbk. as corporate holding also expect PAMA SMMS to implement several aspect of Environment, Social & Government (ESG). GHG Reduction is one of Astra Sustainability Aspiration with target 17,12% absolute reduction (Scope 1 and Scope 2) at 2030 from baseline 2019 for PAMA. Meanwhile GHG absolute reduction (Scope 1 and Scope 2) is 30% for ASTRA target. Energy efficiency energy efficiency is one of the mitigation actions taken by PAMA to reduce GHG.

Fuel is the most operational structure cost with 42%. Fuel efficiency become a mandatory program from corporate. The main energy sources used by PAMA SMMS are biodiesel (98.19%) and electricity (1.81%). Biodiesel is used for Heavy Dump Truck, Low Dump Truck, and Loader operations and electricity for office and dormitory. Total Energy consumption in 2021 is 1.143.773 GJ with Significant Energy Use (SEU) consist of Heavy Dump Truck (38%), Low Dump Truck (13%), and Overburden Excavator (16%).

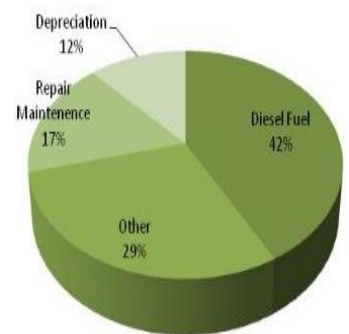


Figure 5. PAMA SMMS Cost Structure

Energy Management Actions

PAMA SMMS has committed to conduct energy efficiency plan well as contributing in emissions reduction. Implementation of energy management at PAMA SMMS based on the Astra Green Energy criteria is **Grade A**, this shows that PAMA-SMMS has integrated aspects of energy management and efficiency in its overall business strategy. Another several recognitions that PAMA SMMS Certified to ISO 9001:2015, 14001:2015, 45001:2018 and 50001:2018. Goals of PAMA SMMS energy performance stated on Key Performance Indicator.

| DISTRİK | 2020 | | | | 2021 | | | |
|---------|--------------------|-------------------|------------------------|--------------------------------------|-----------|-------------------|-------------|-------------------|
| | Fuel Total (Liter) | Total Energy (GJ) | Total Production (Ton) | Energy Intensity (GJ/Ton Production) | Reduce 1% | Target Semester 1 | Reduce 2,5% | Target Semester 2 |
| SMMS | 32.760.033,00 | 1.143.773 | 63.965.484,99 | 0,0184 | 0,0018 | 0,0164 | 0,004 | 0,0144 |

Figure 6. Key Performance Indicator CO2 Emission Reduction PAMA SMMS

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2022

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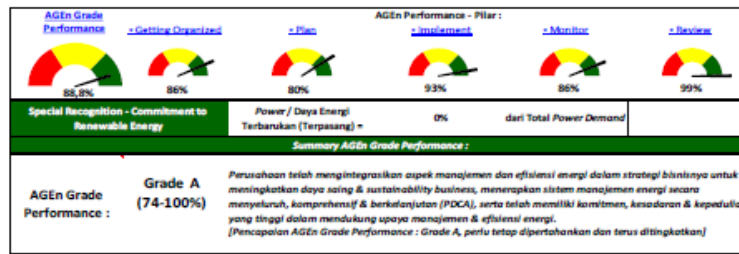


Figure 7. Astra Green Energy (AGEn) Grade Performance PAMA SMMS



Figure 8. PAMA SMMS ISO Series Certificate (9001, 14001, 45001, 50001)



“The certification of PAMA ISO 50001 is a cost-saving program reinforcement, a good system and requires consistency in day-to-day implementation”

—Frans Kesuma, PT Astra International Tbk. Board of Director

Business Benefits

In scope activity of overburden removal, coal getting & coal hauling, ISO 50001 has been implemented in PAMA SMMS since 2021 with total implementation cost of USD 823.000

Tangible Benefits

Financial benefits: Cost saving USD 12.241.971,19 calculated based on energy performance gap between actual energy consumption compared to baseline, then can be described in the cumulative of sum (CUSUM).

Environmental Benefit: CO2 reduction of 13.922 metric tons equivalent in 2021, calculated based on emission factor of biodiesel in 2.28687 kg CO₂e/L.

Productivity Benefit: Productivity over improvement has increased from 433,44 bcm/hours to 514,24 bcm/hours.

Intangible Benefits:

Beyond monetary benefit

- PAMA SMMS Behavior Based Energy Saving has significantly improved as a result of the energy program implemented sustainably which complies with ISO 50001. It leads PAMA SMMS to be The Best District in PAMA Site on Behavior Based Energy Saving (BBEnS).

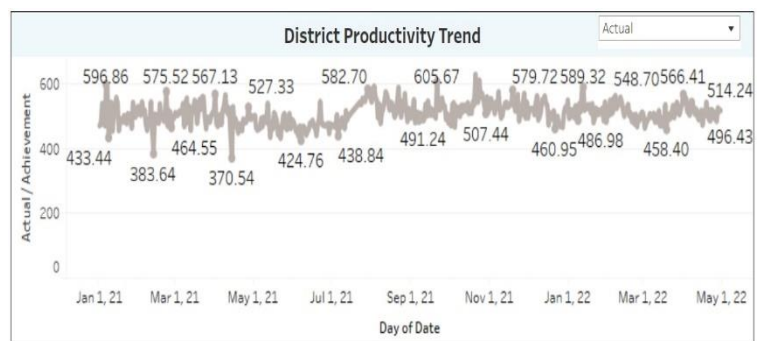


Figure 10. PAMA SMMS Productivity Trend

ISO 50001 Energy Management System – Case Study

2022

INDONESIA

- Implementation of SMART-D Program in Utilities Area leads PAMA SMMS to be The Best District in PAMA Site in applying Zero Over Grade.
- PAMA SMMS has committed in POCYS and FECO utilization to be The Best District in PAMA site achieving Most Efficient Equipment Fleet.

Although this case study is not a multiple site entry around PAMA Group. Energy Management System involving all departments and subcontractors in the operational area. Operation Department collaborate with Operational Subcontractor to build more efficient mining road. Supply Management Department collaborate with fuel supplier and component supplier to keep quality of energy supplies.

Plan

As a corporation, PAMA is very committed to implementing energy efficiency which is one of the aspirations of ESG. The organization is connected with district level. Each member formed in the energy organization is given their respective duties and responsibilities to support the program in achieving the energy management system in PAMA SMMS. Top management issues policies on energy management and conducts periodic evaluations related to the implementation of energy management. Management monitors program achievements and determines corrective action if needed as soon as possible. Financial support and resources are determined by management during the evaluation and plan for financial and resource needs which is carried out at the beginning of each year. In process of recertification ISO 50001:2018 there is several key successes:

1. Tightening scope and role of responsibility of department that have operational control of SEU.
2. Gamification to all parties (supplier and subcontractor) for energy use.
3. Normalize any substandard condition that make bias of energy performance analysis.

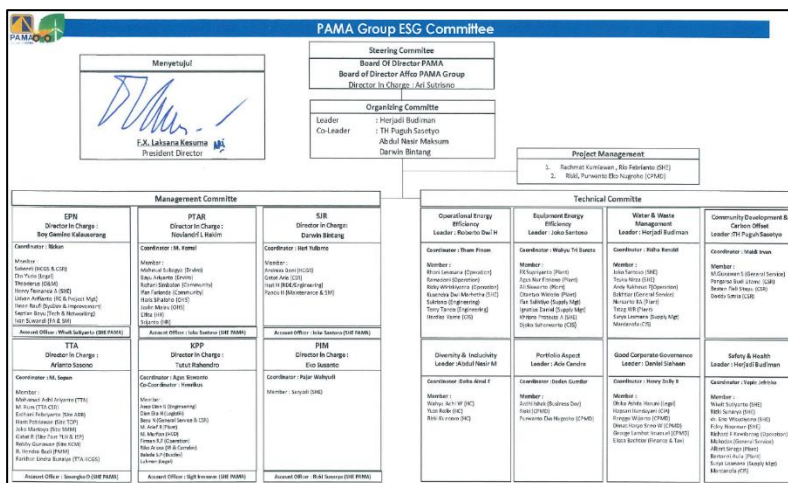


Figure 11. PAMA Group Environment, Social, Governance

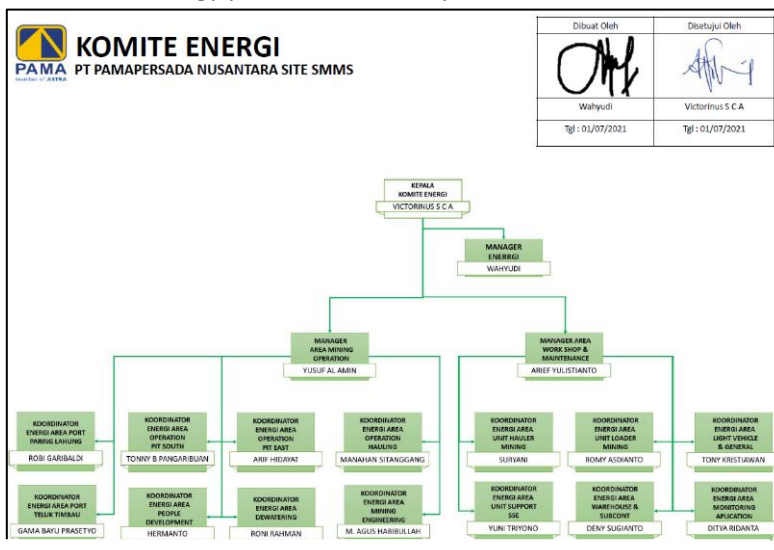


Figure 12. PAMA SMMS Energy Policy (Left) & PAMA SMMS Energy Committee (Right)

Determination of energy performance baseline is done by regression method. From the regression data, 2020 is set as the baseline. The 2020 baseline will serve as a reference for measuring energy performance in 2021 and setting targets for each energy efficiency improvement. With $R^2 = 0,9545$ (Figure 10), 2020 energy performance data is reliable to use as baseline. In determining priority energy efficiency programs, the identification of significant energy use (SEU) is carried out first. based on the energy profile, the significant energy use of PAMA SMMS can be seen in the figure 14.

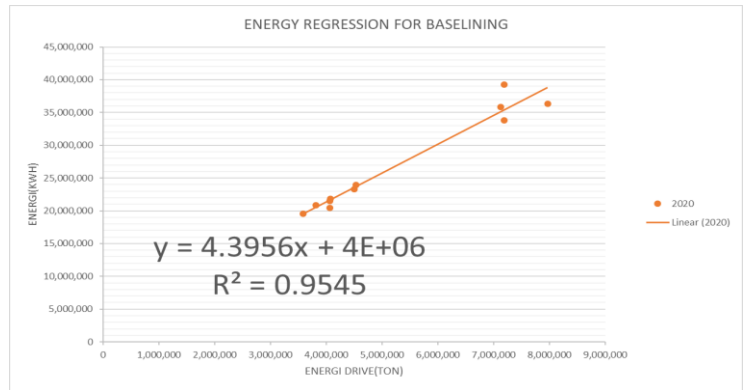


Figure 13. Baseline with Regression Methode

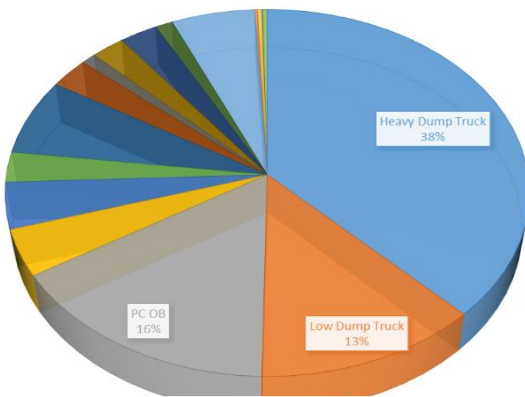


Figure 14. PAMA SMMS SEU

PAMA SMMS Significant Energy Use (SEU) consist of heavy Dump Truck (38%), Low Dump Truck (13%), and Overburden Excavator (16%). On this improvement period, PAMA SMMS focuses on Operator Behavior Based Energy Saving, Road Infrastructure & Efficient Fleet Management System, and Machine Efficiency Performance Improvement. Improvement choose by energy committee based on 2020 energy review and mandatory program from PAMA Head Office. PAMA SMMS prioritizes the use of technology in implementing energy management programs. This can be seen from the installation of several devices that support energy efficiency programs (FECO, POCSYS, SMART-D).

Do, Check, and Act

Behavior Based Energy Saving (Involvement of Operation Departement, Safety Health Environment Department)

Operator is one of the keys to our energy improvement program, we ensure that the operator understands the unit's operating procedures. So that operators can work safely, productively and efficiently. We also have a Big Data monitoring system that monitors operator behavior in operating the unit called **IO-Intelligence Operationality**, so that we can follow up on behavior that does not support us quickly and precisely. **Eco-Driving training** is organized by Pama's operational training center, both through simulators and field practice aimed at all operators as an effort to form correct and energy efficient driving competencies and build a culture of energy awareness among individual operators. **Energy saving from this improvement is 4.940 GJ/year**

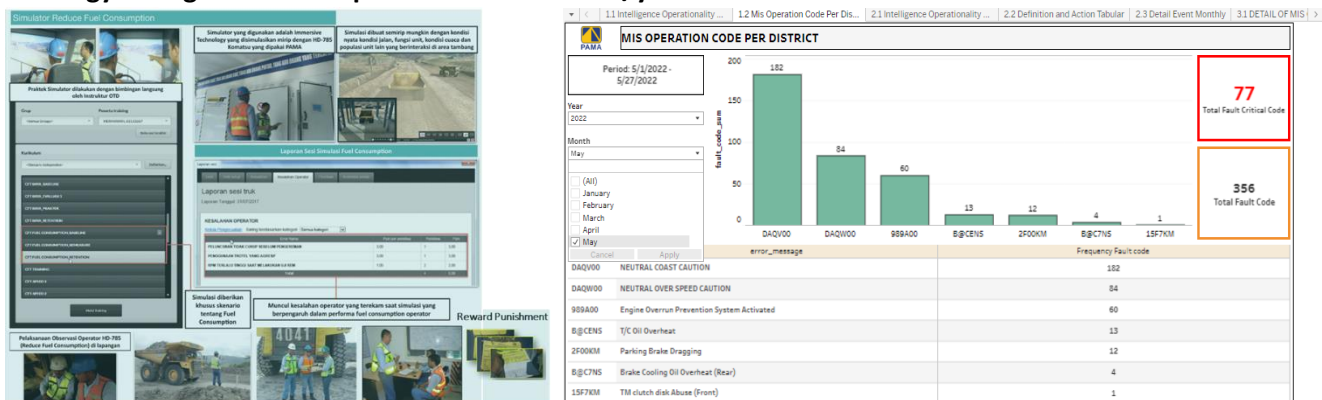


Figure 15. Eco Driving Training for Operator (Left) & Behavior Based Energy Saving Dashboard (Right)

Road Infrastructure & Efficient Fleet Management (Involment Engineering Departement, Operation Departement)

We as pioneers are committed to being able to optimize the condition of the mined road as an environmental factor that affects the optimization of the speed unit by carrying out road design in accordance with good mining rules and energy efficiency, ensuring execution in the field according to the plan and controlling environmental conditions with periodic and quick inspections. action for each deviation.



Figure 16. Optimum Speed Average Improvement

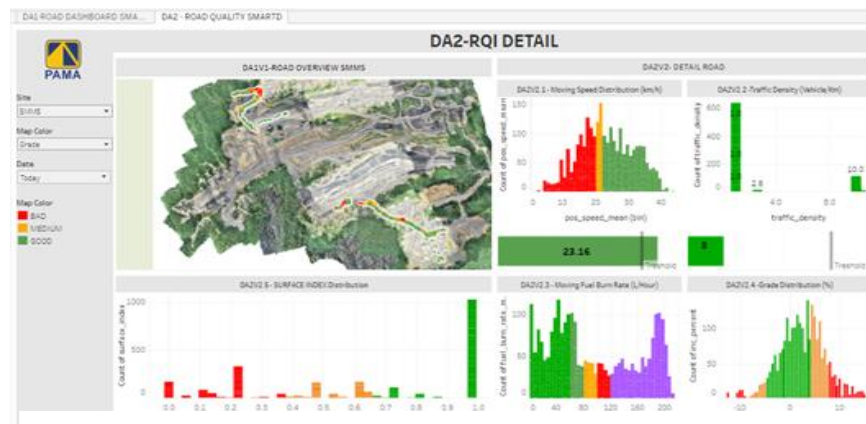


Figure 17. Road Quality Dashboard

We are committed to always creating zero overgrade road conditions in terms of planning from engineering and field execution, because if an overgrade occurs it can increase fuel consumption in the unit, we also have a "SMARTD" Big Data digitization system that can be used to monitor road conditions in real time. From this SmartD application we can monitor the condition of grade, surface, speed unit and fuel consumption unit. **Energy saving from this improvement is 44.462 GJ/year**

Machine Efficiency Improvement (Involvement of Plant Departement, Supply Management Departement)

Dump Truck is the top SEU of PAMA SMMS. We are committed to always doing and looking for improvement opportunities in reducing energy consumption, where one of what we do is to regulate the combustion of the Fuel unit hauler that operates with a tool that we created with the name **Fuel Economic Controller (FECO)** while still considering the performance of the hauler unit. **Energy saving from this improvement is 114.976 GJ/year.** Optimizing the use of **Excavator units** in order to produce as well as possible is done by means of daily monitoring of unit performance, periodical service, forming reliable supervisors in dealing with productivity condition problems, as well as controlling infrastructure problems that may occur, thereby reducing the productivity of PC units. We need to identify potential part damage as early as possible and repair it immediately. This is one of our commitments in maintaining the performance of the operating unit so that the condition of the low power unit can be suppressed to minimize fuel wastage when operating, to support this we created a system that we call **POCSYS**, from this system the unit is able to identify potential damage to the unit. Main

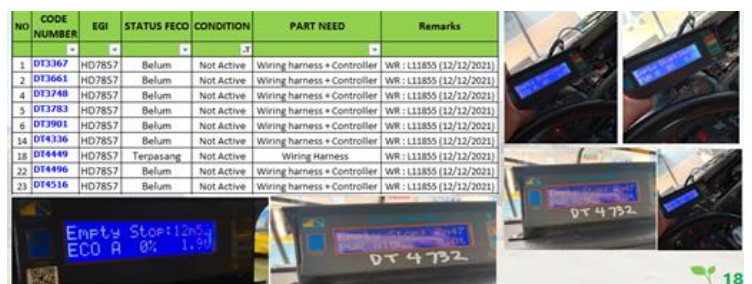


Figure 18. Fuel Economic Controller (FECO)

ISO 50001 Energy Management System – Case Study

2022

INDONESIA

component in optimizing the performance of the loader unit in order to achieve optimal productivity is by paying attention to the condition of the loader cylinder unit. **Energy saving from this improvement is 33.354 GJ/year**



Figure 19. POCYS and loader cylinder monitoring

In each period, periodic evaluations are carried out to see if the improvement activities carried out are still appropriate so that they are able to get results according to the targets set by site management. From the results of improvements and evaluations that have been carried out, the level of achievement of Energy Performance indicator on our site.

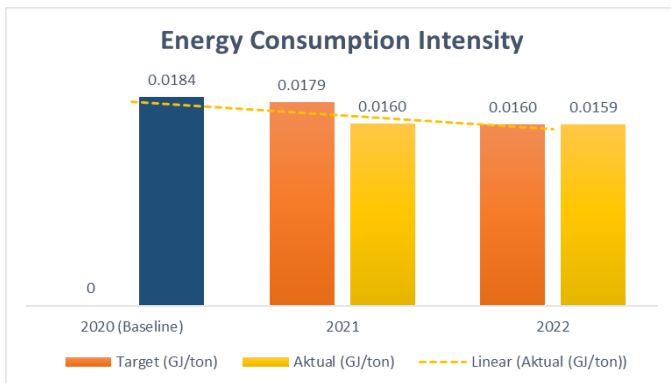


Figure 20. Energy Consumption Intensity Level 1

Through the implementation of good energy management, PAMA SMMS succeeded in reducing energy intensity from the baseline in 2020 of 0.0184 GJ/ton to 0.0160 GJ/ton in 2021. This is a very good achievement because the reduction target mandated by the Head Office is 0.0179 GJ/ton. Meanwhile, for 2022 until this report runs, the energy intensity of PAMA SMMS is 0.0159 GJ/Ton, smaller than the target for Q1 2022 reduction of 0.0160 GJ/Ton.

Dump Trucks, which are SEU PAMA SMMS, have a big role in reducing total energy intensity. Dump Truck Energy Intensity reduced by 20% during implementation period. Meanwhile, through several energy efficiency programs, it can reduce the energy intensity by 0.14%.

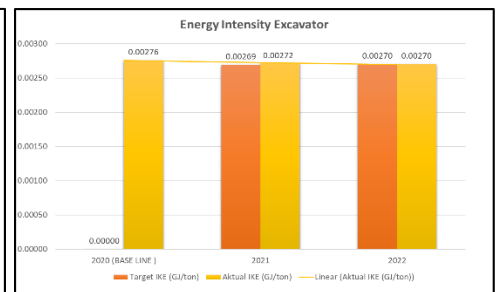
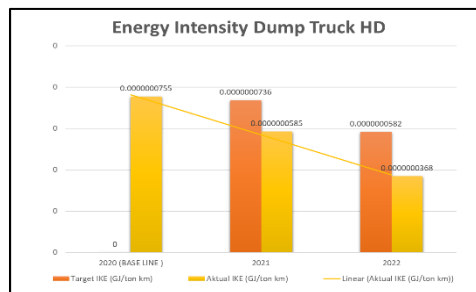


Figure 20. Energy Consumption Intensity Level 2 (Dump Truck & Excavator)

On **Red Period**, PAMA SMMS still had fluctuative energy performance. **Orange Period** PAMA SMMS started initial implement ISO 50001. On **Green Period**, ISO 50001 cycle running well and energy improvement show efficiency progress and record best ever energy performance. **Blue Period** PAMA SMMS adapt with new challenge: **Production increase**.

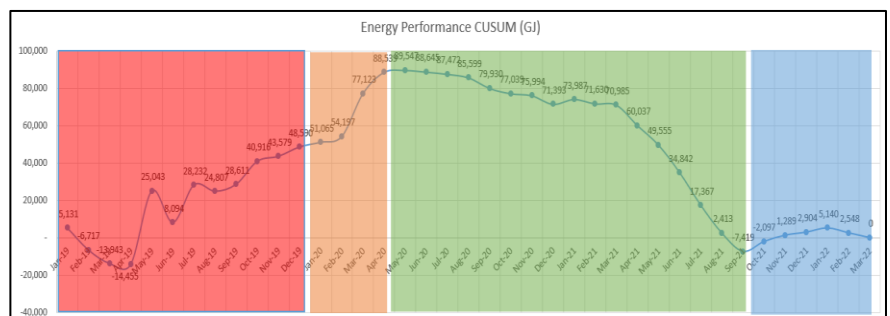


Figure 21. Energy Use CUSUM



“PAMA SMMS has done a very good reduction in energy intensity, especially since it can educate and change operator behavior to become more energy efficient, which is something extraordinary”

—Ari Sutrisno, Human Capital General Service and Safety Health Environment Director - PT Pamapersada Nusantara

Transparency

PAMA SMMS ISO 50001 Achievement has been published in several report:

1. PT Pamapersada Nusantara Sustainability Report 2021
2. PT United Tractors Tbk. Sustainability Report 2021
3. PT Astra International Tbk. Sustainability Report 2021

What We Can Do Differently

PAMA SMMS committed to do energy improvement in order to reduce GHG Emission and strive to Net Zero by 2050.

Mitigation Aspiration with alternative and increase renewable energy mix Hybrid tower lamp, electric forklift, hybrid genset as Medium-Term milestone program. And Electric Vehicle, Hydrogen Based fuel as Long-Term milestone program initiatives. Implementation of ISO 50001. The sustainability of the implementation of energy management through ISO 50001 is something that PAMA SMMS must do in overseeing the program on a medium to long term basis. Nationally, PT Pamapersada Nusantara will also extend the scope of ISO 50001 certification to other districts. This is done to ensure that the energy management system is carried out with correct and appropriate rule.

| Term | Unit | Program | Deskripsi | Diviso | EGI | Status | Progress | Target Done | Reducing Fuel (Target) per Project | Status |
|--------------------------|----------|----------------------------|---|--------|---------------------------|-------------|----------|-------------|------------------------------------|----------|
| Mid term (3 - 5 years) | All Unit | Hybrid Tower Lamp | kombinasi towerlamp menggunakan battery dan diesel | Plant | Tower Lamp | Trial | 0% | 2024 | 55% | Open |
| | | Electric forklift | Konversi unit Forklift elektrik | Plant | Forklift | Running | 2% | 2026 | 100% | Progress |
| | | Hybrid Genset | Konversi Genset solar ke Gas | Plant | Genset | Trial | 0% | 2024 | 33% | Open |
| | | SCR Engine Cummin series | menambahkan SCR pada engine2 cummins series | Plant | Excavat or Hitachi series | Opportunity | 0% | 2024 | 10% | Open |
| Long term (5 - 15 years) | All Unit | Electric Excavator | Konversi Excavator menjadi elektrik excavator | Plant | All Excavat or | Opportunity | 0% | 2030 | 100% | Open |
| | | Hybrid Light Dump Truck | Hybrid Light Dump Truck Solar + Gas | Plant | Volvo Dump truck | Opportunity | 0% | 2030 | 40% | Open |
| | | Electric Scania Dump Truck | Konversi bahan bakar Truck Scania menggunakan Battery | Plant | Scania Series | Opportunity | 0% | 2030 | 100% | Open |
| | | Gas Scania Dump Truck | Konversi bahan bakar Truck Scania menggunakan Gas | Plant | Scania Series | Opportunity | 0% | 2030 | 100% | Open |
| | | Electric Drive Dump truck | Konversi Dumptruck menjadi electric drive dumptruck | Plant | HD7857 | Opportunity | 0% | 2035 | 20% | Open |
| | | Hydrogen Dump truck | Konversi bahan bakar HD menggunakan Hydrogen gas | Plant | HD7857 | Opportunity | 0% | 2035 | To be confirm | Open |

Figure 20. PAMA SMMS Medium & LongTerm Energy Program Plan

Adaptation Aspiration with carbon sequestration PAMA SMMS was planted **81.496 trees on 118,54 Ha** is equal with reduce **3.082,04 tCO₂e**.



Figure 22. PAMA SMMS Transition Target & Net Zero Program Plan by 2050 (left) and Tree Planting (Right)