ISO 50001 Energy Management System – Case Study

2024 Indonesia

CHANGSHIN INC

The first sport footwear manufacturing company certified with ISO 50001 in Indonesia. CHANGSHIN INC Indonesia Factory is consistent in maintaining energy and environmental sustainability based on ISO 50001:2018. Over three years, CHANGSHIN INC Indonesia Factory has committed to improving energy efficiency, successfully achieving a 13% increase. As a result, GHG emissions have been reduced by 7,565 TonCO_2e.



Figure 1 Green Team CHANGSHIN INC Indonesia Factory

Case Study Snapshot	
Industry	Footwear manufacturing
Product/Service	Footwear
Location	Karawang Plant and Cikampek Plant
Energy performance improvement percentage (over the improvement period)	13 % improvement over 3 years
Total energy cost savings (over the improvement period)	USD 808,382
Cost to implement Energy Management System (EnMS)	USD 488,697
Total energy savings (over the improvement period)	11,720 MWhe
Total CO_2-e emission reduction (over the improvement period)	7,565 Metric Tons

Organization Profile / Business Case

CHANGSHIN INC is one of the largest footwear manufacturing groups in the world, with a total production capacity of 62 million pairs per year across over 50 models. CHANGSHIN INC consistently strives to mature into a "**top-flight company that grows together with its customer**" driven by its vision of becoming a "**world-class manufacturer**". CHANGSHIN INC Indonesia Factory is one of the factory site that established in May 2010, located in Karawang and Cikampek. CHANGSHIN INC Indonesia Factory utilizes multiple energy sources, including electricity, natural gas for thermal oil heating (Boiler), diesel for gensets and fleet operations, with an average annual energy consumption of 95,560 MWhe.

Our Motivation for Managing Energy – CHANGSHIN INC Indonesia Factory's facilities are comprehensive, covering the entire footwear manufacturing process, from raw materials to producing A-grade quality footwear. In this mature age, CHANGSHIN INC Indonesia Factory overcome various challenges in the global market era, so management make critical decisions to sustain the company's business. The increment of global market competition poses challenges for CHANGSHIN INC Indonesia Factory's survival, particularly in managing operational costs that continue to increase such as material and energy prices. Therefore, the best approach for the company is to focus on reducing energy consumption. With numerous facilities, the company incurs significant energy costs. Thus, effective energy management is essential to contribute to operational cost savings. Additionally, the company must comply with government energy planning regulations and buyer demands to keep consistency of maintaining energy, environmental sustainability, and reduce GHG emissions from the footwear manufacturing process to produce high-

quality and eco-friendly product. Since its inception, the company has initiated energy efficiency initiatives. The ISO 50001:2018-based Energy Management System (EnMS) has been instrumental in sustaining energy management by identify energy usage based on Significant Energy Use (SEU), ensuring targeted energy efficiency activities are carried out effectively.

Energy and Sustainability Strategy – CHANGSHIN INC Indonesia Factory has been dedicated to implementing the Energy Management System (EnMS) since 2012. We received support from UNIDO energy management experts when we first implemented the ISO 50001. This led to our ISO 50001:2011 certification in 2017. Then, in 2022, we migrated to ISO 50001:2018 to stay updated with the latest standards. In the process, CHANGSHIN INC Indonesia Factory also transformed its production operations through energy efficiency and conservation programs. This was achieved by implementing digital automation systems to integrate machinery and monitor energy usage across all factory facilities. CHANGSHIN INC Indonesia Factory maintains consistency in implementing ISO 50001:2018 EnMS with the target of 25% reduction of energy intensity until 2025 and through programs that are beneficial for the environment too. Aligned with EnMS practices in energy conservation, this also significantly contributes to reduce GHG emissions. CHANGSHIN INC Indonesia Factory actively supports the government's GHG emissions reduction targets, aiming for a 29% decrease by 2030, and aligns with the buyer's goal of a 46% reduction by the same year. Since implementing EnMS, CHANGSHIN INC Indonesia Factory has successfully reduced GHG emissions by 13%, equivalent to 7,565 TonCO2e, through energy efficiency projects conducted over three years. We deeply understand our role in preserving environmental sustainability, both now and in the future, Energy Management System is one of the pillar of Chang Shin's Sustainability Vision (Figure 2) and align to support commitment of global warming mitigation and environmental sustainability.

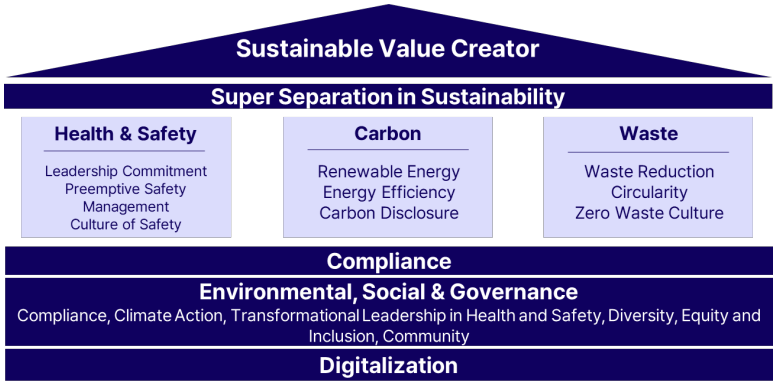


Figure 2 CHANG SHIN INC Sustainability Vision House



"We have put sustainable development first and foremost as our management goal and is in action, one of them is energy management system ISO 50001." ***—Lee Sang Sun, General Director***

Business Benefits

In efforts to implement EnMS ISO 50001, CHANGSHIN INC Indonesia Factory has invested approximately US$ 488,697. Most of this budget has been utilized for consultancy and external expert assistance, including training to enhance the competency of the internal energy team, certification processes, technical support, energy usage monitoring tools and others. Considering the complexity of footwear production processes, management realizes that the incurred costs are almost negligible compared to the significant benefits obtained after implementing EnMS. Among these benefits are:

Conserving the Energy – By strategically implementing targeted energy efficiency measures, CHANGSHIN INC Indonesia Factory has achieved an absolute energy saving of 11,720 MWhe since FY2021 to FY2023. To measure energy savings, we first assess energy performance by calculating the difference between actual energy consumption and

estimated energy consumption based on predetermined baseline data. This difference is presented in cumulative sum (CUSUM) format (Figure 3).

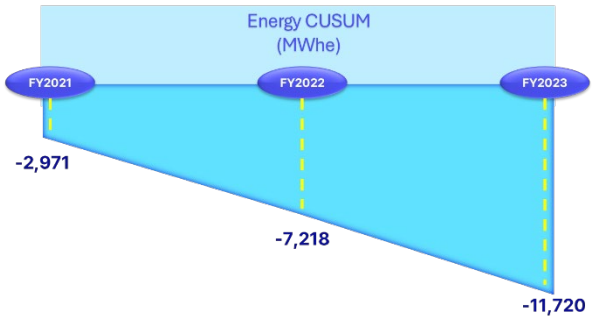


Figure 3 Energy CUSUM

Energy Cost Savings – CHANGSHIN INC Indonesia Factory achieved energy cost savings of US$ 207,945 in the first year, continuing to accumulate a total cumulative savings of US$ 808,382 over three years (Figure 4). With absolute energy savings, the company has been able to reduce energy intensity by 12% from the baseline (Figure 5), while total production has increased by 28% this year (Figure 4).

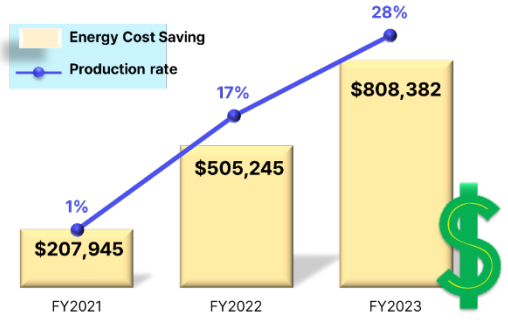


Figure 4 Cost Saving and Production Rate

Reducing Cost of Production – Implementing energy efficiency based on EnMS (Energy Management Systems) can significantly reduce utility costs, especially in the consumption of natural gas for Oil Thermal Heaters, which is the second-largest energy cost after electricity. By conducting regular maintenance and innovating in utility modifications, our finance department has validated that this contributes to the overall reduction in utility costs as part of the company's Production Costs. Calculated utility costs have decreased by 8.1% from US$ 0.03 per pair of footwears in FY2020 to US$ 0.02 per pair of footwears in FY2023.

GHG Emission Reduction – Aligned with EnMS practices in energy conservation, this also significantly contributes to reducing GHG emissions. CHANGSHIN INC Indonesia Factory actively supports the government's GHG emissions reduction targets, aiming for a 29% decrease by 2030, and aligns with the buyer's goal of a 46% reduction by the same year. Since implementing EnMS, CHANGSHIN INC Indonesia Factory has successfully reduced GHG emissions by 13%, equivalent to 7,565 TonCO_2e, through energy efficiency projects conducted over three years. In addition, management has also taken several steps to reduce the company's GHG emissions, including the voluntary purchase of 62,299 units of REC TIGRs and the systematic planting of katapang trees along the Citarum River watershed area as part of CSR initiatives. These efforts are aimed at greening the river area and fostering environmental stewardship within the community.

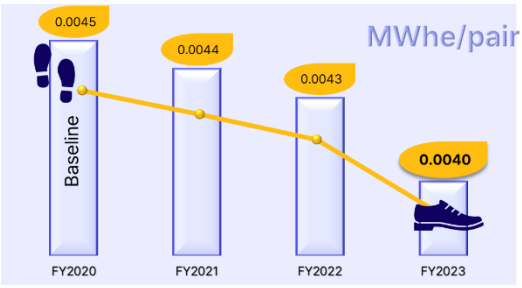


Figure 5 Energy Intensity

Conserving the Water – In our sustainability efforts, EnMS reminds us to use water responsibly. CHANGSHIN INC Indonesia Factory maintains well-managed WWTP facilities that allow for water reuse in both production and non-production processes without compromising water quality. Additionally, we harvest rainwater from the factory roof, which is treated through DWTP for employee use. Through these initiatives, we can save more than 48,341 m^3 of groundwater annually.

Corporate Social & Governance Benefits – EnMS delivers positive impacts for stakeholders, including buyers, employees, suppliers, government and regulators, as well as the broader community. This is evident of CHANGSHIN INC Indonesia Factory's consistent efforts in environmental sustainability, ensuring buyer satisfaction by achieving energy reduction and GHG emissions targets while maintaining product quality. CHANGSHIN INC Indonesia Factory also provides regular environmental awareness training for employees, aiming to enhance knowledge, cultivate a culture of sustainability, and develop leadership qualities in preserving the environment. And management carefully checks that all our suppliers follow Good Manufacturing Practices and show strong commitment to environmental

sustainability. The government also recognizes our efforts in implementing EnMS, confirming compliance with existing regulations by reporting energy management online through the POME website. All these achievements will ultimately maintain the reputation and credibility of CHANGSHIN INC Indonesia Factory within the community.

Multiple Sites Benefits – In the footwear production process, there are several stages including bottom and midsole manufacturing, upper and accessories production, and assembly. CHANGSHIN INC Indonesia Factory operates in two plant locations in Karawang and Cikampek. The facilities at the Karawang plant are more comprehensive, encompassing processes from bottom manufacturing to finished good footwear, while the Cikampek plant focuses on midsole production to support the operations in Karawang. EnMS has facilitated energy management within the company by establishing an energy team between the Karawang and Cikampek plants, ensuring a shared understanding and conduct energy management based on ISO 50001 standards.

Plan

Leadership and Commitment – CHANGSHIN INC Indonesia Factory believes that consistently implementing EnMS can have a positive impact, ensuring the company's sustainability, and creating a work environment that cares about the environment. In line with Chang Shin's Sustainability Vision, top management has set an energy policy for CHANGSHIN INC Indonesia Factory to reduce energy use and GHG emissions in the long term, comply with energy regulations, improve energy efficiency, and use more renewable energy sources. Additionally, top management has established a Green Team to oversee the implementation of EnMS, led by a certified Energy Manager, involving responsible employee from various departments to ensure consistent and structured EnMS implementation. Top management also allocates financial resources to ensure the execution of energy projects, allocating US$ 221,321 for Capital Expenditure (CAPEX) and investing US$ 20,233 for Operational Expenditure (OPEX) in competency enhancement through certifications, training, workshops, and audits.

Data Quality and Energy Review – The EnMS helps us to be more cautious about energy usage in the company. CHANGSHIN INC Indonesia Factory has installed FEMS (Factory Energy Monitoring System) to monitor electricity consumption and power quality in real-time at every electrical panel meter distributed across more than 10 buildings (Figure 9). To ensure its accuracy, the company conducts calibration and routine maintenance of electrical panel meters every year. We also conduct power quality analysis by competent internal employees led by certified energy auditors regularly using power quality analyzers. As part of the EnMS requirements, we also conduct internal audits twice a year. With these facilities, we obtain actual energy measurements within the company, allowing us to monitor energy usage at each factory facility, analyze energy consumption, identify energy usage anomalies, and seek energy-saving opportunities.

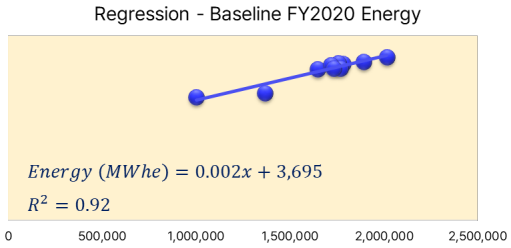


Figure 6 Energy Baseline

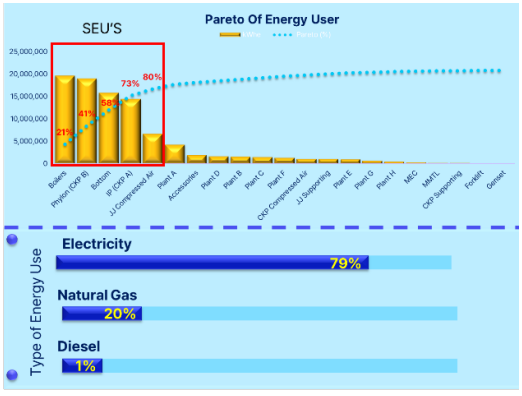


Figure 7 Energy Mapping

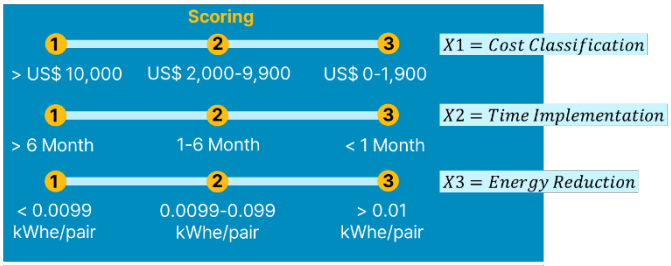
Energy Baseline and Energy Performance Indicator (EnPI) – CHANGSHIN INC Indonesia Factory determines the energy baseline using regression methods with the highest correlation value of over 90% between energy consumption and production output (Figure 6). Footwear production in pair is set as the energy indicator parameter. We chose FY2020 as the base year and energy baseline because it provided the most representative normalization for future conditions. We monitor the types of energy used and map each energy user. We found that electricity is the most used energy, making up 79% of our total energy consumption. After monitoring all facilities, we identified the Boiler, Phylon (CKP B), Bottom, IP (CKP A), and JJ Air Compressor as Significant Energy Use (SEU), contributing to over 80% of our energy use (Figure 7).

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Support on Strategy & Target of Organization – CHANGSHIN INC Indonesia Factory's management review long-term energy-saving possibilities listed in the Long-term Plan as energy projects. When creating the list of energy projects, we evaluate them based on return on investment, implementation time, and their impact on reducing energy (Figure 8). We start implementing energy projects based on their priority level, from high to low.

Development for Multiple Sites – By adopting ISO 50001, we can easily implement an Energy Management System (EnMS) at two CHANGSHIN INC Indonesia Factory locations, namely Karawang and Cikampek. We consistently update data and use the latest technology to continuously monitor energy management at both of our sites. Our structured energy team has a uniform understanding and knowledge of the EnMS, helping CHANGSHIN INC Indonesia Factory create a consistent working environment that supports energy management



Category	Total Score
Low	1 - 3
Middle	4 - 6
High	>6

Figure 8 Project Priority Assessment

Managing GHG Emission – CHANGSHIN INC Indonesia Factory has implemented GHG emission management based on ISO 14064 and evaluated Life Cycle Impact Assessment using OpenLCA software to identify hotspots generating the largest GHG emissions in the footwear manufacturing process, namely the bottom and midsole processes using the highest electricity and natural gas energy, resulting in a total GHG emission of 42,019 tons CO_2e per year. From these findings, we have identified and prioritized energy efficiency focus areas, which are reflected in the opportunities list with high category.

Re-certification – In line with CHANGSHIN INC Indonesia Factory's vision for consistent energy and environmental sustainability, we have recently undergone recertification and upgraded from ISO 50001:2011 to ISO 50001:2018. Additionally, in 2022, we integrated it with other management systems such as ISO 14001:2015 and 45001:2018.

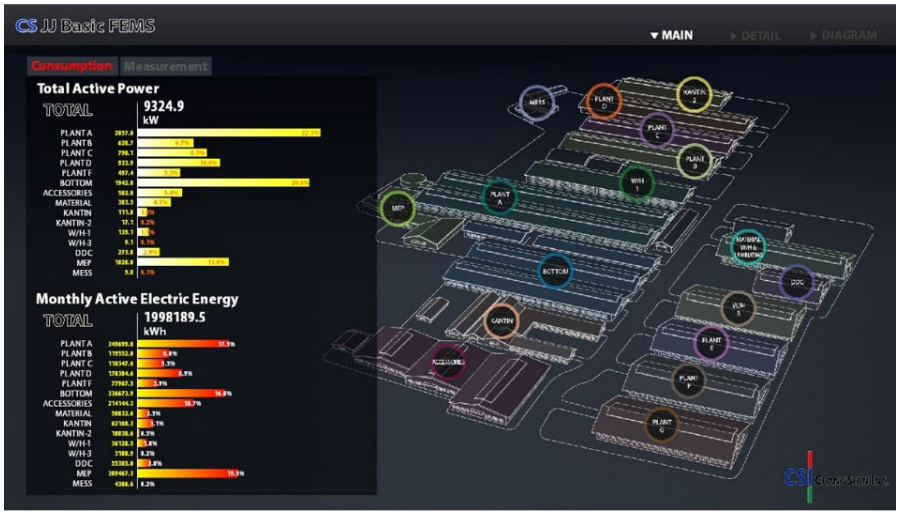


Figure 9 Factory Energy Monitoring System



"We worked on ISO 50001 for beyond compliance reasons, now we feel the best benefits from the business side."

—Ida Nurhaida, Deputy Director Responsible Sourcing and Manufacturing

Do, Check, and Act

Operation and Implementation – Top Management establishes energy management as Policy Deployment in the company to support the achievement of Chang Shin Vision. We develop an Energy Carbon Long-Term Plan every five years and an Annual Plan each year, which includes energy management activities and a list of energy efficiency projects. The Green Team is responsible for managing energy efficiency projects by carefully analyze and assesses the priority of energy projects, therefore, The Green Team integrates to communicate the energy efficiency project plans to the field energy team and implements all projects starting from high to low priority categories (Table 1). Energy management achievement, progress of energy project, and energy performance are reported through biannual management reviews and Top Management is not only involve in reviewing monthly and yearly energy performance but also provide input for continuous improvement.

Table 1 Energy Project

Activity	Saving			Score			Priority
	Energy (MWhe)	Emission ($TonCO_2e$)	Cost (USD)	X1	X2	X3	
Efficiently machine control	5,987	4,615	419,127	3	3	3	High
Install and maintenance air preheater performance for efficiency Boiler	2,001	458	128,096	1	3	3	High
Inspection for reduce air compressor leakage from 25% to 10%	1,480	1,140	103,581	2	3	2	High
Install insulator between hot & cold station for reduce heat loss	856	659	59,899	1	2	2	Middle
Install oxygen controller for Boiler	708	162	49,564	1	2	2	Middle
Install automatically system for On/Off Machine using PLC, LD Micro or IC NE55	683	527	47,819	1	2	2	Middle
I3 Increase motor efficiency by replace inefficiency motor with IE3 motor	5	4	296	1	2	1	Middle

In addition to implementing initiatives through projects outlined in the Long-term and Annual plans, our top management fully supports all employees who innovate in energy savings through the Kaizen Award. Through the Kaizen Award program, all employees can compete to contribute their ideas for energy savings in their respective work areas. As a form of appreciation, management rewards the entire team that significantly contributes to energy savings in the company with monetary incentives (Figure 10).

Operational control – The production output of footwear, measured in pair, is a key variable in our energy performance index. Efficient energy consumption in footwear production is influenced by both operational control and maintenance. We establish critical operational parameters (ER6 - OP) managed by SEU's person to maintain optimal conditions for energy efficiency. Additionally, critical maintenance parameters (ER6 - MP) are monitored by the TPM team using Centralized Machine Monitoring System (CMMS) technology. Both ER6-OP and ER6-MP are reviewed regularly, with corrective actions taken daily, weekly, and monthly to ensure ongoing efficiency improvements.

Team Collaboration – The Green Team is responsible for implementing EnMS across all CHANGSHIN INC Indonesia Factory locations, including Karawang and Cikampek. The Green Team consists of 26 members, led directly by a certified Energy Manager. It involves various relevant departments such as finance, environment, production, TPM and utility, CE, and other supporting employees. Also, we have 11 certified internal auditors of ISO 50001 who conduct internal audits twice a year. To improve our employees' skills and knowledge, our HRD team creates and evaluates training plans each year. Energy awareness training is provided to new employees and conducted annually for all employees.

Key high-level equations and explanation – Individual energy savings were calculated for each facility expected energy consumption (from their individual baseline) is Actual Energy Consumption – Expected Energy Consumption. Individual savings for Electrical and natural gas were accounted and a cumulative summary to total energy savings, Energy performance improvements as follow:

$$\frac{Total\ Energy\ Savings}{Baseline\ Period\ Energy\ Consumption}\ x\ 100$$

Assessing Energy Performance – We measure our energy performance on a weekly, monthly, quarterly, biannual, and annual basis using an energy equation that calculates energy consumption compared to the baseline in a normalized format. The energy performance results are calculated using Excel and displayed in CUSUM energy graph. If the CUSUM shows a negative value, it indicates that energy efficiency has been achieved compared to the baseline. We will evaluate and plan follow-up improvements if we observe a deviation of more than 25% from the energy performance of the previous month according to ISO 50015 (Measurement and verification of organization's energy performance). We have developed an energy monitoring system in each building integrated with building panel meters to display real-time electricity usage results (FEMS). Additionally, our company already has GMES (Global Manufacturing Execution System), an interactive system to report production results across all areas in real-time, including production output, defects, footwear components, and waste.

GHGs implementation – Through our EnMS, we have effectively identified that the electricity consumption in the bottom and midsole areas, along with natural gas usage, is part of the Significant Energy Use (SEU) at CHANGSHIN INC Indonesia Factory and significant contributor to GHG emissions. This has been proven too through the life cycle impact assessment as a hotspot of footwear production using OpenLCA software. Therefore, we believe that focusing on implementing energy efficiency for electricity and natural gas will significantly increase energy savings and reduce GHG emissions. One innovative measure we have taken to manage these hotspots is the installation of an air preheater on our boiler to enhance natural gas efficiency, which is categorized as a high priority. This initiative has resulted in substantial savings, reducing natural gas usage by 2,709 MWhe. Additionally, we continuously monitor electricity energy efficiency projects to ensure ongoing improvements. We calculate GHG emissions using formulas agreed upon by buyers and relevant ministries, and we distribute the results nationally for PROPER purposes.



Figure 10 Kaizen Award, Energy Meeting and Training

Continual Improvement – Since implementing EnMS, we've achieved a 13% energy savings compared to the baseline. This indicates a successful outcome from our EnMS implementation at the company. The company is committed to continuously improving based on audit findings, whether from internal or external audits, as part of its efforts to enhance operations. The results of implementing EnMS have met the expectations of top management by achieving energy targets. Therefore, management has challenged us to upgrade the baseline and energy targets in the future. Our next plan is to calculate the baseline using multiple regression methods, aiming for more accurate energy predictions with a precision level above 95%.

Transparency

Our progress and results in achieving ISO 50001 are reported to and validated by our government through:

- Online Energy Management Reporting (POME) by the Indonesian Ministry of Energy and Mineral Resources (https://simebtke.esdm.go.id/sinergi/)
- Corporate Performance Rating Program in Environmental Management (PROPER) and emission monitoring by the Indonesian Ministry of Environment and Forestry (KLHK) (https://proper.menlhk.go.id/) and (https://ditppu.menlhk.go.id/simpel/).
- Our ISO 50001 certification can be seen on (https://ceksertifikat.sucofindo.co.id/publik/info?param1=1&param2=24998&param3=)

Additionally, we publish our energy and environmental performance through our annual Sustainability Report, which is available on our company website. As part of our commitment to the traceability of sustainable materials we use, some of our products are certified under ISCC Plus.

- Chang Shin Sustainable Report on (http://www.changshininc.com/sustainability/protected_en.html)
- Traceability product CHANGSHIN INC Indonesia Factory in ISCC Plus, Cert. Number: ISCC-PLUS-Cert-ID218-20240073 and ISCC-PLUS-Cert-ID218-20240074 on ISCC website (https://www.iscc-system.org/certification/certificate-database/all-certificates/)

What We Can Do Differently

Lessons Learned – In a relatively short period, we have successfully implemented our EnMS effectively. However, we have also learned many lessons from its execution. Through our EnMS, we will continue to explore energy management. Here are the areas we plan to develop.

1. The baseline determination needs to be adjusted using multiple regressions to enhance accuracy in energy predictions, thus ensuring that energy analysis results can depict actual conditions in the future.
2. The footwear we produce consist of over 200 footwear models. Understanding energy usage based on each model will provide many benefits for us, especially in terms of business sustainability and financial forecasting for the company.
3. Monitoring the usage of natural gas independently using integrated measuring tools through the system to provide real-time usage values.

Looking Ahead – We are committed to maintaining the implementation of EnMS as an integral part of our company culture, as part of management efforts to ensure environmental sustainability within the company. We recognize the importance of monitoring energy usage in the company, and we are committed to continually enhancing our FEMS monitoring system with the latest technology. Our management targets are not only focused on monitoring energy types but also on developing facilities to monitor energy-consuming equipment such as machinery and utilities. Another effort we undertake is reducing GHG emissions by periodically conducting feasibility studies to transition from fossil fuel energy to renewable energy sources, such as solar panels, biomass, and waste heat recovery.