Energy Management System Implementation: Case Study

ASTARTA-KYIV agri-industrial holding

"Yareskivsky Sugar Plant" LLC "Tsukoragroprom"

1 COMPANY OVERVIEW

"Yareskivsky Sugar Plant" LLC "Tsukoragroprom" (hereinafter **Yareskivsky Sugar Plant)** is a member of the Astarta, a vertically-integrated agro-industrial holding in Ukraine, a public European company that manages a socially responsible business and produces food products geared towards global markets.

Yareskivsky Sugar Plant joined the company in 2000 and since then has been steadily developing and integrating into the Corporate Integrated Management System.

The plant has been in operation for more than half a century and is confidently holding the leading position among sugar producers in Ukraine. The production is based on the manufacture of sugar from sugar beet.

The technological process of production includes a fast-growing process of processing raw materials (sugar beet) to obtain the main products (white crystalline sugar).

The accompanying products of sugar beet processing are:

- grease;
- molasses.

Sugar Factory Partners: CocaCola, Pepsi, Sandora, Roshen, Philip Morris.

The system of energy management at the enterprise was implemented and certified in accordance with the requirements of ISO 50001 in 2019.

2 INITIAL CONDITIONS FOR EnMS

Scope of EnMS is the whole enterprise. Energy resources consumed in the enterprise: electricity, natural gas, water.

To participate in the **UNIDO-GEF project "Implementation of the standard of energy management systems in Ukrainian industry"** (hereinafter **UKR IEE project**), the company had an understanding of the need to build a system of energy management and systematically manage energy consumption.

The assessment of energy efficiency for participation in the project was based on:

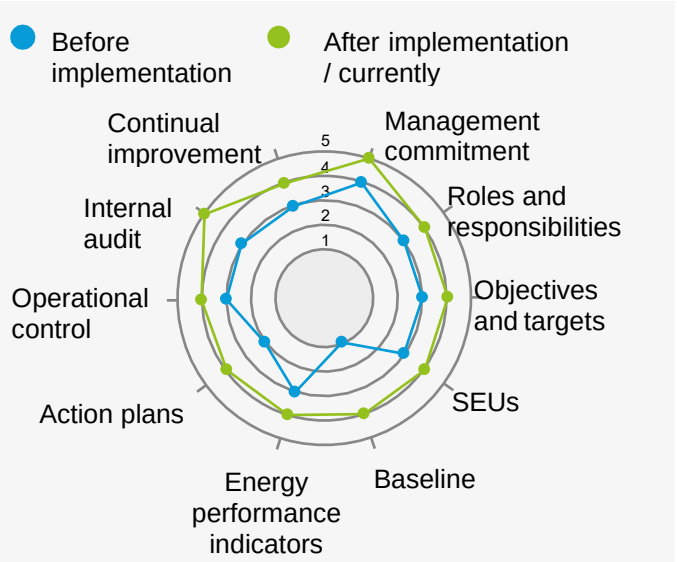
- trends in energy consumption;
- comparisons to past years;
- calculation of unit costs per unit of output.

Not done:

- education on energy saving and energy efficiency;
- energy analysis;
- assessment of compliance with legislative and other requirements.

Practically there was no procedure for taking into account the efficiency of the procurement in procurement and design, only the price factor was considered.

The diagram shows the level of compliance with the requirements of ISO 50001 to the **Yareskivsky Sugar Plant** before and after the implementation of the energy management system.



3 BENEFITS FROM EnMS IMPLEMENTATION

Within the framework of the **UKR IEE project**, the **Yareskivsky Sugar Plant** received theoretical and practical knowledge about the peculiarities of the functioning of the energy management system.

Within the framework of the training, information was collected which consisted of 4 modules, which fully covered the requirements of the international standard ISO 50001 and gave the opportunity to the company's customers to estimate the actual energy consumption of output. The main products of the company are presented at Figure.

As part of the training, the practical experience in conducting internal audits of the EnMS was also obtained. Also, has been received a tool developed by UNIDO to facilitate the implementation of the EnMS.

Were used the UNIDO approaches to calculating energy consumption that were not used at the Enterprise.

In particular, the regression analysis, which gave a chance to more accurately, from a mathematical and statistical point of view, approach to the estimation of energy consumption. This made it possible to assess the accuracy of available methods for calculating energy efficiency.

During the introduction of EnMS, the energy manager appeared in the company, and the energy management group was organized.

Objectives of 2018, plans were made to implement ISO 50001: 2011 and to reduce consumption of natural gas and electricity. The actual reduction of natural gas consumption per 1 ton of sugar compared to the plan was 3,04%, while the electricity per ton of processed beet was less by 5,53%.

4 IMPLEMENTED ACTIONS

Accordingly, for the support and continuous improvement of the EnMS, the management of the enterprise formed a group of energy management.

Composition of the energy management team

Team leader	**Technical director**
Team members	**Technological-ecological safety engineer -** (representative Integrated Management System) **Deputy Chief Power engineer –** responsible for EnMS implementation Engineer (Energy Manager) **Chief technologist –** responsible for operation control

The list of actions implemented in 2018 is provided in the table below

Energy saving measure	Month of 2018	Expected savings after implementation
1. Installation of frequency converters for pump and fan of boiler № 2 (CHP)		**211000 kWh / production period**
2. Replacement of lighting with the introduction of LED lamps		**25000 kWh / production period**
3. Installation of thermal insulation		**25000 m³ of gas during the production period**

5 IMPLEMENTATION RESULTS

The enterprise has implemented and operates a system of energy management, which operates within the framework of the Corporate Integrated Management System. At the enterprise, as a definition of the energy efficiency of work, energy analysis procedures were developed using the approach used by the UNIDO tool provided as part of the **UKR IEE project**.

According to the form, at the enterprise were determined following factors influencing the consumption of electricity and natural gas:

- Beet reworked, t.
- The content of rotten mass% from the base level to the mass of beets.
- Pumping juice,% from the base level to the mass of beets.
- Sugar produced, t.
- Sugar content of beet,% of base level.▸ Sugar on a machine, t.
- Degree days (15 ° C).
- CP content in presses. pulp,%.
- Dry pulp produced, t.
- Made of pulp pellets., T.
- Water consumed in surface m³.
- Molasses are made, t.
- Consumption of condensate water m³.

And the following baselines are defined:

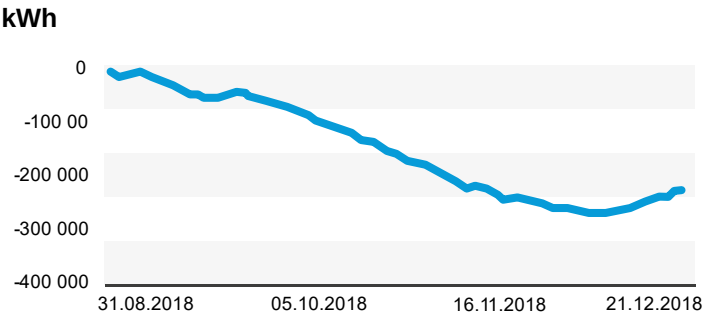
- Natural gas consumption for production needs m³;
- Natural gas consumption for drying and granulation m³;
- Own electricity consumption for production needs, kWh.
- Own electricity consumption for drying and granulation
- requirements, kWh.

Adjusted R^2

Baseline		Equation to determine energy efficiency
Consumption of natural gas for needs production m³/day	0,98	7415-172* (Pumping of juice,% to the mass of beet) + 1683 * (Succulency of chips%) + 16,8 * (Sugar on a machine, t) + 0,72 * (Produced by it, kWh)
Natural gas consumption for drying and granulation m³/day	0,98	7599-190 * (Content of CP in presses,%) + 220 * (Produced pulp granulated, t) -157 * (Degrees-days (15 ° C))
Own electricity consumption for production needs, kWh/day	0,79	36985 + 302 * (Pumping of juice,% to the mass of beets) + 33,4 * (Produced sugar, t)
Own electricity consumption for drying and granulation requirements, kWh/day	0,91	1301 + 79.5 * (Made of pulp granulated, t)

The CUSUM chart for electricity savings for production needs in kWh is presented in picture.

CUSUM electricity consumption (savings) for production needs, kWh in 2018



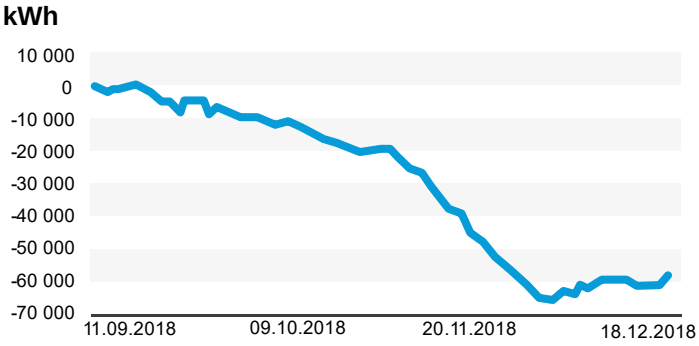
Working days during the production period

According to the figure, total electricity savings for production needs in 2018 amounted to 2 % from baseline.

All the days of the plant's operation were effective, and the work efficiency at the beginning and at the end of the season requires research.

The CUSUM chart of consumption of own electricity for the needs of drying and granulation in kWh is presented below.

CUSUM electricity consumption (savings) for the needs of drying and granulation, kWh in 2018

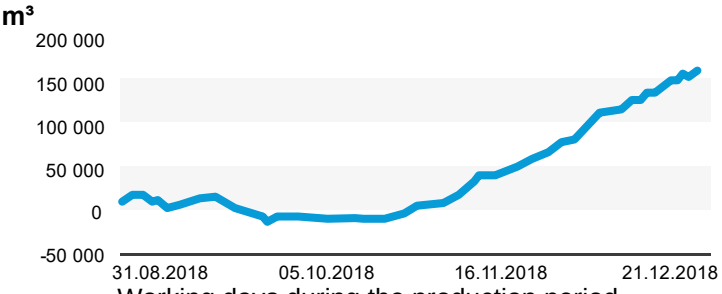


Working days during the production period

According to the figure, total electricity savings for drying and granulation in 2018 amounted to 4 % from baseline.

The CUSUM chart for natural gas savings in m3 is presented below.

CUSUM natural gas consumption, m3 in 2018



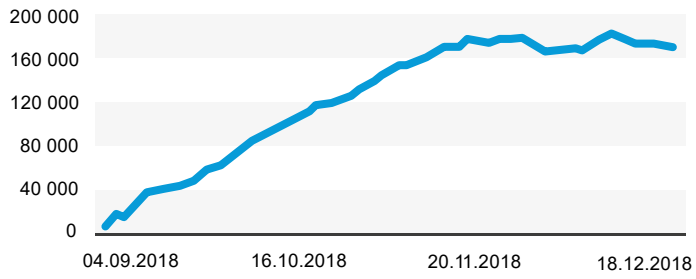
Working days during the production period

According to figure, the overrun in 2018 was 1 % of the baseline.

This overhead requires research with the release of typical periods of the production season (start and stop).

The CUSUM chart for natural gas savings for drying and granulation in m3 is presented below.

CUSUM natural gas consumption, m3 in 2018



Working days during the production period

According to figure, the overrun consumption of natural gas for drying and granulation needs 4 % of the base level.

This overhead requires research with the release of typical periods of the production season (start and stop).

6 CONCLUSIONS AND RECOMMENDATIONS

Training in the framework of the **UKR IEE project** provided the **Yareskivsky Sugar Plant** with theoretical and practical knowledge on the construction of energy management systems within the framework of energy planning processes. More detailed understanding of the use of statistical methods, namely, regression analysis as a tool for comparing energy consumption to normalized conditions.

The materials presented by the project representatives and lecturers were useful and had significant theoretical and practical value as part of the work on implementation of energy management systems. In particular, the approaches outlined in the training were used in the energy management system of the Enterprise.

Recommendations before and during the implementation of EnMS:

- Conduct a comprehensive energy audit.
- Enlist the support of top management during EnMS implementation.
- Develop a procedure for motivating staff to achieve results that are higher than goals set in energy policy.
- Conduct outreach and awareness raising activities among staff regarding the normalization of energy consumption data.