INDUSTRIAL ENERGY EFFICIENCY PROJECT IN GHANA

Energy Management Systems (EnMS)

CASE STUDY

INDUSTRIAL DECARBONIZATION ACCELERATOR

UNIDO

Cocoa Processing Company Limited

Tema Industrial Area, Ghana

Company size (personnel)
Large
(100 or more)

Sector
Cocoa beans processing into finished and semi-finished products

Utility intervention
Electricity, diesel

Year joined project
June 2021

Date of implementation
October 2021 to September 2022

Duration
12 months

Company profile

Cocoa Processing Company Limited (CPC) was established in 1965 and is currently based in Tema, an industrial zone on the outskirts of Accra. It was incorporated as a limited liability company on 30 November 1981 and publicly listed on the Ghana Stock Exchange on 14 February 2003.

CPC is one of only a few companies in the world that process cocoa beans without any blending. It uses only the finest, locally sourced, premium beans. The company manufactures a range of products that meet strict international quality standards. Products include semi-finished cocoa liquor, cocoa butter and natural/alkalized cake. CPC also makes finished retail products under the brand Golden Tree, including chocolate bars, couverture, chocolate coated peanuts, drinking chocolate powder, chocolate spreads and cocoa powder.

Plant profile

CPC's facility has three distinct units: two cocoa factories and one confectionary factory. The facility's total installed plant capacity is approximately 64,500 metric tons of products per year. A packaging facility is also located at the site for packaging bulk materials and confectionary products.

Energy breakdown: areas of significant energy consumption

The main sources of energy at the plant are electricity and diesel. Electricity is used throughout the plant to provide energy for all machinery, including coolers and chillers and many of the utilities. Diesel and some liquefied petroleum gas (LPG) is used in the boilers for generating steam and providing thermal energy to various areas of the plant. The largest consumers of electrical energy are Cocoa Plant 2 and the Confectionary Plant.

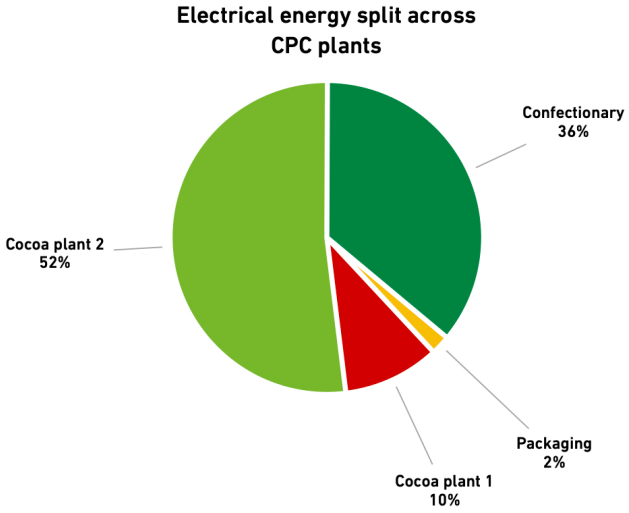

Figure 1: Energy use split across CPC's plants.

Industrial energy efficiency capacity building programme

Between June 2021 and February 2022, UNIDO, in partnership with the Ghana National Cleaner Production Centre, conducted an ISO 50001-compliant Energy Management System (EnMS) training for selected CPC staff under the Ghana Industrial Energy Efficiency Readiness Project. Through the training CPC staff have been supported to implement sustainable solutions to identified energy challenges. Through classroom and field exercises, they have learnt how to conduct an energy performance assessment, identify significant energy users and saving opportunities and propose and develop options to improve energy performance.

Key findings table

Implementation period	October 2021 to September 2022
Total number of projects	2
Monetary savings in GHS per year	262,000
Energy savings in GJ (kWh)	1,137.6 GJ (316,000 kWh)
Total investment made in GHS	178,000
Overall % of total consumption saved	3.2% (electrical savings only)
Payback time period in years	0.67 years
GHG emission reduction (ton CO_2e)	329 tons CO_2e per year

Note 1: CO2 conversion factor is set at 1 GJ = 0.2896 tCO2e.
Note 2: Electrical energy tariff of GHS 0.83/kWh.

Scope and boundaries

CPC has elected to include all facilities at the site in its EnMS. Before moving to implementation, CPC will review all projects from a financial and technical perspective.

For the first part of EnMS implementation, the company focussed on electricity. CPC already had a project in the pipeline to introduce a combined heat and power (CHP) biomass boiler to provide thermal energy for the plant. The company then looked at optimizing the thermal energy equipment, following the fuel change for the new biomass boiler.

Nature of the challenges

The rising cost of energy, both electricity and diesel, is a major challenge for CPC. Increased operating costs have affected how regularly machinery is maintained and how often aging machinery is replaced. Aging machinery earmarked for replacement is still in service, and this is contributing to increased operational outages and increased energy costs.

Collecting data on energy use has been challenging as the facility has no submetering equipment. Recent changes to the top management structure have also slowed down acceptance and implementation of the EnMS.

Energy baseline and energy performance indicators

All energy sources have been considered. Energy baselines have been developed for electrical energy usage. Other sources, including diesel and LPG, are yet to be determined. Electrical energy consumption data and production data were collected monthly and analysed to identify their correlation. Variables influencing the consumption of electrical energy were found to be the amount of raw cocoa beans processed and confectionary output.

The energy performance baseline is shown in Figure 2 below. The baseline year was 2019. COVID-19 disrupted production output in 2020 and 2021. Some signs of recovery were evident towards the end of 2021.

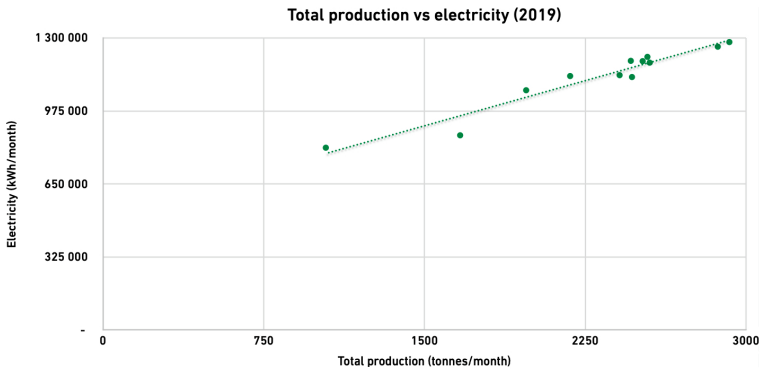

Figure 2: Electrical energy performance baseline (2019).

The following activities under each phase have been completed or are being implemented.

Phase 1: Management responsibility and policy:

- Top management are ready to accept the implementation of an EnMS.
- An energy team has been created.
- Some roles and responsibilities have been assigned to selected energy team members.
- An energy policy has been created but it has not been signed.

Phase 2: EnMS energy planning:

- All energy sources have been identified.
- Significant energy uses have been identified for electricity.
- Overall plant energy data have been acquired and analysed.
- An overall energy balance has been constructed.
- Energy baselines have been developed for electricity.
- Thermal energy (diesel and LPG) usage is still being analysed.

Phase 3: EnMS implementation and operations:

- Initial general energy awareness training has been conducted.
- Some operational control measures (i.e., switch-off measures) have been identified and implemented.
- Planning and development of specific energy awareness training for operational and production personal is currently underway.
- Identifying submetering areas is in the development phase.

Phase 4: EnMS audit and management review:

- Identifying the technical energy assessments and systems to be analysed for energy saving opportunities is in the planning phase.
- No management reviews or internal audits have been conducted as yet.

Implementation challenges

- There is only partial commitment among management to implement an EnMS.
- The bureaucratic nature of business in the company hinders the implementation of EnMS initiatives.
- Historical data were difficult to gather and required purchase transactions to be manually reviewed. Consequently, an energy consumption baseline for diesel could not be established.

Highlights of operational / electricity system operations interventions

Summary of all interventions

- An energy team has been established.
- CPC has started implementing the EnMS.
- Initial energy awareness training has been conducted.
- Planning for more detailed and focused energy training is currently underway.

Lighting upgrades

Following the start of the EnMS programme in June 2021, the company embarked on a programme of changing lights to more efficient units. Old ballast-type fluorescent lamps in offices, discharge lamps in manufacturing areas and halogen floodlighting were all changed to more efficient LED equivalents. It is estimated that more than 825 lamps have been replaced at a cost of GHS 178,000.

General awareness

Through the EnMS programme, the company conducted energy awareness training for operational and technical personnel. The key message conveyed was to switch off lights and machinery when not in use.

For the two interventions above, the electrical energy savings was calculated using the energy performance indicator developed in Figure 3. The cumulative electrical energy savings achieved between October 2021 and September 2022 (12 months) was 316,000 kWh. This is approximately 3.2 per cent of total annual electrical energy consumption.

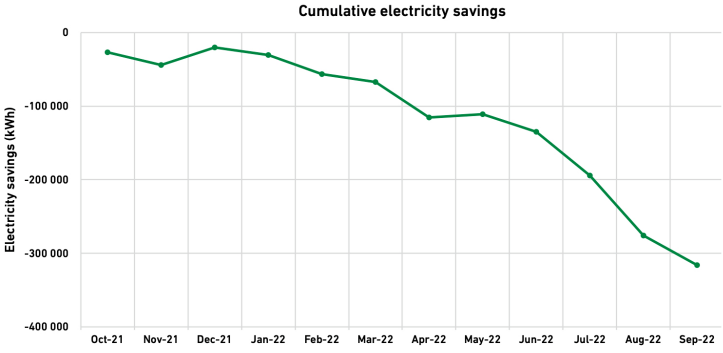

Figure 3: Cumulative electrical energy savings.

Other electricity systems interventions

The company is planning to introduce a CHP biomass boiler to replace its existing fossil fuel boiler. This is expected to reduce utility costs by 28%.

Benefits, lessons learned and value added

Benefits

- The EnMS training has made managers and technical staff more aware of the financial cost of inefficient energy management.
- Management is now aware of the potential financial benefits of implementing an EnMS.
- Technical staff have realised that energy savings opportunities can be unlocked by taking a structured approach to analysing how energy resources are used during operations.

Lessons

- Energy savings are not only achieved by spending money. Low-cost initiatives exist and need to be identified, prioritized and implemented.
- Data collection is crucial to quantifying energy consumption and analysing energy performance.
- Data collection is also vital in determining the potential savings that may be gained by implementing energy savings projects. CPC will be critical and more precise in its data collection so it can conduct a more refined analysis.
- Providing adequate resources and support for the energy team is vital for the continuity of the EnMS.

Future plans

- CPC is investigating other no/low-cost interventions.
- CPC plans to intensify awareness and training of staff on EnMS to ensure behavioural change.
- Air-conditioning units will be changed to energy efficient ones in October 2023.
- Certification to the ISO 50001 standard is being considered.

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