PT ISM Bogasari Flour Mills Tbk

Bogasari was the first flour mills to achieve ISO 50001 in South East Asia. The energy performance was improved by 16.6% during the first three years of EnMS implementation and is committed to a continual improvement with the integration of clean energy applications in the forthcoming years.

Figure 1. Bogasari's Integrated Flour Mills Facilities

Case Study Snapshot	
Industry	Food Manufacturing
Product/Service	Wheat Flour and Pasta
Location	Jakarta and Surabaya Plant
Energy performance improvement percentage (over the improvement period)	16.6 % improvement over 3 years (2019-2021)
Total energy cost savings (over the improvement period)	USD 3,671,800
Cost to implement Energy Management System (EnMS)	USD 53,390
Total energy savings (over the improvement period)	210,690 GJ
Total CO_2-e emission reduction (over the improvement period)	27,520 Metric Tons

Organization Profile / Business Case

As the largest integrated flour mills in the world, PT ISM Bogasari Flour Mills Tbk ("Bogasari"), with a total annual capacity of around 4.4 million tonnes, serves both industrial and retail customers in domestic and international markets. A comprehensive range of flour products is sold under established brands such as Cakra Kembar, Segitiga Biru, Kunci Biru and Lencana Merah, as well as La Fonte brand for pasta products. Bogasari operates four flour mills in Jakarta, Surabaya, Cibitung, Tangerang and is supported by its own shipping maritime units and packaging units.

Our Motivation for Managing Energy – For more than 50 years, Bogasari has maintained its leadership in Indonesia's flour industry through competitive advantages that included a diversified portfolio of consistent and high-quality products, backed by differentiated brand equities and strong distribution networks. Nevertheless, we recognize some key risk factors in our large scale operations, including the increased competition among industries and the fluctuation of commodity and raw material prices. The competition for market shares and business opportunities could affect our ability to maintain and/or increase its sales volume, while, the commodity and raw material fluctuation prices could also affect our costs of production and prices of finished products. At that point, we understand that reducing the cost of raw material or manpower can reduce the cost of production, but in the other hand, might also lead to greater risk. Meanwhile, raising the prices of finished products will not be a popular decision for our consumers. In such conditions, we opted to reduce our cost of production through the implementation of ISO 50001 - Energy Management System ("EnMS"). We are confident that the implementation of EnMS will not only provide us the opportunity to achieve the cost efficiency, but also an added value for our product quality and safety as we can integrate the ISO 50001 to impose stringent controls across all stages of manufacturing processes along with various international quality and food safety standards. This strategy enabled us to remain focused on strengthening our supply chain, reinforcing our environmental base, and improving our productivity.

Climate and Sustainability Strategy – We deeply understand our role as the custodian of the environment and its natural resources for present and future generations. We strive to be responsible and apply the precautionary approach in managing our energy and natural resources, as well as taking steps toward climate change mitigation and Greenhouses Gas ("GHG") emissions reduction. The ISO 50001 provides a perfect approach to Bogasari, so that we can transform the way we manage our energy and integrated the EnMS into our business practices.

When we first implemented the EnMS, we received support from UNIDO's energy management experts as our external consultant. We started our journey by raising awareness of ISO 50001 while also refining our energy and environmental data quality prior to developing energy baseline based on the ISO 50006 guidelines. Our pilot site in Jakarta were successfully implemented and ISO 50001 certified in November 2018, which then replicated to other sites in the following years. Bogasari Jakarta getting re-certification in March 2021 and without a doubt to having continually improved energy performance in the forthcoming years. In the process, we also transformed the flour mill operations by increasing productivity and improving industrial process efficiency. This was successfully achieved by implementing a digital automation system to integrate our yield and EnMS across our operations from the jetty port to our flour mill facilities. Our efforts are recognized by the Indonesian government, as we received the INDI 4.0 Award for our contribution in accelerates "The Making Indonesia 4.0" and the Green Industry Award which recognize the efficient and sustainable use of resources in industrial development while preserving environment and benefiting communities.

Phase 1 (2017)	Phase 2 (2018-2020)	Phase 3 (2021-2025)
Pre-conditioning • Awareness ISO 50001 • Refine data quality & baseline • Energy manager and auditors training & certification	**EnMS Implementation & Certification in Flour Mills** • Jakarta Plant *(Pilot)* • Surabaya, Cibitung, Tangerang Plant *(Replication)*	**Clean & Renewable Energy Application** • Solar Photovoltaic (PV); Total 2 MWp initial capacity with potential expansion **Extended EnMS Implementation** • Packaging Factory and Shipping Maritime units

Figure 2. Bogasari's Journey on EnMS Implementation

> ***" Apart from energy and cost efficiency, ISO 50001 is also a guidance to forming leadership and fostering sustainability culture to our employees "***
> — Bobby Ariyanto, Senior Vice President Manufacturing

Business Benefits

To implement our first ISO 50001-EnMS we spent around US$ 53,390, which was mostly for technical assistance from external experts including training, consultation and followed with accredited party certification. Considering our large and complex operations, we recognize that cost of EnMS implementation can be almost negligible, in addition to all positive impact and benefits gained during implementation, includes:

Economic Benefits

Energy Cost Saving – We achieved a US$ 1,095,700 energy cost saving in the first year and continue to a total of US$ 3,671,800 in three years of cumulative saving. Prior to determining the energy cost saving, we were measuring the energy performance by calculating the differences between actual energy consumption and the predicted energy consumption as given from the predetermined baseline. The differences were displayed in the cumulative of sum (CUSUM) and clearly described our energy performance along with energy cost saving as displayed in Figure 3.

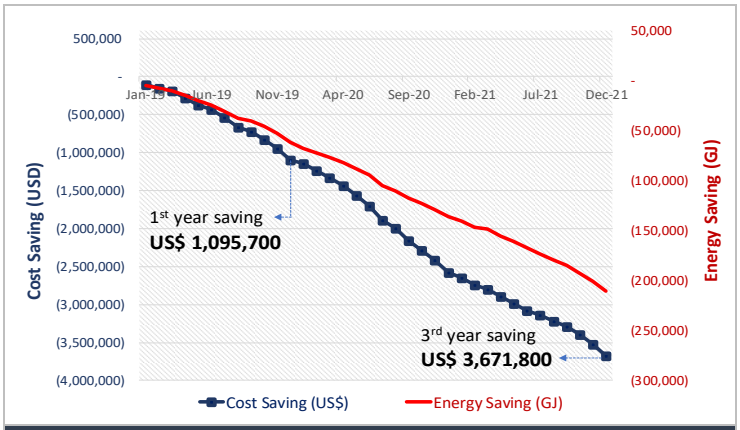

Figure 3. Energy Cost Saving in Three Years Cumulative

Reducing Cost of Production – Our finance department has validated that the achieved energy cost saving has also directly contributed to reducing total utility cost as part of our Cost of Production. The calculated utility cost was decreasing by 9.2% from US$ 6.5/ton of product in 2018 to US$ 5.9/ton of product in 2021.

Environmental Benefits

Conserving the Energy – As we effectively implement EnMS and reduce our energy intensity, we also reduced our absolute energy consumption while our sales value and production remain higher. With the total sales value increased on average of 6.9% per year, we are still able to conserve the energy by around 210,690 Giga Joules (GJ), which by calculation, the amount is indirectly equivalent to bringing opportunities for more than 3,100 micro-scale industries having access to electricity for their day-to-day business operation.

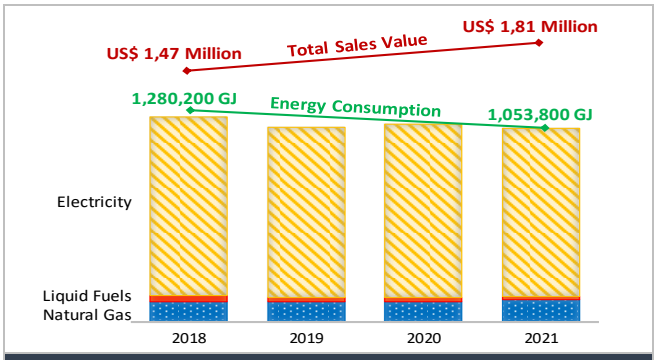

Figure 4. Energy Consumption vs Total Sales Value

Figure 5. Clean Energy - Solar PV Application

Clean & Renewable Energy Application – Beyond operational efficiency, we also considering to diversified our energy sources by using cleaner energy. Currently, we installed 1 MWp Solar Photovoltaic (PV) on top of our building and plan to expand it into 2 MWp capacity. With the free and lifetime energy available of over 120,000 GJ per year along with more capacity to be expanded in the upcoming years, we believe this effort can also have contributed to minimizing the air pollution effect on the surrounding community.

Carbon Offset – With the improved EnMS practices, we can also reduce our GHG emissions by 10.6% from 259,950 tCO_2e in 2018 to 232,430 tCO_2e in 2021. Other than that, we also plant mangroves as powerful carbon sinks in our jetty areas to prevent coastal erosion as well as absorbing carbon dioxide.

Conserving the Water – In a bid to reduce stress on groundwater resources, we installed a seawater reverse osmosis system onsite to treat seawater for use in production process. In addition, we also harvest rainwater on the roof of the factory and reuse the treated good quality wastewater for non-production purposes. The EnMS reminded us to use water in a responsible way, and with this effort we able to conserve more than 250,000 m^3 of groundwater each year.

Corporate Social & Governance Benefits

EnMS as an integral part of our business activities have positive impact on every stage of our value chain for the stakeholders, including consumers, employees, suppliers, Governments and regulators, and the wider community. By implementing the EnMs, we are able to maintain the affordable prices of products to satisfy our consumers. We raise knowledge, foster sustainability culture, and forming leadership among employees in protecting the environment. We also ensure that each of our suppliers meets applicable Good Manufacturing Practices, as well as food safety, and quality. In addition, all imported wheat grains from our suppliers are received at our port, which is recognized as “The Most Innovative Terminal to Support Green Port”, and “Best Terminal for Environmental Management Facilities”. Our Government also recognized that our efforts in EnMS implementation are far beyond compliance. We have awarded as Winner in National Energy Efficiency Award for Energy Management in Large Scale Industry together with INDI 4.0 and Green Industry Award as previously mentioned. We also get government incentives related to tax relief for purchasing energy-saving equipment and low-interest rate funds for energy conservation investments. All of achievement, at the end will maintain our company reputation and credibility for the communities.

Multiple Sites Benefits

As a large-scale corporation with multiple operating units, Bogasari recognizes that EnMS shall be developed in effective and practical ways. We choose Bogasari Jakarta as the pilot plant due to its large and complex facilities and should have easier replication to the other less-complex plants. Bogasari Jakarta invites the person-in-charge of the other plants to be involved during the development process to learn and discuss together as well as share ideas on any energy efficiency opportunities. This learning process is a key factor to speed up the EnMS implementation for all plants. Other than that, the cost for replication is minimum, since the external consultant does not necessarily require to technically assist on each of the plants. In addition, the offering cost for surveillance and certification, from an accredited third party, can be merged as one corporation instead of individually charged to each plant, thus it also reduces the total cost of replication.

Plan

Leadership and Commitment – As a leader in the flour industry for five decades, we recognize that energy is playing an essential role in our business process, and to be able to maintain the company position in longer term, therefore our top management has demonstrated its leadership and commitment with respect to continual improvement in each stage of the EnMs implementation. To reinforce the process, our top management has also formed a new organizational structure, called as Energy Management System (EnMS) & Sustainability Department. This special department is headed by a certified energy manager to lead energy management in each department as well as across Bogasari plant, and to directly report every progress and results to top management. Our top management is actively involved in regular energy meetings across the plants, to discuss and give suggestions not only for the technical problems but also related to financial aspects along with giving direct approval on financial support as required to speed up the entire progress.

Data Quality and Energy Review – We have considered some key risks and opportunities to bring smooth EnMS implementation. We are aware that in general, electricity is the main energy source and the key opportunities for efficiency will mostly come from it. On the other hand, we found that one of the risk factors is data quality, therefore, before we proceed further, we ensure that all of our power meters are properly calibrated, and replaced the entire malfunctioning meter. In such conditions, we also conducted internal energy audit, using portable instruments to obtain data reference prior to developing an energy review, analyzing energy use and consumption, identifying Significant Energy Use (SEU), and to observing Energy Conservation Opportunities (ECO).

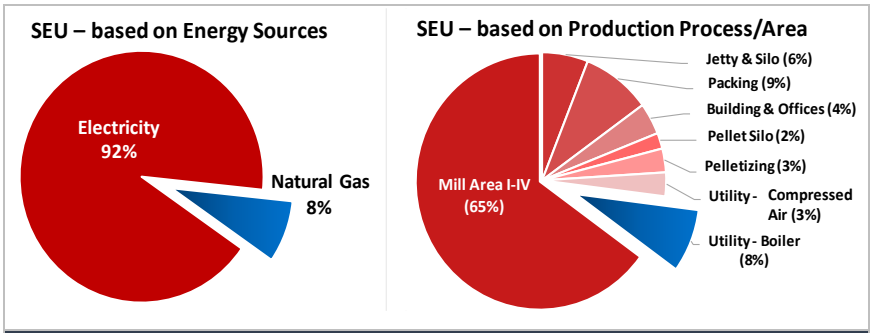

Figure 6. Review on Significant Energy Use (SEU)

Energy Baseline & Energy Performance Indicator (EnPI) – We develop energy baselines based on statistical regression analysis which have the highest correlation (>90%) between energy consumption against production drivers. We set two 1st tier level baseline (as of electricity and natural gas), and 2nd tier level baseline which represent our area production. We also determined a total of 23 baselines in 3rd tier level dedicated for Mill Areas, as we have 15 primary mills in Jakarta Plant and 8 primary mills in Surabaya Plant. We were defining 2018 as the base year due to better quality of data and minimum data normalization. Nevertheless, during the first two years of implementation, our energy team agreed to have more focus and prioritize energy efficiency in Mill Areas.

Plant	SEU	1st Tier Baseline Equation
Jakarta	Electricity	y = 73.83 x + 1898399
	Natural Gas	y = 87.99 x + 2890
Surabaya	Electricity	y= 67.76 x + 443485
	Natural Gas	y= 3.196 x + 28.631

y = energy consumption; x = wheat flour production

Figure 7. Energy Baseline Equation

Support on Strategy & Energy Target – As we observe a list of ECO during the energy review, we found that many opportunities have raised our attention. We carefully assess each potential idea by using a scoring matrix to prioritize the ECO which have higher benefit, along with lower cost and risk, to be prioritized for action plans. Furthermore, we calculate our possibility to achieve 2% energy efficiency in the first year and 5% for each subsequent year, as this was also agreed by top management. At the same time, as the demand for our product increased, top management also set targets to increase production. This simple strategy, however, was beyond successful as the productivity increased together with industrial process efficiency improvement (see results in Fig. 3-4).

Development for Multiple Sites – We acknowledge a systematic approach provided by ISO 50001 are useful for the adaptation of people, process, and technology during EnMS development. While industrial processes and technologies are similar among our plants, we found that people might be the element of differences. Therefore, Bogasari Jakarta as the pilot plant composed standard operating procedures and details of working instructions, which will be used for the energy team to have the same understanding, eliminating ambiguity and providing quality control, so that every required task can be completed in a more efficient manner. The full set of procedures then adopted by other plants.

Re-certification – We have the re-certification process along with upgrading the ISO 50001:2011 into ISO 50001:2018 version. Prior to re-certification, the energy team joined short courses from external experts, so we learned the key differences and to be easily adapted to the standard. We recognized that the new version of the standard is high-level structure and compatible with the other management system we followed. It also provides better integration in our strategic management process as well as bring stronger emphasis on the role of our top management to lead the EnMS.

Do, Check, and Act

Operation and Implementation – In the first two years of implementation, we have more focus on the 'low-hanging fruits' program, which bring more benefit with less cost and risks. We learned that wheat as raw material has unique characteristics which have a direct impact on the production process. Higher protein of wheat is sourced from harder wheat material but will require less energy to produce, while on the other hand, softer material will require more energy to produce. Therefore, one of our initial action plans is to put stringent control on each of our mills, by adjusting the production indicators ratio, depending on specified raw material input. As this simply-look method is successfully bringing operational efficiency, the energy team is getting more confident to adjust the 'conventional operation parameter' into new-critical efficient parameters to the other applications. Each small step with positive results is appreciated by our Top Management, as they considered this as new kind of investment, not only because the cost saving can be invested in other program, but also the energy-saving culture that is invested within our employees. As an important asset, our employees are incentivized to actively contribute new ideas and are encouraged to cultivate a culture of learning. Our top management also provides monetary award to employees who share their experiences in applying best practices and presenting their innovative ideas on improving productivity. They also provide capacity building to improve employee mastery in their field of energy-related work and envision Bogasari to be able to host people outside the organization who are eager to learn energy management practices in the flour industry.

Year	Action Plan	Capital Cost (US $)	Cumm. Cost Saving (US$)
2019	Adjustment on Production Indicator Ratio In Mill Area	-	464,290
2019	Process Optimization by Removing Infest Destroyer at FMP	-	14,960
2019	Ship unloading Optimization at jetty B	-	122,430
2020	Compressor Optimization Using Full Load Method	-	66,350
2020	Transfer Line Simplification at Mill M & N	185,170	21,440
2021	Process Optimization at Mill A & B	11,290	2,350
2021	Adding Die Holes in Pelletizing Machine	25,720	10,550
2021	W.A.G.E. S Centralized Energy Monitoring System	285,720	-
2021	Auto Bagger Optimization at FSBP	-	18,300
2021	Boiler Distribution Line Simplification & Burner Optimization	15,720	58,420
2021	Transfer Line Simplification at Mill O	78,390	6,970
2021	Packing Capacity Optimization at FMP	14,290	16,140
Total		**616,300**	**802,200**

Figure 8. Examples of Action Plan at Bogasari Jakarta

Figure 9. Bogasari Jakarta hosts a Training on Compressed Air System Optimization

Team Collaboration – As one corporation with typical business activities, energy saving ideas can be shared from one plant to the others. However, each plant has its own action plan and is executed independently. The implementation progress and results will be coordinated under the Head of EnMS & Sustainability Department and regularly reported to SVP Manufacturing. The energy performance will be monitored and measured in accordance with ISO 50015 guidelines, while the cost efficiency will be validated by the Finance Department. We also involve Purchasing Department to redefine the procurement process of which the energy team must provide Lifecycle Cost Analysis (LCCA) prior to procuring new equipment with a cost of over US$ 200,000.

Assessing Energy Performance – We carefully measure the overall energy performance based on the 1st tier baseline equation to determine the difference between actual and expected energy consumption on monthly basis. In addition, we also monitor our production area and each mills by using the 2nd and 3rd tier baseline on weekly and daily basis. The performance results are calculated using Microsoft Excel and simply displayed by using the CUSUM graph. A negative CUSUM value indicates energy savings relative to the 2018 base year, while a positive CUSUM indicates otherwise. We determine that over 50% deviation in one point of result, shall be addressed and recorded due to the probability of unusual events (eg. trial of new equipment or production for a special case project) and other factors. Moreover, if a deviation occurs three times in a row, the 'red notice' will be sent to the impacted Process/Area Manager to lead the required action, in coordination with EnMS & Sustainability Manager, although, this incident has never occurred so far.

Figure 10. Display Example on W.A.G.E.S Centralized Energy Monitoring System

We also established W.A.G.E.S Centralized Energy Monitoring System to enhance our energy management system on real-time basis, which in details includes Water, Air, Gas, Electricity, and Steam. With automated data reading and real-time actionable insights along the production line and supply chain, the system can collect energy consumption data and operation information from on-site and forming a classification of energy consumption, sub-item and sub-area statistics. It includes online monitoring, analyzing, reporting, controlling, maintenance, production management, prediction, and other functions.

Continual Improvement – During the reporting period, Bogasari has demonstrated continual energy performance improvement towards the energy targets. We have achieved a 16.6% cumulative result, by the end of 2021, as this is also beyond the target. We also ensure the effectiveness of our EnMS implementation, by conducting regular internal audits in each of our plants as well as cross-audits from different plants to ensure objectivity and impartiality of the audit process. Furthermore, the external audit was always going smoothly, as we successfully implement and maintain ISO 50001 certification in our flour mills, followed by a plan to extend EnMS implementation into our packaging factory and shipping maritime units.

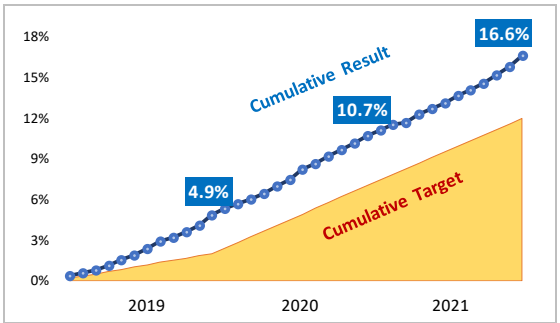

Figure 11. Energy Performance against Target

Transparency

Our progress and results in achieving the 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 (KESDM) and Company Performance Rating Assessment Program in Environmental Management (PROPER) by the Indonesian Ministry of Environment and Forestry (KLHK). Other than that, we also published our energy and environmental performance through the Annual Report and Sustainability Report, as well as our website (www.bogasari.com). We also actively participate in industry forums, and communicate with fellow industry players via various associations, including Indonesian Food & Beverages Association (GAPMMI) and the Indonesian Low Carbon Emission Network (JIRE). We embrace any opportunity for stakeholders' collaboration because we recognize that complex energy and environmental challenges often benefit from partnership solutions.

" We knew that ISO 50001 would add a positive impact on our financial and environmental aspect, but we never imagine it could also strengthened our corporate social and governance practices "

— Andry Wiryanto, Vice President Engineering & Technology

What We Can Do Differently

Lesson Learned – Despite achievements we had, we learned that strategic and tactical planning during the energy planning process was very crucial in our first EnMS implementation. We were experiencing among other things that:

- To gain some insight on energy saving ideas, we conducted an energy audit externally, just before we started the EnMS. Although the ideas were good, however, this audit was an ad-hoc process and implemented under project based, thus the effectiveness cannot be measured properly. From there, we learn that we should start the EnMS step-by-step as provided by ISO 50001, and include the energy audit to be an integral part of EnMS implementation. In addition, we should have to prioritize to gain more information and feedback from internal technical staff or operators as they are involved more in the day-to-day operation which in return can also provide more valuable ideas for improvement.
- When preparing the energy baseline, we are eager to have statistical regression equation up to the 3rd tier level which is time consuming and required additional measurement in the process. We realized that even a simple energy intensity ratio was good enough to start the implementation, while we can continuously be improving within the next years.

Forward Looking – As we work toward extended EnMS implementation on the next phase, we plan to enhance the utilization of the W.A.G.E.S Centralized Energy Monitoring System to be integrated not only for the flour mills but also for packaging factory and shipping maritime units. We expect with this advancement will also speed up the progress and bring more excellent EnMS implementation, along with the use of clean energy applications in our operations.