Energy Management System (EnMS)

Case Study: Operational control

UNIDO, Russia 2014

About the company

Name	*Baltika Breweries*
Sector (ISIC code)	*Brewing 2082*
EnMS Tools	*Operational control, low cost savings and energy performance indicators*

Introduction and context

Baltika is a major brewing company with 8 breweries in Russia. It is part of the Carlsberg group. In 2013 Baltika joined the Industrial Energy Efficiency (IEE) Programme implemented by the United Nations Industrial Development Organization (UNIDO) in collaboration with the Russian Energy Agency and with financial support from the Global Environment Facility (GEF). Within the scope of the partnership with UNIDO, Baltika started a process to implement energy management systems (EnMS) in all its Russian breweries. The EnMS was designed to be aligned with the requirements of ISO 50001 and also with the UNIDO Energy Management Capacity Building and Implementation programme. The total energy consumption of the company in 2014 was 1,132 GWh.

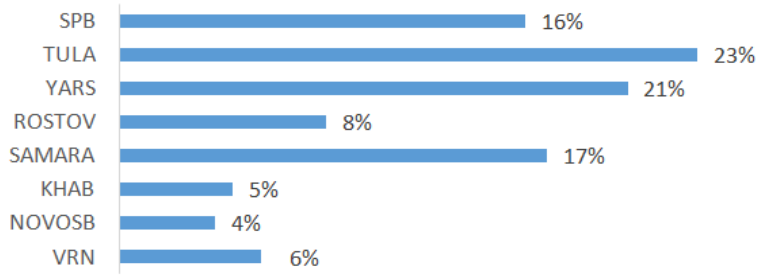

Figure 1 Relative electricity consumption of the eight breweries in 2014

The program consisted of training and mentoring support of 30 Baltika personnel by UNIDO international energy management experts and national consultants. The training and implementation program spanned a period of just over 12 months. During this time each of the Baltika plants implemented the energy management system. The EnMS focused on 3 broad areas of improvement; firstly people and change management, secondly energy performance measurement and analysis and thirdly technical improvements to machinery and processes.

One of the key components of the EnMS is how equipment is operated and maintained. This applies to equipment regardless of its age or condition. Experience from around the world is showing that significant savings can be achieved through improved operation and maintenance practices.

Arcelor Mittal Saldana Works company saved about 80 GWh of energy, worth approximately 9 million USD, with zero capital costs in its first year of collaboration with the UNIDO South Africa IEE Programme (2011). Moldova dairy Lactis SA attained 22% reduction of its annual natural gas consumption through review and optimization of its milk processing schedule and operational control.

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An assessment of nine facilities certified within the US Superior Energy Performance (SEP) Programme carried out in 2012-2013 showed average incremental energy savings of 3.8% during first year of EnMS implementation and 10.1% during the second year just through operational improvement actions and no-cost/low-cost interventions (McKane et alia, 2013).

This case study is focussed on the savings achieved in Baltika through improvements in routine operations and maintenance. These savings are achieved without capital investment. They are achieved largely at no cost or at very low cost.

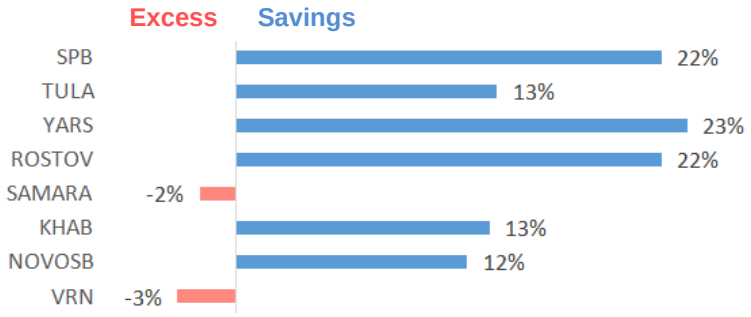

Figure 2 Relative acquired electricity savings of the eight breweries from September 2014 to February 2015

The Baltika plants were already operating at good levels of energy efficiency prior to joining the UNIDO Energy Management Capacity Building and Implementation programme. Collectively they had implemented close to 1000 energy saving initiatives over the previous 5 years. The standard of engineering knowledge and competence is very high by international standards. The plants also have a high standard of continuous improvement processes including Total Productive Maintenance (TPM). Therefore there was a considerable challenge in improving further especially without investment in new technology. They also benefited from a number of global management and improvement initiatives supported by Carlsberg.

At the beginning of the process for the implementation of the EnMS the plants were under considerable pressure to reduce costs to maintain and improve competitiveness.

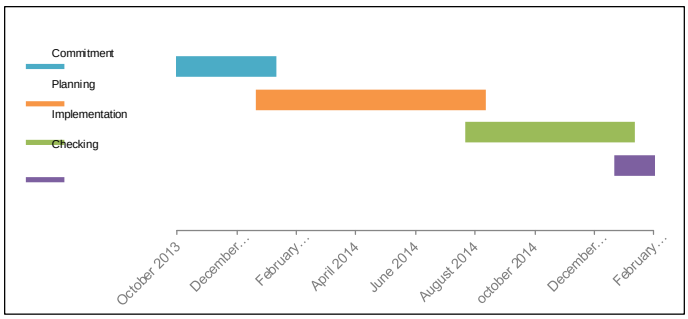

Figure 3 Baltika EnMS Timeline

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Energy Management System implementation

An EnMS is how an organisation manages its people, energy information and technology to improve its energy performance. It means applying good management practices to day-to-day operations to reduce energy consumption. A set of business process is needed to ensure optimum use of available resources and that all personnel involved have clear roles and responsibilities.

The EnMS is based on a cycle of developing real commitment to accepting the need for change and support from top management. It requires the development of a set of plans of how performance will be improved and a coherent approach to implementing the changes, projects and other initiatives to improve performance.

After the implementation of these plans verification is required to check the improvements and that the system is functioning properly. The EnMS based on a cycle of continuous improvement of performance and continuous improvement of the management system itself.

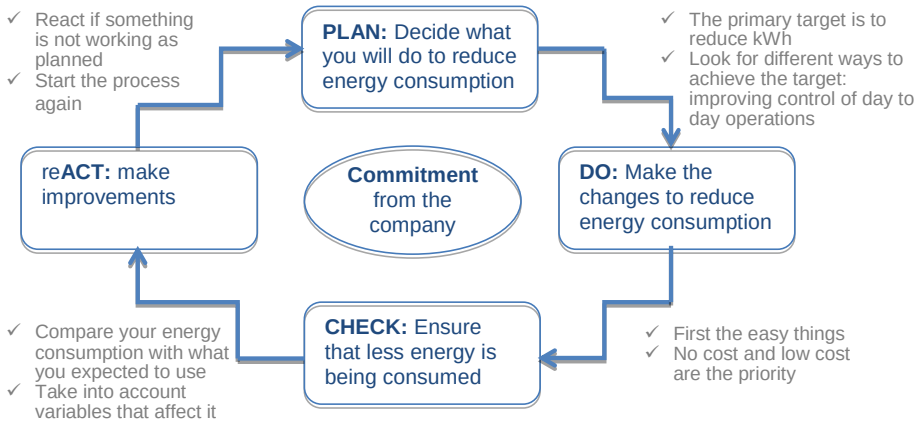

Figure 4 Schematic overview of the EnMS implementation process

Results and achievements

In a period of 6 months, the 8 plants achieved savings of 7.4% of electricity consumption and 4.9% of gas consumption. This corresponds with savings of over 24 million Rubles. These savings were achieved in a sustainable way, meaning that they will continue to be saved into the future and further savings are expected as the management system becomes embedded in the culture of Baltika. These savings take account of variations in production levels and product mix.

The trends in figures 5 and 6 below show the comparison of actual energy consumption with expected consumption if the program was not implemented.

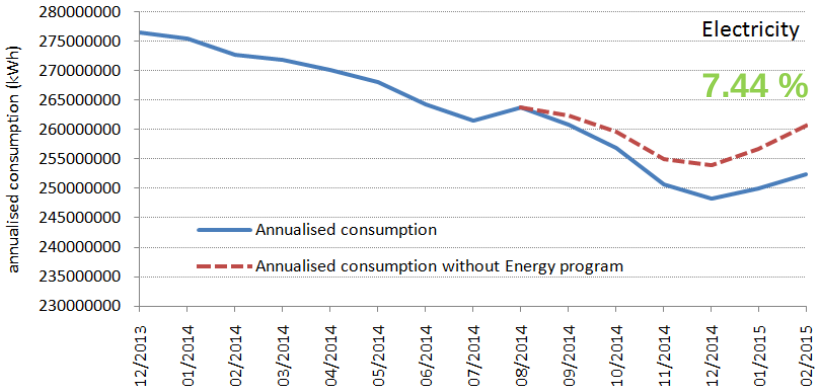

Figure 5 Electricity annualised consumption trend

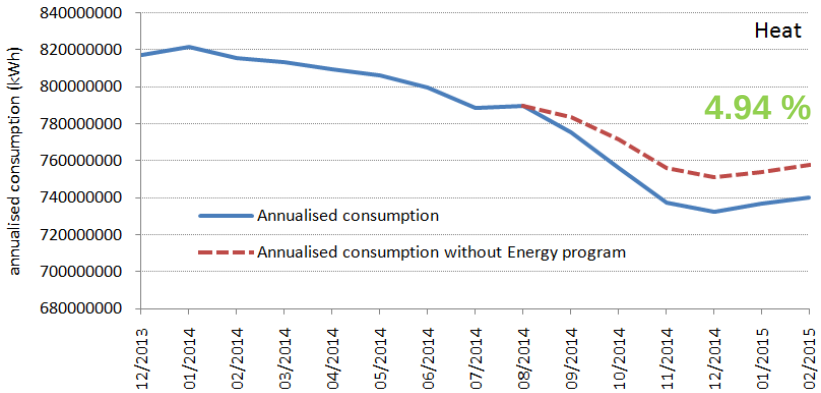

Figure 6 Heat annualised consumption trend

	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Sub-Total
Water	-1,7	-0,8	-0,4	-1,1	-1,2	-0,1	-0,8	-0,1	**-6,2**
Electricity	-0,8	-2,2	-4,7	-3,2	0,4	-1,7	-2,2	0,7	**-13,6**
Heat	0,0	-0,2	0,0	-2,0	3,0	-5,3	-1,4	1,7	**-4,3**
Total (RUB)	**-2,6**	**-3,1**	**-5,2**	**-6,3**	**2,3**	**-7,2**	**-4,4**	**2,3**	**-24,1**

Table 1 Savings in million Roubles from September 2014 to February 2015 achieved without capital investment

Critical success factors

There are a number of factors that are critical to the success of implementing an effective EnMS. The process is largely one of organizational and behavioural change applied to energy. The critical success factors include:

- Openness to change and to doing things differently. This applies at all levels of the organisation. Resistance to change at any of a number of levels makes the process much more difficult. Baltika already had a very good attitude to change and improvement.
- Support and commitment from senior management are crucial to success. This is much more than an acceptance of the need for and the possibilities of energy performance improvement. It requires that senior management remove obstacles to improvement, make decisions to support improvement and pushes for and require tangible results.
- The appointment of a central coordinator whose role was to ensure that the plants' energy efficiency managers followed up on their commitments. He also shared learnings between the plants, both good and bad.
- It requires cooperation between departments. Success will not come from the engineering or energy department alone. It requires change and improvement in all operational areas that impact energy consumption. Building on the thorough work completed at the planning stage on shared roles and responsibilities, Baltika energy teams and their interactions with other organization units and areas have progressively grown and improved over time.
- Making continuous improvement and energy management an active and routine part of day-to-day operations.
- In cooperation with the production and quality departments, the energy team developed operating limits and associated checklists for energy critical parameters. This level of cooperation was very beneficial and critical to the success of the program and ensured that energy savings could be achieved without compromising the high quality of the products.
- Regular communication including daily meetings between energy and production personnel to build on the initial success. The energy team demonstrated the savings that were being achieved and the production people continued to identify further opportunities and to monitor stable implementation of changes and improvements.
- Once initial success was demonstrated this provided an impetus for stronger commitment and other improvements in the other plants and other departments, helping to remove any remaining scepticism and resistance to the new EnMS approach.
- Baltika engineers already had a very good understanding of energy performance measurement and analysis. This allowed them to clearly and quickly pick up the data and energy performance indicators driven methodology taught by the UNIDO programme and see the savings being achieved.
- There was a big turning point when the breweries' engineers themselves started to clearly see the results of their efforts and then pushed for more actions and savings. Seeing the benefits of their work had a bigger effect than when management told them to do it.
- The process of developing annual energy budgets included allowance for targeted savings. This helped align both savings and spending.
- The employee motivation program is aligned with the energy savings program and the EnMS.

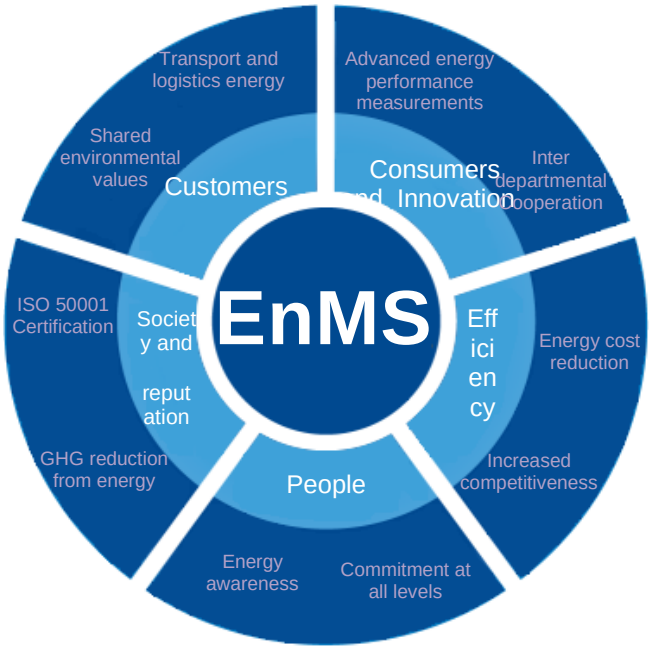

Figure 7 Energy management wheel in Baltika

Barriers encountered in achieving these savings

- There is always a barrier to low cost savings in that they mostly require changes to established work practices and behaviours. In many companies where investments have been made in new and upgraded technology, this barrier is often greater. This barrier was overcome through improved communication and by demonstrating practical examples of the potential. This improvement was aided by Baltika's general openness to change.
- The barrier to change is often strongest at senior and middle management levels. This is often due to different priorities at these levels and also different levels of technical expertise. This situation was improved through communication with management. Once they accepted that these improvements were realistic and achievable, they increased their level of support. They also needed to understand that the savings would be achieved without compromise to quality, safety, productivity or any other primary concerns. Indeed almost all energy improvements result in improvements to these areas as well.
- Improvements to the energy efficiency of existing equipment and systems require a specific type of technical knowledge that is often not readily available. It requires knowledge of both the theory of the machine and how it can be operated differently. The significant savings shown by early practical examples combined with the UNIDO programme's emphasis on strengthening internal capacity showed the benefits of improved competence in these areas.
- The use of specific energy consumption or energy consumed per unit of production is almost always a significant barrier to improvement. In the process of EnMS implementation, largely aware of the limitations of its indicators, Baltika engaged in and made the most of UNIDO's training and shifted to energy performance analysis based on indicators in absolute terms.
- There was a tendency to explain and defend periods when energy consumption exceeded expectations. This prevented further improvement. Behaviour was changed to treating these deviations as opportunities to improve through investigation and corrective action.

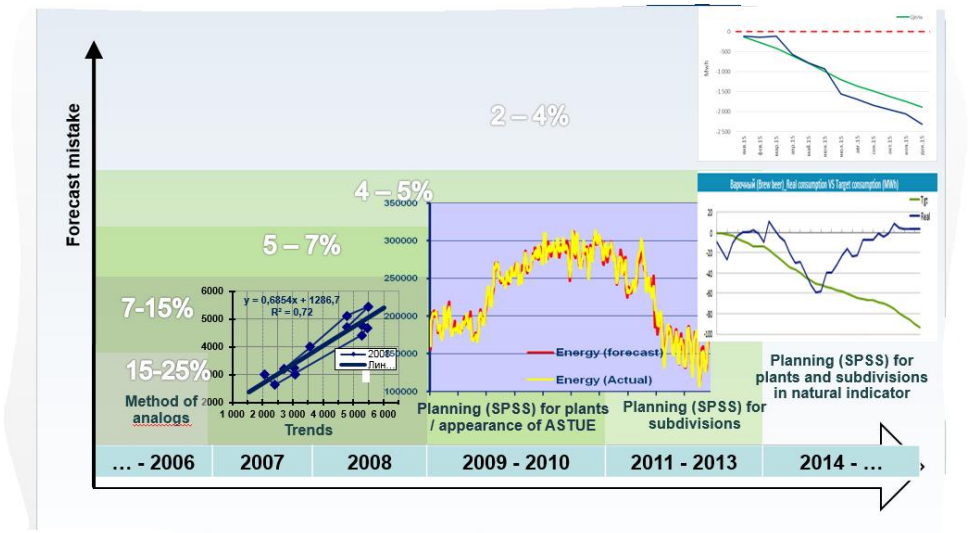

Figure 8 Stages of planning system development

How the improvements were achieved

As already stated, most of the savings were achieved through no cost and low cost initiatives. A sample of the type of changes that were made is shown below. These and other similar improvements are available in many industrial plants.

- Debugging of refrigeration systems and alignment of parameters between the refrigeration machinery and the consumer department requirements.
- Improvements to maintenance planning and prioritisation leading to on-going savings from items such as leak detection and repair.
- Investigation and optimisation of critical process parameters including time schedules, pressures, temperatures.
- Collection and reuse of water from scrubbers and gravel filters
- Improvements to algorithms for the control of carbon dioxide stations.
- Regulation of pressure and flow of compressed air

Energy Efficiency Improvements and Benefits (2014)	
Total Annual Energy Consumption [MWh]	1,132,000
Energy savings (op. control; no-cost; low-cost) [MWh]	25,416,746 (2%)
Energy savings (capital investments) [MWh]	21,858,331 (2%)
Energy cost savings (op. control; no-cost; low-cost) [RUB]	30,981,776
Energy cost savings (capital investments) [RUB]	16,983,250
Annual GHG Emission reductions (CO2)	13,950 ton
Other non-energy benefits	828,928 m3 water (9%) 17,642,536 RUB

Figure 8 Business benefits achieved

Примечание [MM1]:

If Leonid can provide the energy savings by fuel source, I can calculate the GHGs

Non energy benefits (NEBs)

There is growing international experience that there are additional benefits to the organisation from implementing energy savings on top of the direct benefits of the energy savings themselves. This applies particularly to low cost initiatives. These additional benefits derive from the improvements made to the control of operations and processes. These savings typically include improved productivity, improved quality and reliability, reduced maintenance costs, etc. The financial value of the non-energy benefits typically exceeds the financial value of the energy saved.

Direct benefits include cost reduction and reduced green house gas emissions associated with the organisations consumption of energy derived from fossil fuels.

In the case of the improvements in Baltika this has also been the experience.

At the beginning of the EnMS Planning phase Baltika made the decision to include water usage in the scope of its energy management systems. The decision was the result of discussion with the UNIDO expert team and substantial practical evidence that water usage performance can also greatly benefit from and improve through a systematic management approach like the one for energy. The decision of Baltika proved to be the right one with water savings exceeding 11% compared to the expected baseline consumption.

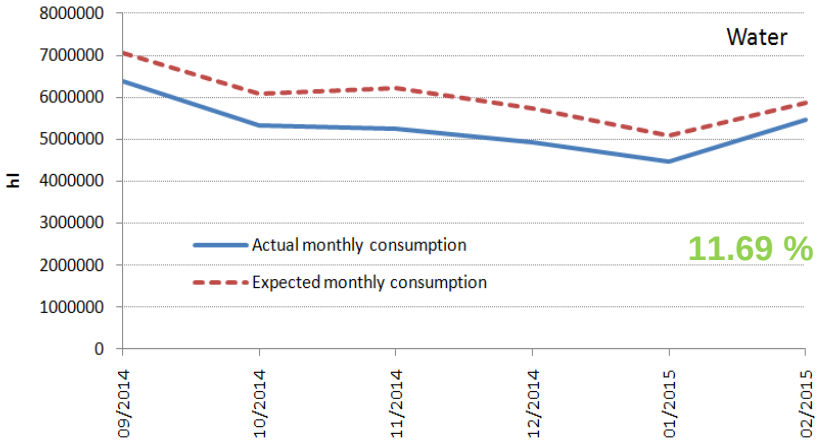

Figure 9 Water savings

Results and conclusions

The most significant result of this project has been large energy costs reductions without financial investment in a company that was already performing very well in terms of energy consumption and efficiency.

These improvements also resulted in many other benefits to the company including improvements to product quality, equipment reliability, interdepartmental co-operation and motivation of staff.

These were achieved through a combination of a systematic approach, strong commitment from the energy team, effective performance measurement and improvements in day to day routine operations.