INDUSTRIAL ENERGY EFFICIENCY PROJECT IN GHANA

Energy Management Systems (EnMS)

CASE STUDY

Fanmilk Limited

North Industrial Area, Accra, Ghana

Company size (personnel)
Large
(100 or more)

Sector
Food processing company

Year joined project	Date of implementation
June 2021	2021

Company profile

Fanmilk is a diary food manufacturer dedicated to the production and distribution of healthy food across West Africa. A Danish entrepreneur and other investors in Ghana started Fanmilk in 1959 under the name Ghana Cold Store. It was renamed Ghana Milk Company in 1960 and had the primary aim of producing and distributing fresh milk-based products. The need for quality logistics gave birth to a partnership between the company and the Danish sourcing and trading company, Emidan, which started supplying dairy factories in Ghana in 1960 and later other parts of West Africa.

Fanmilk was converted to a public limited liability company in 1969, and now produces and distributes quality and refreshing milk-based and fruit-based products. Fanmilk's milk-based products consist of a range of frozen ice creams, frozen flavoured milk drinks and yoghurt drinks (both frozen and drinkable). Fanmilk is strongly committed to producing quality, healthy and nutritious products for consumers and is certified by ISO, the Ghana Standards Authority and the Ghana Food and Drugs Authority.

Plant profile

The company has over 600 staff when operating at full capacity. Its plant has an installed capacity of 100,000 metric tons per year (2016 data) and produces the following products: FanYogo, FanChoco, FanIce, FanMaxx, SuperYogo and FanVanille. It has three boilers, which produce 11,500kg of steam per hour, four condensers with a power rating of 18,400kWh, three freezers with a total installed capacity of 8.2 tons, a heat exchanger with an installed capacity of 14 tons per hour, three gensets with a total installed capacity of 6,000kVA and a waste plant treatment with an installed capacity of 120 metric cubes per day.

Energy sources and usage

The facility uses four energy sources:

- Electricity.
- Biomass (firewood and kernel).
- Diesel for backup generators in the event of power outages.
- Solar power.

The bulk of energy comes from electricity from the grid.

The significant electrical energy users (SEUs) are shown in the graph below (miscellaneous includes the heat pump, motors and pumps). The significant biomass energy user is mainly the steam boiler (figure 1).

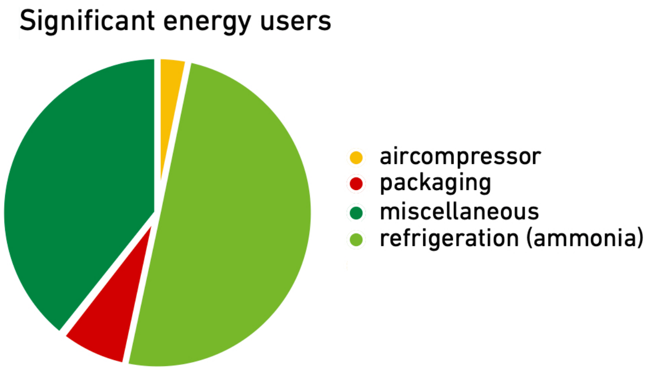

Figure 1: Sign energy users.

Process flows

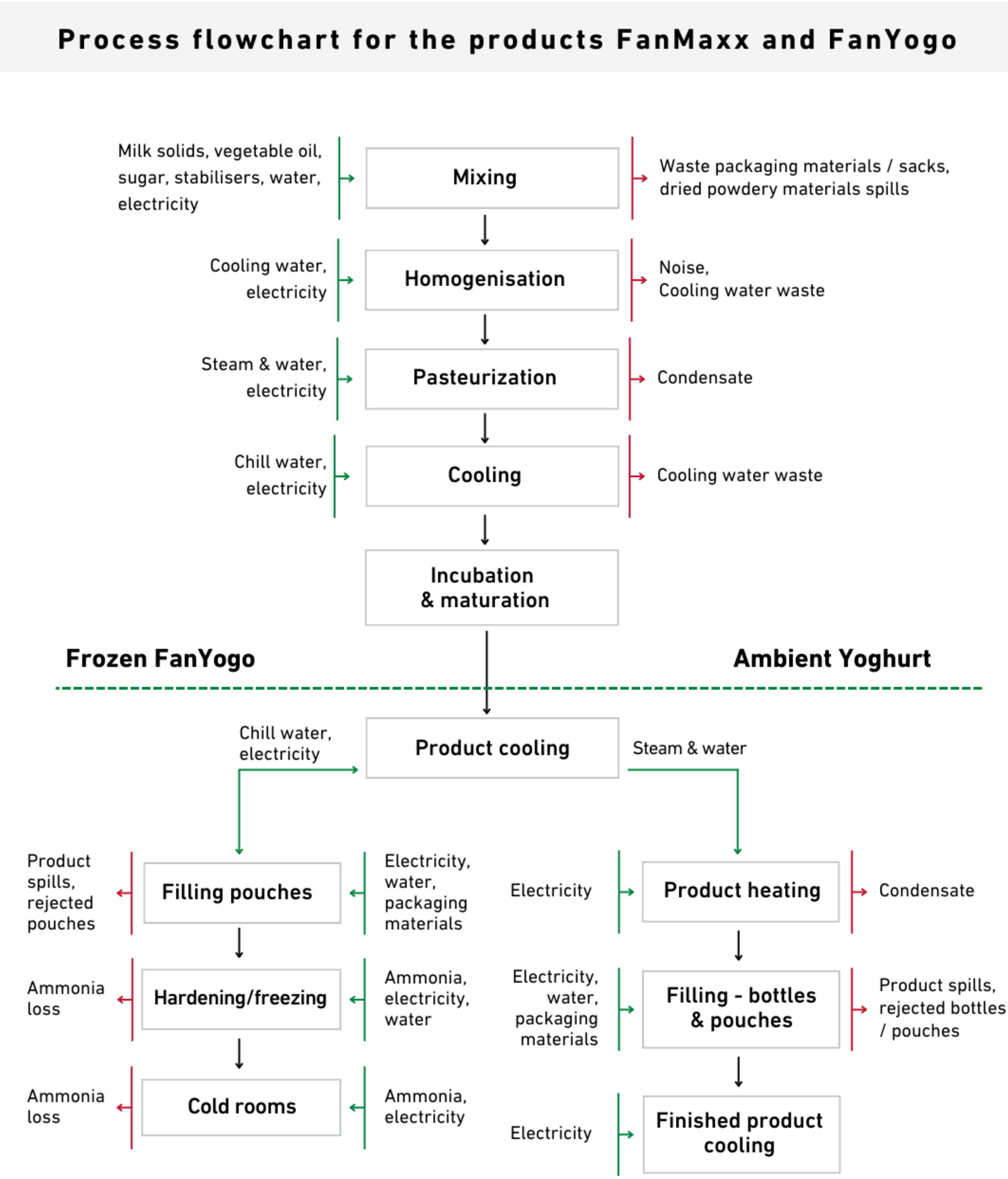

Figure 2: Process flowchart for the products FanMaxx and FanYogo.

Process flowchart for the product FanIce

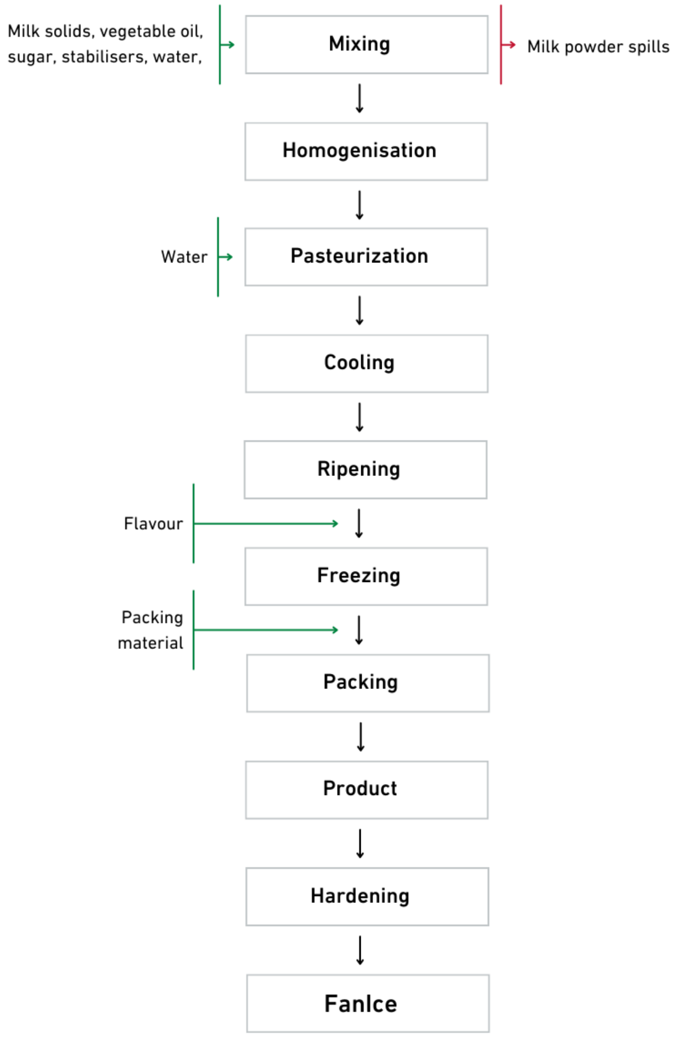

Figure 3: Process flowchart for the product FanIce.

Nature of the challenges

The increasing cost of energy and water is a growing concern to the company, and this spurred Fanmilk to work with the Ghana National Cleaner Production Centre under the UNIDO Ghana Industrial Energy Efficiency Readiness Project in late 2021. The UNIDO team undertook a resource efficiency, cleaner production assessment and energy audit at the site.

The assessment revealed existing opportunities for energy reduction. Management of Fanmilk noted these challenges and is taking steps to implement some of the energy system optimization (ESO) recommendations that stemmed from the audits, beginning with those that have low or no-cost implications. These efforts need to be better coordinated and evaluated, and the measurable outcomes and benefits clearly documented prior to project initiation. This will allow management to clearly observe the benefits.

Capacity building

Internally, more capacity building will be required to enable full implementation of an energy management system (EnMS). Two staff participated in UNIDO's EnMS training. These staff have positions that do not directly impact production. Therefore, more work needs to be done to capacitate the new heads of Plant and Production and production staff on energy management.

The creation of general awareness about the need to improve energy savings and change operational behaviours should be emphasized through a detailed and sustained communication campaign and training.

Proposed interventions

Saving opportunity 1:

Many steam valves are not insulated, and this is also a safety issue.

- Investigate the potential heat recovery of the exhaust air (temperature is 250 degrees).
- Steam is generated at 6 bar and uses mainly at 4 bar. Do an energy efficient design assessment to reduce the demand of steam.
- Complete a steam trap survey and replace the failed steam traps.
- Insulate the steam traps.

Identification date	October 2021
Significant energy use	Steam system
Barriers or risks	Education and monitoring
How are potential savings estimated?	Temperature loss due to an exposed system
Non-energy benefits	Improved workflow and reduced accident risk

Saving opportunity 2:

The air compressors produces 8.2 bar and they use 7/6 bar. During distribution there is a pressure drop and there is air leakage. (Reduce leakage, and possibly install a bigger compressed air receiver.)

Identification date	October 2021
Significant energy use	Air compressors
Barriers or risks	Education and monitoring
How are potential savings estimated?	Energy loss due to leakage
Non-energy benefits	Increased productivity and better use of time

Saving opportunity 3:

- Turn off the standby ammonia compressor because it still consumes energy.
- The compressors all have different set points but produce two types of cooling; therefore, all the set points should be adjusted to the same type. This can be incorporated into standard operating procedures, which state the desired set points. This is for the HP compressor and the LP compressor.

Identification date	October 2021
Significant energy use	Ammonia cooling system
Barriers or risks	Education and monitoring
How are potential savings estimated?	Energy loss due to leakage
Non-energy benefits	Increased productivity and better use of time

Implementation of an Energy Management System

The EnMS implementation project has five distinct phases and will take place over 12 months. Management has committed to implement an ISO 50001 EnMS. The first steps that have been taken toward this include the five different phases.

Phase 1: Management responsibility and policy:

- A signed energy policy.
- A clearly defined scope.
- Access to detailed bulk electricity consumption is now available to help monitor consumption patterns (daily, weekly, etc.).

Phase 2: EnMS planning:

- Energy data were obtained for analysis and development of baseline.
- SEUs were identified with their energy consumptions.
- Objectives, targets and action plans are in progress for all energy sources.

The following are in the planning and development phase:

- Baseline and energy performance indicators (EnPIs) are in progress for all energy sources.
- Maintenance and operational controls.

Phase 3: EnMS implementation and operations:

- Reinforce the energy awareness campaign and follow up with personnel.
- Identify and implement operational controls on equipment.
- Develop and use energy efficiency design technology.
- Communicate and implement a suggestion scheme to generate energy efficiency ideas.

Phase 4: Checking:

- The activities are planned.

Phase 5: Reviews

Implementation challenges

- There is a lack of adequate funds to implement high-cost ESOs.
- There is inaccurate data collection.
- A change in management disrupted the energy management plan.
- Staff behaviour is hard to change.

Highlights of operational and energy saving optimization interventions

Summary of implemented interventions

Based on the proposed opportunities, Fanmilk has implemented the following energy saving measures.

#	Saving opportunity description	Implemented	Energy saving	Cost saving (GH₵)
1	Installation of a heat pump to generate hot water from compressed ammonia heat for hot water optimization	2021	To be determined	To be determined
2	Installation of a solar system for the administration block (161kW)	2021	590,000 kWh	690,300
3	Installation of a biomass boiler to reduce diesel use	2022	1,050,000 litres of diesel	157,500
4	Air curtain installation to entrance of cold rooms	2021	To be determined	To be determined
5	Comprehensive (99%) installation of steam pipes	Not given	47,500kg of biomass	38,000

Monitoring these implemented measures can be done through an EnPI or by documenting the reduction in energy consumption when production is at the same level. The effect of installing the biomass can be verified by the reduction of diesel usage, which is shown in the graph below (figure 4).

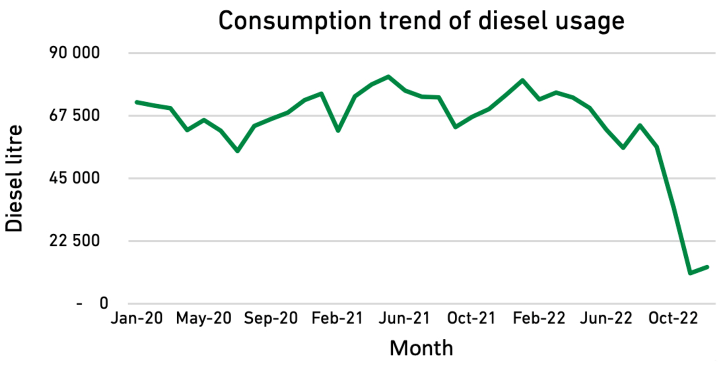

Figure 4: Consumption trend of diesel usage.

Highlights and other energy saving optimization interventions

- Accurate data collection and set up of baseline.
- Monitoring energy performance on a high level.
- Insulation of steam valves.
- Insulation of steam pipes.

Benefits, lessons learned, value added

Benefits

The EnMS implementation at Fanmilk has created a high awareness among management of energy, and the company is considering gaining ISO 50001 certification when the Ghana Standards Authority makes certification available.

Lessons

- Energy management is a continuous improvement process; prioritizing the basics provides the foundation for long-term success.
- Resources and time are required for successful implementation of an EnMS.
- It is critical to determine the key factors that affect energy performance for each SEU.
- Having accurate and timely data is vital for the efficient operation of an EnMS.
- Improving energy performance makes good business sense. It saves money and reduces costs while increasing the reliability of plant and equipment. It also has a positive effect on productivity and enhances the reputation of Fanmilk.

Value added

At the end of the UNIDO EnMS training, participants were able to:

- Create awareness among top management for the implementation of an EnMS.
- Begin measuring and collecting energy consumption and operational data from various departments at the factory.
- Acquire knowledge on EnMS implementation.
- Acquire the expertise to develop EnPIs with production and energy data.

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