PT Perusahaan Industri Ceres Bandung – West Java Energy Audit Report

13rd 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:	**13rd 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. Perusahaan Industri Ceres documents the main findings and results for the energy audit that was carried out in July 2024 with great assistance from PT. Perusahaan Industri Ceres.

1.2 Plant description

PT Perusahaan Industri Ceres was established in the 1950s and has since grown to become one of the leading food manufacturers in Indonesia. The company is known for its high-quality and innovative products. It produces a wide range of food products, including chocolate, candy, and dairy-based products. Famous brands produced by PT Perusahaan Industri Ceres include SilverQueen, Delfi, Top, Ritz, and Chunky Bar. These products are highly popular in both domestic and international markets.

The plant for energy audit purpose was selected in Bandung. Total energy consumption of Ceres in 2023 was 76,836 MWh or 6,606 ton oil equivalent (TOE) that is mandatory to implement energy management at 4,000 TOE (46,520 MWh) above referred to Government Regulation Number 33 Year 2023. Factory layout is shown in Figure 1.

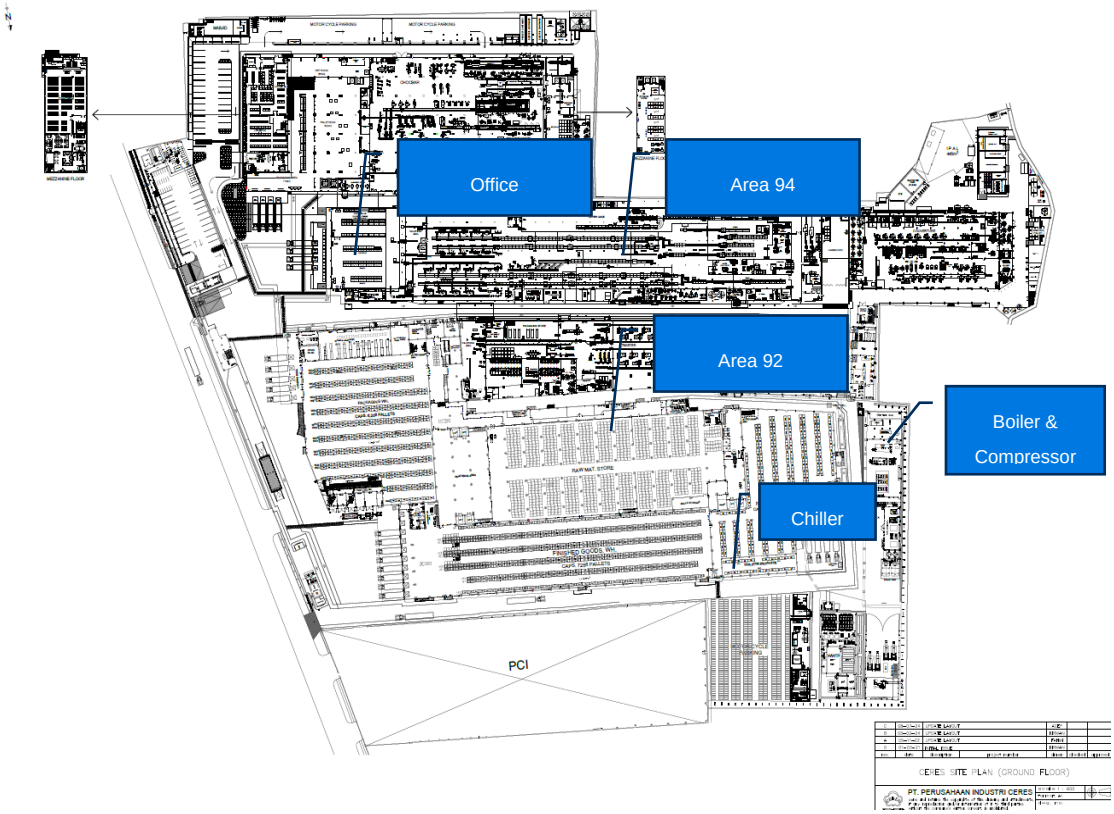

Figure 1. Perusahaan Industri Ceres facilities

1.3 Operation

The Ceres facility is operation 24 hours per day in 320 days per year. 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

Processing Line	Year	
	Production (MT)	Production (CS)
2022	34,537	8,565,428
2023	32,210	8,552,187
January – June 2024	14,292	3,945,728

1.4 Location

Address:

Raya Dayeuhkolot Street 94 - 92,
Pasawahan, Dayeuhkolot, Bandung,
West Java 40256,
Indonesia


Cipeundeuy
Cikalong
Cipatat
Padalarang
Lembang
Cimahi
Cimenyan
Batujajar
Bandung
Cileunyi
Margaasih
PT Ceres
Rancaekek
Cicalengka
Sindangkerta
Baleendah
Nagreg
Soreang
Ciparay
Majalaya
Ciwidey
WEST JAVA
Pangalengan
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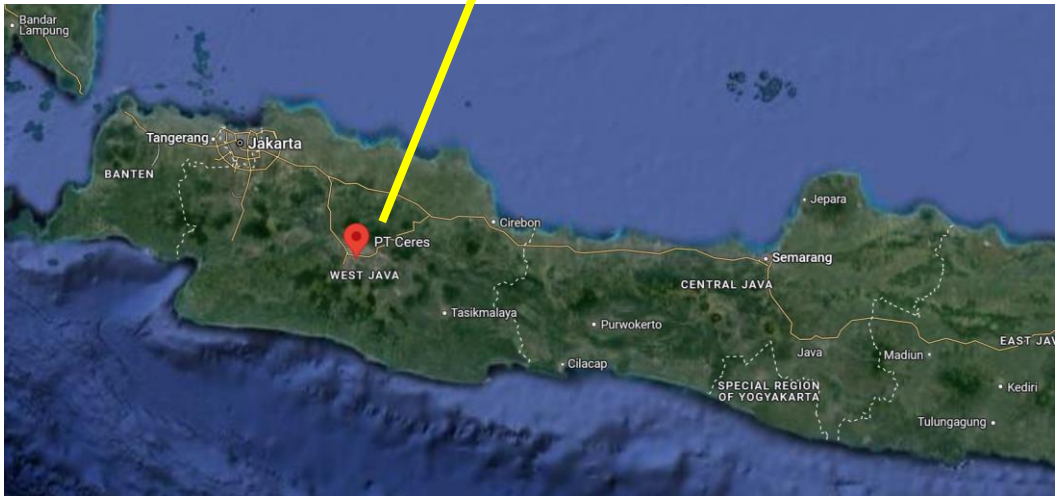
Bandar Lampung
Tangerang
Jakarta
BANTEN
Cirebon
PT Ceres
WEST JAVA
Jepara
Semarang
CENTRAL JAVA
Tasikmalaya
Purwokerto
Cilacap
Java
Madiun
EAST JAVA
SPECIAL REGION OF YOGYAKARTA
Kediri
Tulungagung

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 tree-day site visit was planned and conducted from the 10th until 12nd of July 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 Ceres management and team, representatives from EBTKE and the auditing team. At the meeting, information was given about Ceres as well as the EBTKE and DEA cooperation and the objective of the audit.

The auditing started with a walk through for understanding the process and get an overview. During the audit information was gathered from Ceres, data was taken from meters and measurements was conducted when needed. Every morning and evening a status meeting was held with the Ceres 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 PT. Perusahaan Industri Ceres plant can be divided into eleven product processing lines and two operational buildings, as follows:

- Chocbar processing line with production volume unit using carton (CS)
- Conbar processing line with production volume unit using carton (CS)
- Mixer processing line with production volume unit using metric ton (MT)
- Dragees processing line with production volume unit using carton (CS)
- Snack processing line with production volume unit using metric ton (MT)
- Twister processing line with production volume unit using carton (CS)
- Frying & candy processing line with production volume unit using metric ton (MT)
- Powder processing line with production volume unit using metric ton (MT)
- Chocrice processing line with production volume unit using metric ton (MT)
- Biscuit processing line with production volume unit using metric ton (MT)
- Yuraku processing line with production volume unit using metric ton (MT)
- OS WH Soetta building
- FG WH Soetta building

Total energy consumption for the plant based on Year 2022, 2023, and Jan-June 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 – June 2024. In 2023, SEC was slightly reduced against 2022 that indicates the impact of heat recovery system in thermal energy consumers.

Table 2. Annual total energy consumption for each processing line.

Remarks	2022	2023	Jan-June 2024
Electricity, MWh	36,691	37,466	18,512
Chocbar	4,899	4,860	2,198
Conbar	3,244	3,186	1,429
Mixer	5,999	5,485	2,674
Dragees	1975	5,765	2,717

Remarks	2022	2023	Jan-June 2024
Snack	20,570	18,168	2,402
Chocrice			1,382
Twister			441
Frying & Candy			158
Powder			231
Biscuit			530
Yuraku			236
OS WH Soetta building			71
FG WH Soetta building			119
Others: NPD, Lab, Office depan, Boiler, Compressor, WWTP, RO FG, RM Warehouse, LPG, Mesin cuci palet, pompa banjir, Pompa raw tank, dan groundtank			3,917
Thermal (Compressed natural gas), MWh	41,253	39,371	*17,152*
Conbar	5,711	*4,740*	*2,165*
Twister	3,806	*3,137*	*1,750*
Snack	3,744	*4,963*	*2,125*
Frying	729	*661*	*213*
Boiler	*27,260*	*25,867*	*10,897*
Ton Oil Equivalent (TOE)	**6,702**	**6,606**	**3,066**

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

Table 3. Specific energy consumption (SEC)

Remarks	2022	2023	Jan-June 2024
Total Energy Consumption, MWh	77,944	76,836	35,664
Total production, CS	8,565,428	8,552,187	3,945,728
Ratio or SEC, MWh/CS	**0.0091**	**0.0090**	**0.0090**

**) 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 boiler 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
Boiler	25,868	66	-	-	-	-
Blowdown and Compressor Heat Recovery			426	36	694	2.9
Condensing Economizer			1,383	119	2,500	3.2
Biomass Boiler			-	5,225	10,590	2.3
Steam Trap			1,057	91	170	0.5
Conbar	4,741	12	-	-	-	-
Economizer Baking Oven			618	53	1,200	3.5
Twister	3,137	8	-	-	-	-
Economizer Baking Oven			537	46	950	3.0
Snack	4,964	13	-	-	-	-
Economizer Baking Oven			575	49	1,000	3.1
Frying	661	2	-	-	-	-
IN TOTAL	**39,371**	**100**	**14,542**	**5,619**	**17,104**	**2.5**

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
Chocbar	4,860	12.97	-	-	-	-
Chiller Area 94, 60%	1,994	5.32	-	-	-	-
Others	2,866	7.65	-	-	-	-
Conbar	3,186	8.50	-	-	-	-
Chiller Area 94, 40%	1,330	3.55	-	-	-	-
Others	1,856	4.96	-	-	-	-
Mixer	5,485	14.64	-	-	-	-
Chiller mixer	2,200	5.87	-	-	-	-
Others	3,286	8.77	-	-	-	-
Dragees	5,765	15.39	-	-	-	-
Chiller Area 92, 57%	3,820	10.19	-	-	-	-
Others	1,946	5.19	-	-	-	-
Snack	4,599	12.27	-	-	-	-
Chiller Area 92, 26%	1,762	4.70	-	-	-	-
Others	2,837	7.57	-	-	-	-
Chocrice	2,646	7.06	-	-	-	-
Chiller Area 92, 11%	756	2.02	-	-	-	-
Others	1,890	5.04	-	-	-	-

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
Twister	844	2.25	-	-	-	-
Chiller Area 92, 3%	211	0.56	-	-	-	-
Others	633	1.69	-	-	-	-
Frying & Candy	304	0.81	-	-	-	-
Powder	443	1.18	-	-	-	-
Chiller Area 92, 3%	195	0.52	-	-	-	-
Others	248	066	-	-	-	-
Biscuit	1,016	2.71	-	-	-	-
Yuraku	452	1.21	-	-	-	-
OS WH Soetta building	138	0.37	-	-	-	-
FG WH Soetta building	229	0.61	-	-	-	-
Others: NPD, Lab, Office depan, Boiler, Compressor, WWTP, RO FG, RM Warehouse, LPG, Mesin cuci palet, pompa banjir, Pompa raw tank, dan groundtank	7,498	20.01	-	-	-	-
Install Inverter / VSD boiler feed water pump			34	30	110	2.8
Install pressure demand controler			123	109	400	2.8
Install centrifugal compressor			746	664	3,000	3.5
Install high class motor efficiency			3,114	2,774	7,505	2.1
Air Leak Repair			19	17	5	0.5
Optimization of chiller system			476	424	1,000	1.9
Replacement of Chiller Pump Trane 200 and 400			233	207	612	2.6
High Efficiency Transformer			1,045	931	5,000	4.3
IN TOTAL	**37,466**	**100**	**5,790**	**5,156**	**17,632**	**2.7**

1.6.3 Saving strategy when implementing an energy management system (EnMS)

PT Perusahaan Industri Ceres continues to develop an energy monitoring system. It is indicated by the increasing energy monitoring installed on both utility and production line. The implementation of EnMs will improve monitoring and evaluating energy performance. In 2023 there were 5 of energy meters installed, while in 2024 there will be ongoing additional of 14 energy meters installed in the production line to measure electricity consumption.

The EnMS can be developed to provide some advantages in the form of:

1. Root cause analysis

- helps understand sources of energy waste
- finds out why equipment is not operating

2. Finds out the power quality
   - finds out how good the quality of electricity is on the network, whether there are voltage or frequency fluctuations
   - finds out the harmonic distortion that appears
3. Measurement and verification
   - able to estimate energy usage trends in a facility
   - verifies the benefits of implementing energy conservation
4. Cost allocation
   - Can help estimate the cost of goods sold
   - Benchmarking with other similar tools or process

For it is highly recommended to install EnPIView application software to obtain advantages as follows :

1. Knowing the details of the energy consumed, utilized, and lost energy.
2. Analyzing losses both in total and partial to eliminate losses.
3. Setting energy baseline (EnB) and performing normalization if necessary.
4. Calculating Energy Performance Indicator (EnPI).
5. Providing warnings when decreasing in energy performance and identify areas / equipment that can be improved
6. Tracking annual progress of energy intensity and efficiency.

1.6.4 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. Baking Oven : Flue gas heat recovery system on top of baking oven to generate hot water.

1.6.5 Saving strategy if biomass boiler is installed

When a biomass 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

1.6.6 Saving strategy if an electrode boiler is installed

PT Perusahaan Industri Ceres has installed 1,750 kWp on-grid solar PV system. Meanwhile, they try to source Renewable Energy Certificates (REC) from PLN to achieve less carbon emissions. Therefore, this is a great electrification opportunity in the future to convert gas steam boiler to electric steam boiler. This

conversion will reduce approximately 2,339 ton CO_2 emission per annum per ton steam. However, care must be taken, since the cost of electricity is around double the cost of steam.

To compensate on increasing energy bill in case of using electric steam boiler applied, it can be explored to do further steps to reduce steam consumption, such as follows:

- energy conservation program such as steam and heat distribution losses reduction, maximise hot condensate recovery, etc.
- conversion from steam used hot water generator to commercial heat pump hot water generator
- energy consumption monitoring and reporting: Utilizing an advanced monitoring system to track natural gas consumption in real-time and analyze data to identify potential savings opportunities.