PT Garuda Food Putra Putri Jaya

Pati – Central Java

Energy Audit Report

4th May 2023

Project no:	**Mapping/benchmark on Energy Efficiency in Industries under the Energy Partnership Programme between Indonesia and Denmark (INDODEPP)**
Report:	**Energy Audit Report PT Garudafood Putra Putri Jaya**
Date:	**4th May 2023**
Prepared by:	**Rusmanto et al., PT. LANGGENG CIPTALINDO**
QA by:	**Peter Kristensen, Viegand Maagøe**
Approved by:	**Nadeem Niwaz, Danish Energy Agency**

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 i.e. sugar processing industry.

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 CO2 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 Garudafood Putra Putri Jaya documents the main findings and results for the energy audit that was carried out in March 2023 with great assistance from PT Garudafood Putra Putri Jaya.

1.2 Plant description

PT Garudafood Putra Putri Jaya Tbk is one of the largest food and beverage companies in Indonesia. Established in 1990, the founder of Garudafood has started its business activities since 1979 through PT Tudung Putra Jaya (TPJ), a company based in Pati, Central Java, which markets peanut products which later became Kacang Garuda (Garuda Peanut). Garudafood produces and markets food and beverage products under six leading brands, namely Garuda, Gery, Chocolatos, Clevo, Prochiz, and TopChiz. The products include biscuits, nuts, pilus, pellet snack, confectionery, milk drinks, cocoa powder, cheese, and dressing salad. Garudafood exports its products to more than 20 countries, focusing on ASEAN countries, China, and India. PT Garudafood Putra Putri Jaya Tbk has been producing high qualified Roasted Peanut located at Pati, Central Java. Roasted peanut factory layout is shown in Figure 1.

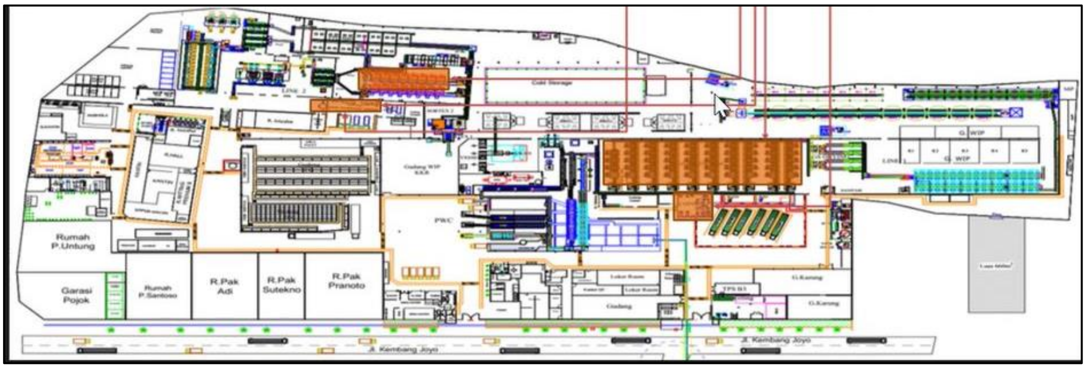


Figure 1. Garudafood facility in the Pati Factory

1.3 Operation

The Garudafood facility is operation 8 hours per day in 240 days per year resulting in 1,920 operation hours per year. Each day 1 working shifts are present 8 hours and the remaining 2 hours are used for cleaning or maintenance. The production has historically amounted as shown in Table 1.

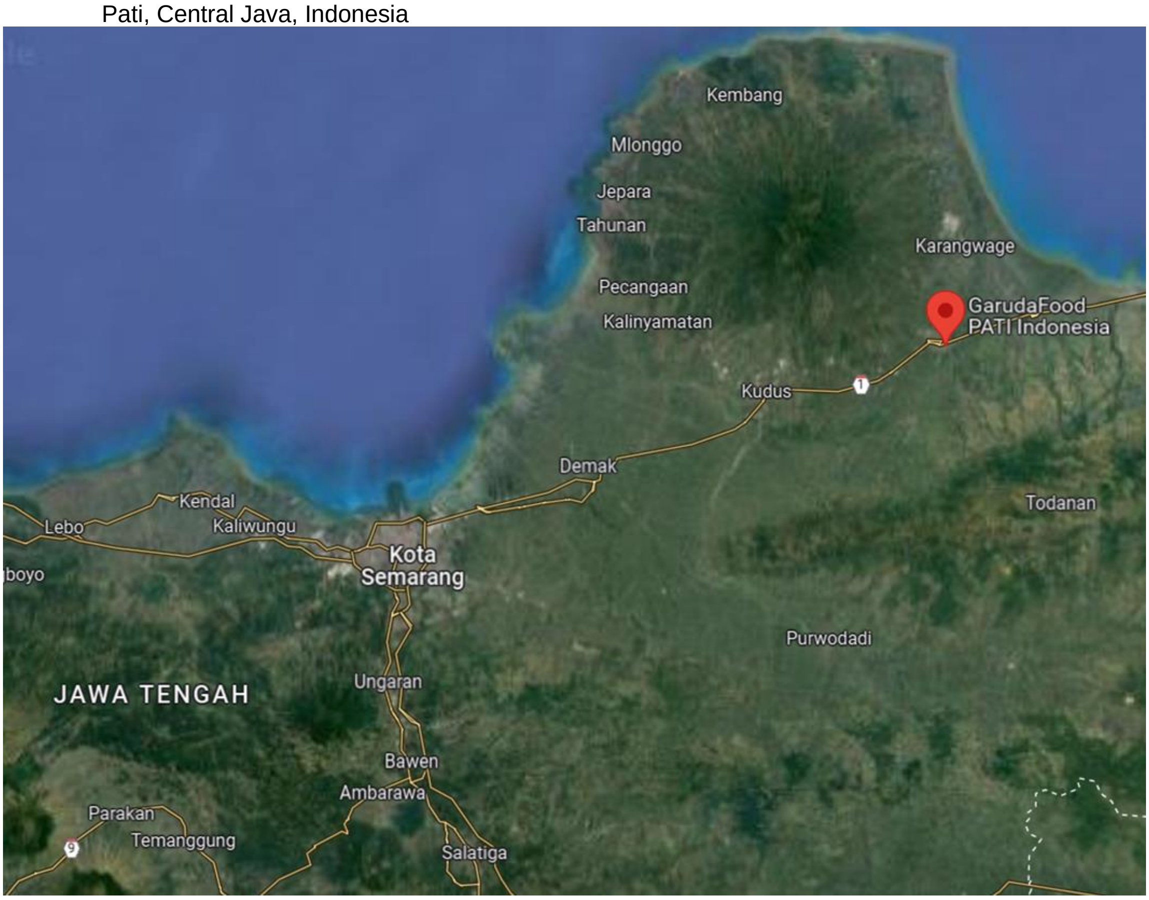
Table 1. Yearly Production (kg Finished Goods)

Years	Production, kg FG
2020	7,819,730
2021	7,902,816
2022	9,007,512

1.4 Location

Address:

Jl. Raya Pati-Juwana Km 2.3
Pati, Central Java, Indonesia



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 Garudafood 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 three-day site visit was planned and conducted from the 1-3 of March 2023. In the site visit the local consultant PT. Langgeng Ciptalindo fielded seven people, five engineers and two technicians under the leadership of Pak Rusmanto.

The site visit was commenced with a meeting between the Garudafood management and team, representatives from EBTKE and the auditing team. At the meeting, information was given about Garudafood 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 Garudafood, data was taken from meters and measurements was conducted when needed. Every morning and evening a status meeting was held with the Garudafood 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 production processes at Garudafood are divided into two lines. Line 1 produces semi-finished goods (as kg drying) from raw material through washing, cooking and drying and then store in storage silo. While Line 2 produces finished goods (as kg FG) through sorting, roasting, and packing then ready to export.

By relating the total energy consumption with the production volume is the specific energy consumption found. Therefore, specific energy consumption (SEC) is divided by each line production, is shown in Table 2 based on date 21 February 2023, while SEC in annual MWh per ton FG production is shown in Table 3.

Table 2. Total energy distribution to production lines per day

Date : 21 February 2023

Remark	Line 1				Line 2				Other Facilities			Total
	Washing	Cooking	Drying	Storage	Sortex	Roasting	Sorting	Packing	Office	Workshop	Warehouse	
Electricity, kWh	172	451	3,174	1,057	216	523	461	205	525	181	3	6,960
Thermal, kWh		2,305				1.258						3,563
Production Line 1, kg drying	15.194											15,194
Production Line 2, kg FG					24,184							24,184
SEC Line 1, kWh/kg drying	0.01	0.18	0.20	0.069								0.47
SEC Line 2, kWh/kg FG					0.009	0.07	0.019	0.008				0.11
SEC Organization												0.43

Note : SEC Organization : Total energy consumption per finished goods in total plant

Table 3. Specific energy consumption in MWh per ton FG production

Year	Total Energy, MWh*)	Production, ton FG	SEC, MWh/ton FG
2020	41,365	7,819.730	5,29
2021	29,129	7,902.816	3,69
2022	34,378	9,007.512	3,82

**) Total Energy is sum of electric and steam 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, are the energy efficiency for all motors 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

Only saving potential for the steam delivered into the production line are included in the Table 4 below.

Table 4. Thermal energy distribution and saving potential

THERMAL ENERGY		Estimated Consumption, MWh	Share of consumption, %	Saving potential, MWh	Estimated CO2-emmision reduction, ton	Estimated Invesment, million, Rp	Estimated PBP, years
Washing	-	-	-	-	-	-	-
Boiler	Cooking	-	-	-	-	-	-
	Roasting	-	-	-	-	-	-
	Others	-	-	-	-	-	-
	Total	2,500	8.07	-	-	-	-
Drying		15,341	49.54	1,360	275	4,200	5,2
Storage	-	-	-	-	-	-	-
Sortex	-	-	-	-	-	-	-
Roasting	-	7,192	23.23	284	57	400	2,4
Sorter	-	-	-	-	-	-	-
Packing	-	-	-	-	-	-	-
Cylinder Dryer	-	669	2.16	24	5	40	2,8
Canteen	-	21	0.07	-	-	-	-
Others	-	5,242	16.93	-	-	-	-
IN TOTAL	**-**	**30,965**	**100**	**1,668**	**337**	**4,640**	**4,7**

Electricity

Only saving potential for electricity consumption delivered into the utility plant are included in the Table 5 below.

Table 5. Electricity distribution and saving potential

ELECTRICITY	Estimated Consumption, MWh	Share of consumption, %	Saving potential, MWh	Estimated CO2-emission reduction, ton	Estimated Investment, million, IDR	Estimated payback period, years
Washing	84.60	2.48	-	-	-	-
Cooking	221.28	6.48	-	-	-	-
Drying	854.72	25.04	14.44	11	315	19,8
Storage	518.66	15.19	-	-	-	-
Sortex	106.17	3.11	-	-	-	-
Roasting	256.29	7.51	-	-	-	-
Sortir	226.32	6.63	-	-	-	-
Packing	100.59	2.95	-	-	-	-
Compressor	702.20	20.57	78.69	64	800	7.5
Kantor	252.64	7.40	-	-	-	-
Workshop	88.65	2.60	-	-	-	-
Warehouse	1.56	0.05	-	-	-	-
IN TOTAL	**3413.68**	**100**	**93.13**	**75**	**1,115**	**10,8**

1.7 Electrification and renewable energy

1.7.1 Present situation

Today, Garudafood receives 100% electricity from a common energy building from the grid, PLN that is generated from fossil. Meanwhile, thermal energy resource is coming from compressed natural gas (CNG). The use of CNG is dominant 90% of total energy demand of the plant, while 10% from electricity. CNG is used main processing such as drying, roasting, and boiler to generate steam at 7 barg.

In mid of 2023, Garudafood has dealed with local boiler manufacturer to install biomass steam boiler instead of CNG boiler to reduce cost of steam and CO_2 emission. Wood pellet has been selected as biomass fuel due to sustainable supply from local supplier around the plant.

1.8 Electrification of the processes

All thermal energy consumption is allocated to the roasted peanut stage of the production mainly for gas steam boiler, drying, and roasting. Steam generated from gas boiler is used for cooking process. The temperature of hot water on cooking process is needed around 96-97^{o}C. 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 cooking process can be covered by heat pumps in the future. With the present commercial equipment, the temperature lift above 90^{o}C needs electrical heating elements. This will reduce the total efficiency in a heat pump solution.

Another option to generate hot air at temperature of 65 ^{o}C on drying process, heat pump technology can be introduced. This heat pump generates hot water up to 90 ^{o}C, that can be exchanged with air inlet using air/water heat exchanger to get 65 ^{o}C, while chilled water generated from heat pump at 10 ^{o}C can be also exchanged with air outlet. Meanwhile, fresh air is heated with a heat pump taking the remaining heat in the outlet air. With around 8,5% loss, it is about 14.000 MWh net utilised for the drying process. With COP=7 it gives 2.000 MWh electricity consumption to the Heat Pump.

1.9 Different ways of electrification

With the current range of power outage, electrification requires upgrading the grid for higher uptime. For reducing the CO_2 emission, the supply to the grid must be upgraded to non-fossil power generation by using *Renewable Energy Certificate (REC)* issued by PLN. In this case the high temperature energy must be delivered by electrode boilers.

A realistic scenario in the future is steam generation by electrode boiler to supply thermal energy to cooking, drying, and roasting process. Thus, electricity will be one energy resource only for the plant.