PT Great Giant Pineapple Lampung 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 Great Giant Pineapple**
Date:	**4th May 2023**
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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 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 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 Great Giant Pineapple documents the main findings and results for the energy audit that was carried out in October 2022 with great assistance from PT Great Giant Pineapple (GGP).

1.2 Plant description

Great Giant Pineapple (GGP) was established in 1979. GGP is a part of Great Giant Food and in the Lampung complex besides pineapple tapioca starch and bromelain enzymes are produced. GGP is the world's largest integrated pineapple plantation and processing facility (see Figure 1). The facility includes five major plants: cannery, can & drum making, labelling and juice. This integration gives GGP an edge in quality control and traceability of products, as well environmental sustainability through synergy in waste management. GGP's land covers 30,000 hectares in Lampung, of which 19,000 is dedicated for growing Cayenne pineapples. Annually, GGP processes more than 500,000 tons of pineapples and exports 11,000 containers with canned pineapples to more than 60 countries with a market share of 25%. Aside from canned pineapple, GGP also produces canned fruit cocktail and juice concentrate.

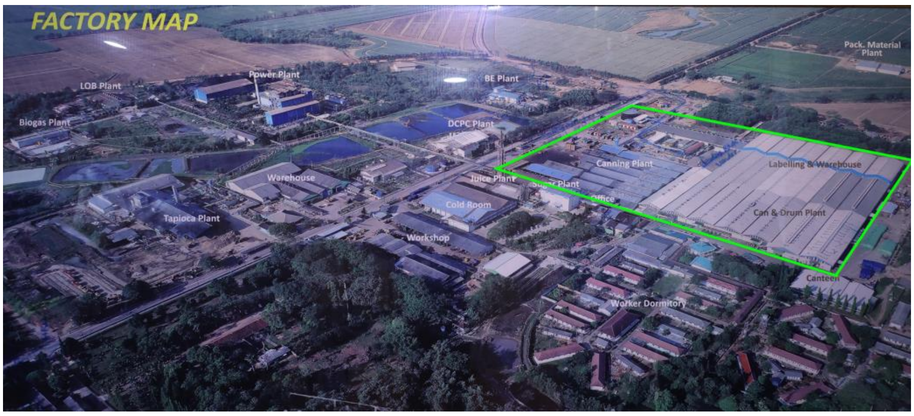


Figure 1. GGP facility in the Great Giant Food complex

1.3 Operation

The GGP facility is operation 20 hours per day in 324 days per year resulting in 6,480 operation hours per year. Each day two working shifts are present 10 hours and the remaining 4 hours are used for cleaning. The production in the can factory has historically amounted as shown in Table 1.

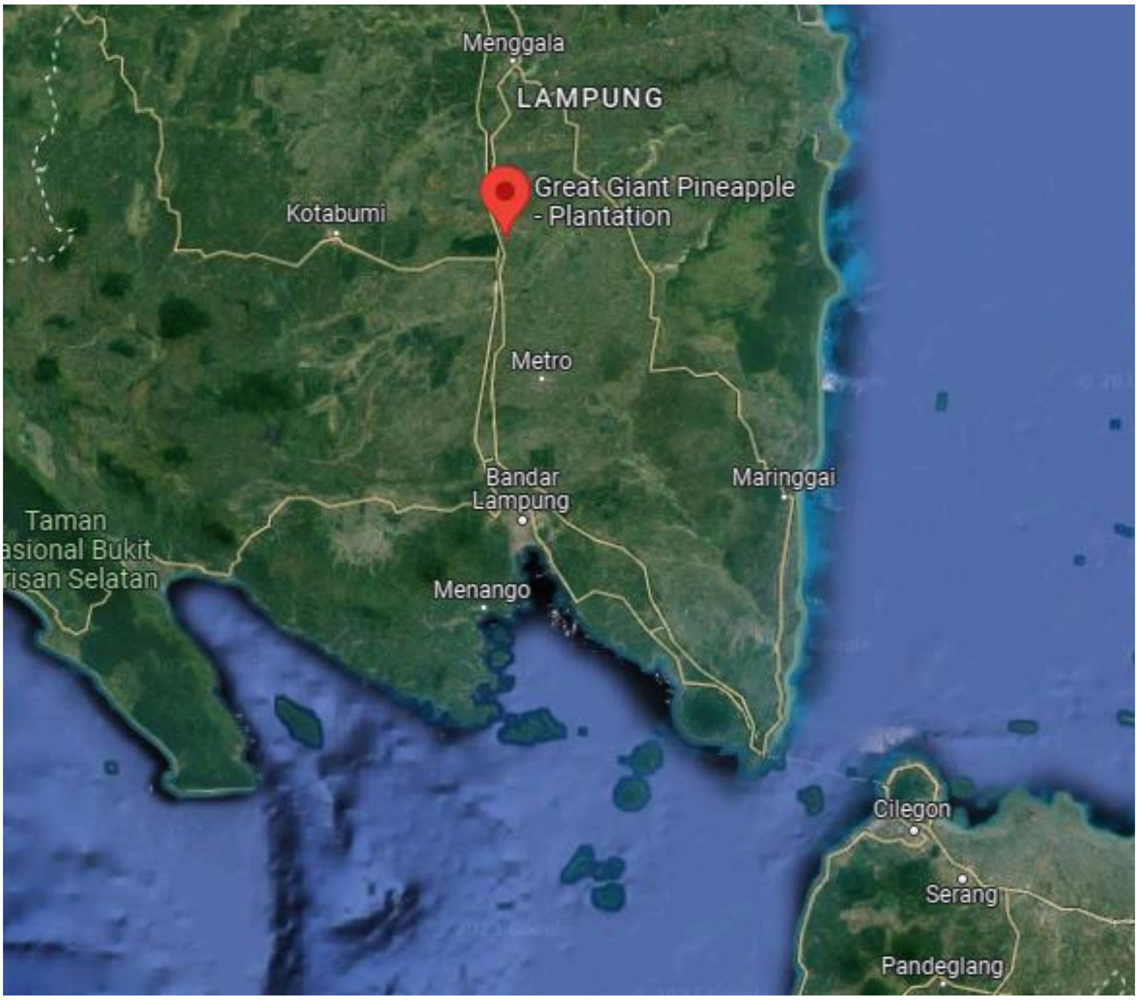
Table 1. Yearly Production (SC)

Year	Production (SC)
2019	9,894,951.14
2020	9,468,150.79
2021	11,505,798.77
2022 (Jan.-Aug.)	8,541,973.87

1.4 Location

Address:

JL. Raya Arah Menggala No.Km 77
Terbanggi Besar,
Lampung 34163
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 GGP and to estimate the potentials for increasing energy efficiency in the F&B sector. Since GGP is part of a conglomerate, Great Giant Food, with different productions gathered in one production site, it was only necessary to examine the pineapple cannery, but since the steam was supplied from a common cogeneration plant, the main data from this was also included. The site visit was prepared with main data collected in a questionnaire.

A three-day site visit was planned and conducted from the 4^{th} to the 6^{th} of October 2022. In the site visit the local consultant PT. Langgeng Ciptalindo fielded six people, four engineers and two technicians under the leadership of Pak Rusmanto. The international consultant Viegand Maagøe participated with Pak Peter Kristensen.

The site visit was commenced with a meeting between the GGP management and team, representatives from EBTKE and DEA and the auditing team. At the meeting, information was given about GGP 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 GGP, data was taken from meters and measurements was conducted when needed. Every morning and evening a status meeting was held with the GGP 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

As outcome of this energy audit, the specific energy consumption has been calculated both for the facility as a whole and for the sub-operations included in it. The GGP canning plant can be divided into five sub-operations with each user as follows and energy distribution for the plant is shown in Table 2.

- Preparation (washing, peeling, coring, slicing)
- Canning (filling, closing, sterilisation, cooling)
- Postprocessing (labelling, packing, delivering)
- Utilization (compressor)
- Can manufacturing (metal works can & drums) etc

Table 2. Total energy distribution to canning plant

Energy type	Preparation	Canning	Post processing	Utilization	Can manufacturing etc
Thermal energy, MWh	-	143,071	-	-	-
Electricity, MWh	1,932	669	912	2,709	11,773
IN TOTAL	1,932	143,740	912	2,709	11,773

By relating the total energy consumption with the production volume is the specific energy consumption found, shown in Table 3. In the first eight months of 2022 has the production volume been high with a low specific energy consumption as a consequence. The idle energy consumption is relatively low when the production lines are well utilised.

Table 3. Specific energy consumption in MWh per ton Cannery Production

Year	Total Energy, MWh*)	Production, SC#)	Specific Energy Consumption, MWh/SC
2019	124,494	9,894,951	0.013
2020	141,469	9,468,151	0.015
2021	161,066	11,505,799	0.014
Jan – Aug 2022	104,114	8,541,974	0.012

**) Total Energy is sum of electric and steam energy*

#) SC is unit of total production

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 canning plant are included in the Table 4 below.

Table 4. Thermal energy distribution to canning plant

THERMAL ENERGY	Estimated Consumption, MWh	Share of consumption, %	Saving potential, MWh	Estimated CO_2-emission reduction, ton	Estimated Investment, million, Rupiah	Estimated payback period, years
Distribution losses	1,510	1.06	1,089	509	300	1.2
Blanching	35,592	24.88	605	283	450	8.7
Can closure	9,311	6.51	-	-	-	-
Sterilization	84,137	58.81	1,430	668	850	3.9
Others (Pouch)	12,521	8.75	-	-	-	-
IN TOTAL	**143,071**	**100**	**2,036**	**1,460**	**1,600**	**3,1**

Electricity

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

Table 5. Electricity distribution to canning plant

ELECTRICITY	Actual Con-sumption, MWh	Share of consumption, %	Saving potential, MWh	Estimated CO_2-emission reduction, ton	Estimated Investment, million, Rupiah	Estimated payback period, years
Transformer losses	333.59	1.85%	148.91	131	500	7.5
Motors	902.53	5.02%	76.78	67	1,838	13.4
Pumps	N/A		-	-	-	-
Drivers	N/A		-	-	-	-
Fans/Blowers	1,030.02	5.72%	-	-	-	-
Compressed air	2,708.58	15.05%	1,019.06	897	5,500	4,0
Cooling towers	N/A	-	-	-	-	-
Others	N/A	-	-	-	-	-
IN TOTAL	**17,994.80**	**100%**	**1,244.75**	**1,095**	**7,838**	**4.9**

N/A: No data available

1.7 Electrification and renewable energy

1.7.1 Present situation

Today, GGP and the other plants receive the electricity from a common energy building. The supply can either be from the own cogeneration plant or from the grid, PLN. In the Lampung area in average 10 power outages occur per month with a duration up to one hour. This is not tolerable for a production like GGP. Consequently, GGF/GGP generate their own electricity also in periods when it would have been cheaper to purchase from the grid. A prerequisite for an electrification of the production will be a reliable grid supply with minimisation of the downtime. In 2022 2% of the electricity was purchased from the grid and 98% originate from the cogeneration. The main fuel is coal supplement with the biogas that can be produced from the wastewater treatment plant. In 2022 the source for electricity was 90% coal and 8 % biogas shown in Figure 2.

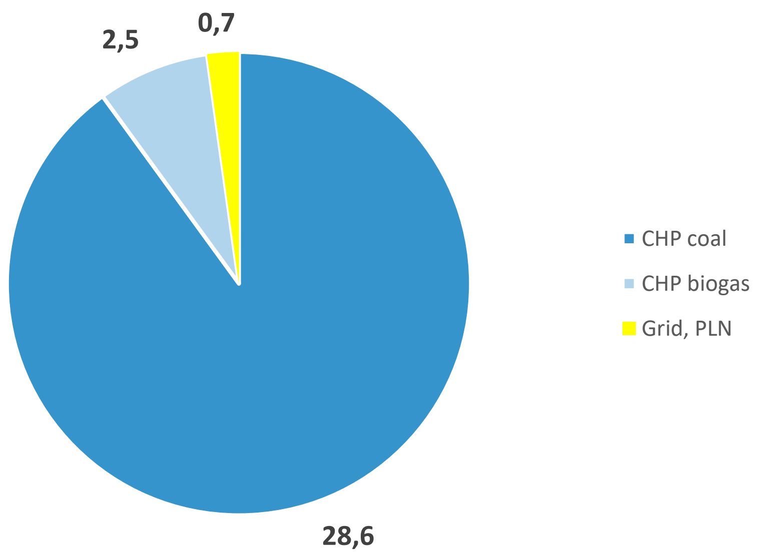


Figure 2. The sources for electricity in 2022 in GWh

1.8 Electrification of the processes

All thermal energy consumption is allocated to the canning stage of the production. The temperature needed is around 100°C. Today commercial heat pumps can deliver 90°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 canning plant 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. The estimation is that the 143 GWh/y steam can be substituted with 57 GWh/y electricity.

Besides the GGP canning plant, the juice, sugar, starch and enzymes production also receive steam from the cogeneration plant and are not included in the report, but it is reasonable to assume that these plants have temperature demands above 120^{o}C and consequently heat pumps may not be feasible for a long time to come.

1.9 Different ways of electrification

With the current range of power outages, electrification requires upgrading the grid for higher uptime. For reducing the CO_2 emission, the supply to the grid must be changed to non-fossil power generation. With these two prerequisites fulfilled, electrification without own power generation is possible. In this case the high temperature energy must be delivered by electrode boilers.

A realistic scenario is a combination of own cogeneration and PV panels with supply from the grid. As the biogas production already take place at the wastewater plant it is natural to use the biogas for the high temperature thermal energy consumption. The biogas production can be extended with a new plant based on the cattle manure and the plant residuals composted today. The fertiliser value will remain in the degas slurry and will be easily absorbable for the plants. Other plant residuals can likely be found in the area, but some plants need a pre-treatment before the gasification process.