T Sarihusada Generasi Mahardhika Prambanan – Central Java Energy Audit Report

18th November 2024

DIREKTORAT JENDERAL ENERGI BARU TERBARUKAN DAN KONSERVASI ENERGI (EBTKE)
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Danish Energy Agency

EMBASSY OF DENMARK
Jakarta

Project no:	**Energy Audit and Pre-feasibility Study in Industries under the Energy Partnership Programme between Indonesia and Denmark (INDODEPP)**
Report:	**Energy Audit Report PT Perusahaan Industri Ceres**
Date:	**18th November 2024**
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Executive Summary

1.1 Introduction

The Directorate of Energy Conservation (DEC) under the Ministry of Energy, Mineral and Resources (MEMR) in Indonesia has embarked on a mapping of energy intensive industries which is in its early phase. The aim is to update information on energy consumption in a selection of industries starting with a focus on the food and beverage sector (F&B). This will support work on developing national industry benchmarks for energy efficiency and set a future direction for industries with high energy consumption. MEMR coordinates with the Ministry of Industry (MOI) on existing available data and is the key partner for this activity. This activity will specifically support empirical data gathering through review of available information on energy consumption and conducting energy audits within the selected F&B sub-sector.

The first objective of this project supported by INDODEPP is to conduct a relevant number of energy audits to get an empirical reference for energy consumption as well as the potential value of implementing energy efficiency measures in the food and beverage sector. The potential will be highlighted for reduction of energy consumption, reduction of energy costs and reduction of CO_2 emissions.

The second objective of the project is to share findings from the energy audits through a workshop/seminar with the private sector and relevant stakeholders from food and beverage sector.

The outcome of this project will provide input to the efforts of strengthening national and regional focus on energy efficiency at energy intensive industries and at the same time provide valuable suggestions and ideas for specific energy saving projects to be implemented in selected industries.

This energy audit report for PT Sarihusada Generasi Mahardhika documents the main findings and results for the energy audit that was carried out in May 2024 with great assistance from PT Sarihusada Generasi Mahardhika (SGM).

1.2 Plant description

PT Sarihusada Generasi Mahardhika (Sarihusada), Danone Group is a company that produces various nutritional products for mothers and children with a focus on taste, affordability and international standards. The company was founded upon the initiation of the government of Indonesia and The United Nations (UN) to address the problem of nutritional deficiencies that occurred in children by the mid 1950s.

Currently Sarihusada has over 1,000 employees all over in Indonesia and operates production facilities in the region of Yogyakarta and Prambanan - Klaten, Central Java to produce a variety of products. Sarihusada also actively interacts and partners with healthcare practitioners, nutrition activists, policy makers and other stakeholders to provide education materials that are required to progress towards a healthy generation of Indonesian.

The plant for energy audit purpose was selected in Prambanan Plant – Klaten. Total energy consumption of PT Sarihusada in 2023 was 59,311 MWh or 5,100 ton oil equivalent (TOE) that is mandatory to implement energy management at 4000 TOE (46,520 MWh) above referred to Government Regulation Number 33 Year 2023. Factory layout is shown in Figure 1.

Figure 1. Sarihusada facilities in Prambanan Plant

1.3 Operation

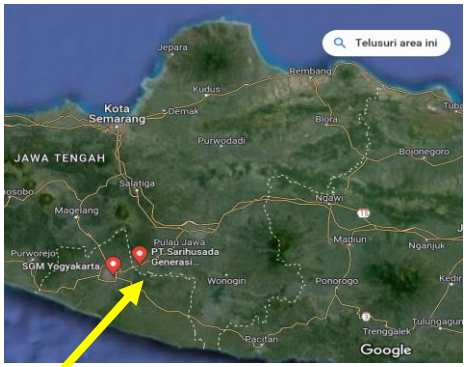
The Sarihusada facility is operation 24 hours per day in 320 days per year resulting in 7,668 operation hours per year based on spray drier operation. Each day three working shifts are present 8 hours. The production has historically amounted as shown in Table 1.

Table 1. Yearly production of each processing line

Year	Processing line (ton)	
	Base Powder	Finished Good Powder
2022	23,432	78,950
2023	25,612	86,005
Jan-April 2024	8,810	29,512

1.4 Location

Address:
Jl. Raya Solo - Yogyakarta No.KM 19,
Tegalbarong, Kemudo, Kec. Prambanan,
Kabupaten Klaten, Jawa Tengah 57454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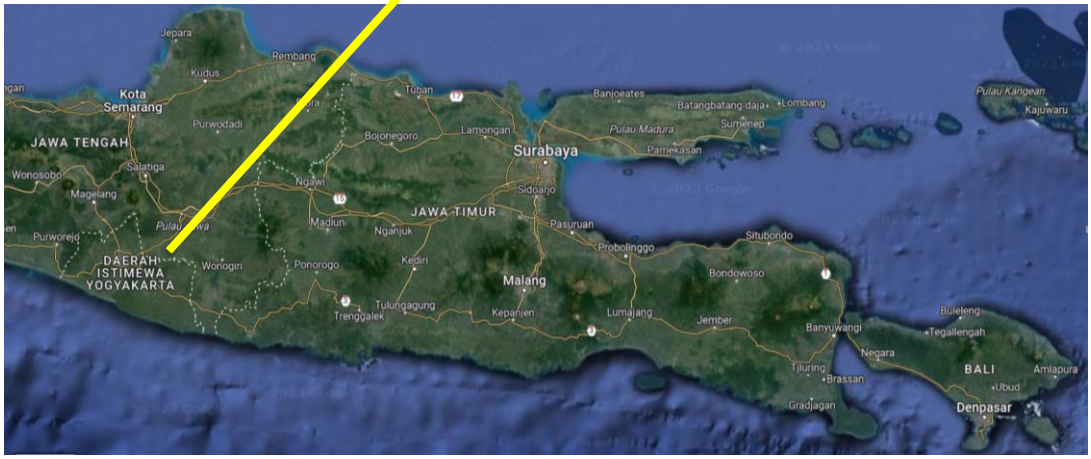
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Bojonegoro
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Sumenep
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Buleleng
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Banyuwangi
Negara
Tiluring
Brassan
BALI
Amlapura
Ubud
Gradjagan
Denpasar

1.5 Methodology

The objective of the energy audit is both to provide the data necessary to establish the baseline for the energy consumption for Ceres and to estimate the potentials for increasing energy efficiency in the F&B sector. The site visit was prepared with main data collected in a questionnaire.

A two-day site visit was planned and conducted from the 2nd to 3rd of May 2024. In the site visit the local consultant PT. Langgeng Ciptalindo fielded eight people, six engineers and two technicians under the leadership of Pak Rusmanto.

The site visit was commenced with a meeting between the Sarihusada management and team, representatives from EBTKE and the auditing team. At the meeting, information was given about Sarihusada as well as the EBTKE and DEA cooperation and the objective of the audit.

The auditing started with a line walk for understanding the process and get an overview. During the audit information was gathered from Sarihusada, data was taken from meters and measurements was conducted when needed. Every morning and evening a status meeting was held with the Sarihusada team to coordinate the next steps. The site visit was concluded with a common recapitulation.

1.6 Overall findings

1.6.1 Specific energy consumption

The SGM (Sarihusada Generasi Mahardika) – Prambanan plant can be divided into two product processing lines, as follows:

- Base Powder processing line with production volume unit using ton
- Finished Good Powder processing line with production volume unit using ton

Total energy consumption for the plant based on Year 2022, 2023, and Jan-April 2024 data are shown in Table 2. By relating the total energy consumption with the production volume, the specific energy consumption (SEC) is found. Table 3 shows SEC in the last 2 years and Jan-April 2024. In 2023, SEC was reduced against 2022 that indicates the impact in successfully applying several energy conservation implementations.

Table 2.Total energy consumption and production in years

Remarks	2022	2023	Jan-Apr 2024	% 2023
Electricity, MWh	20,798	19,769	6,352	33.3
Thermal, MWh	43,439	39,542	12,967	66.7
Diesel Oil (Genset)	*342*	*274*	*102*	*0.5*
Steam (Biomass Boiler)	*33,806*	*35,301*	*10,936*	*59.5*
Compressed Natural Gas (CNG for Thermal Oil Heater)	*9,292*	*3,966*	*1,929*	*6.7*
Total Energy Consumption, MWh	64,238	59,311	19,319	100
Ton Oil Equivalent (TOE)	**5,523**	**5,100**	**1,661**	
Production Volume Base Powder, ton	23,432	25,612	8,810	
Production Volume Finished Good Powder, ton	78,950	86,005	29,512	

**) Total energy is sum of electricity and thermal energy*

Table 3. Specific energy consumption (SEC)

Remarks	2022	2023	Jan-Apr 2024
Total Energy Consumption, MWh	64,238	59,311	19,319
Total production, ton	102,382	111,617	38,322
Ratio or SEC, MWh/ton	**0.627**	**0.531**	**0.504**

**) Total energy is sum of electricity and thermal energy*

1.6.2 Energy saving potential

The energy savings are assessed in relation to Best Available Technology (BAT) and will therefore also include savings that are not financially profitable with current energy prices, but which may become so in the future.

The subsequent energy saving proposals are based on estimations. As an example, the energy efficiency for all motors is compared with the BAT motor with the same rated power and a standardised investment per motor has been used. The feasibility of a replacement shall be examined with the actual conditions of the individual motor. In case of replacement due to break down it is always advisable to substitute with a motor according to BAT as motors have a long lifetime.

Thermal energy

Saving potential for thermal energy from steam boiler and gas thermal oil heater delivered into the plant are included in the Table 4.

Electricity

Saving potential for electricity consumption delivered into plant is included in the Table 5.

Table 4. Thermal energy distribution to production line and saving potential

THERMAL ENERGY	Estimated Consump-tion, MWh	Share of consump-tion, %	Saving potential, MWh	Estimated CO2-emission reduction, ton	Estimated Investment, mill. IDR	Estimated payback period, years
Steam (Biomass boiler)	35,301	89.3	-	-	-	-
Exhaust stack drier heat recovery system			2,009	-	4,748	2.5
Wet process			8,882	-	7,000	2.5
Wireless Steam Trap Monitoring			792	-	2,500	3.7
CNG (hot thermal heater)	3,967	10	-	-	-	-
Flue gas heat recovery system			108	19	340	5.0
Oxygen monitoring			62	11	260	6.0
Air preheater			20	4	40	3.0
Diesel Oil	274	0.7	-	-	-	-
Biomass Cogeneration			18,084	11,639	144,000	10.0
IN TOTAL	**39,542**	**100**	**29,165**	**11,673**	**158,888**	**7.9**

Table 5. Electricity distribution to production line and saving potential

ELECTRIC ENERGY	Estimated Consump-tion, MWh	Share of consump-tion, %	Saving potential, MWh	Estimated CO2-emission reduction, ton	Estimated Investment, mill. IDR	Estimated payback period, years
Main distribution warehouse	327	1.7	-	-	-	-
Main distribution utility	12,374	62.6	-	-	-	-
Pressure demand controller for compressed air system			144	113	384	1.9
Upgrade IE5 motor class efficiency pump			1,108	858	4,538	2.8
New operational configuration of DMDF Chiller			173	134	No Cost	-
Main distribution wwtp	875	4.4	-	-	-	-
Main distribution laboratorium	592	3.0	-	-	-	-
Main distribution spray drier (SWB)	3,291	16.6	-	-	-	-
Upgrade IE5 motor class efficiency pump			53	41	184	2.0
Main distribution B&P	502	2.5	-	-	-	-
Others	1,807	9.1	-	-	-	-
Transformer			129	100	1,068	7.4
IN TOTAL	**19,769**	**100**	**1,607**	**1,246**	**6,174**	**2.8**

1.6.3 Saving strategy if natural gas is preserved

In case of natural gas is preserved due to unstoppable the natural gas pipeline supply, then it is required to reduce thermal losses in these parts as follows :

1. Steam Generation : installing condensing economiser or blowdown and compressor heat recovery system.
2. Steam Distribution : insulation unlagged steam and condensate pipeline, installation moveable jacketing for steam accessories such valves, strainers, and steam traps. Installation of hot water distribution.
3. Steam Usage : condensate discharge from process can be utilised as preheating of hot water preparation or can be utilised as preheating of make up water of gas boiler.
4. Gas thermal oil heater : Flue gas heat recovery system.

1.6.4 Saving strategy if biomass cogeneration is installed

When a biomass cogeneration boiler is installed, the following strategies can be implemented to maximize energy savings and efficiency:

1. Optimize Fuel Supply and Quality

   Ensure a consistent supply of high-quality biomass fuel, such as wood chips or pellets, to maximize combustion efficiency and minimize fuel wastage.
2. Efficient Combustion Control

   Implement advanced combustion control systems to optimize air-to-fuel ratios, ensuring complete combustion and reducing unburned fuel, which enhances overall efficiency.
3. Heat Recovery and Utilization

   Utilize heat recovery systems to capture waste heat from flue gases or condensate. This recovered heat can be used for preheating feedwater or for space heating, further improving efficiency

1.7 Present situation

Currently, Sarihusada receives 100% electricity from the PLN grid comes from fossil fuel with amount of carbon emission at 0.775 ton CO_2/MWh. In order to meet net zero emission from electricity source, Sarihusada will purchase *renewable energy certificate* (REC) or green electricity. In other side, Sarihusada plan to install solar PV with a capacity of 650 kWp. Meanwhile, thermal energy resource is coming from biomass for steam boiler and compressed natural gas (CNG) for hot thermal oil heater with amount of carbon emission at 0,202 ton CO_2/MWh. The small amount of diesel oil is used for generator set as back up that can release carbon emission at 0,267 ton CO_2/MWh.

The use of electricity reached 33.3% of total energy demand of the plant, while thermal energy was 66.7% remaining. Electricity is used for main equipment of production line from raw material to packaging, utilities, and lighting, while biomass is dedicated for steam generation at 10.5 barg distributed to processing line, CNG is used for hot thermal oil heater, and diesel oil for standby generator set.

1.8 Electrification of the process

All thermal energy consumption is allocated mainly to 1 unit of 8 ton/h biomass boiler to generate saturated steam at 10.5 bar for wet process and air drier. Steam users at wet process are mainly pasteurization (wet process) and clean in place system (CIP) to generator hot water. Today commercial heat pumps can deliver 90^{o}C output on the hot side, but different vendors have heat pumps that can deliver 120^{o}C or more in operation in industrial applications. It will be reasonable to assume that the entire thermal energy demand in the hot water generation process can be covered by heat pumps in the future.

1.9 Different ways of electrification

To achieve net zero emission, Sarihusada will purchase of using electricity source with *Renewable Energy Certificate (REC)* from third party. With total annual electric energy demand up to 19,769 MWh, Sarihusada purchased Rp 458 million annually to achieve zero carbon in electricity. Therefore, this is a great electrification opportunity in the future to convert gas steam boiler or hot oil heater to electric steam boiler/heater. However, care must be taken that it will be followed by increasing around double cost of steam. REC electricty is around double cost of natural gas (around 2.3 times gas, in MMBTU unit). To compensate on increasing energy bill in case of using electric steam boiler applied, it can be explored to do further steps such as installation solar PV panels with supply from the grid to further reduce the overall electrical consumption per annum. Sarihusada has planned to install solar PV panels with a capacity of 650 kWp.

Biomass cogeneration or combined heat and power (CHP) that is the use of a heat engine or power station to generate electricity and useful heat at the same time can be considered. This way will achieve carbon neutrality both electricity and thermal energy supply simultaneously with 100% renewable energy source of biomass. Cogeneration can significantly reduce carbon emissions and energy costs. This arrangement utilizes steam generated by burning biomass to generate electric power, as well as to provide steam for processing operations.