

# Energy Management System Implementation Case Study

Republic of North Macedonia

## Alkaloid AD



### Business Case for Energy Management

#### Organization Profile

Alkaloid AD is a joint stock company consisting of two profit centres: Pharmaceuticals and Chemicals, Cosmetics and Botanicals, located in Skopje, North Macedonia. It has two (2) subsidiaries in the country, as well as sixteen subsidiaries and three (3) representative offices abroad. It currently counts around 1,430 employees in the country and 384 employees abroad. It has a manufacturing capacity of 765 tons/year.

Alkaloid AD has an integrated management system that enables the company to control the quality of product from start to finish, i.e. raw materials and end-product. There are three (3) production sites in the Republic of North Macedonia, and one (1) in Serbia.

The main driver for undertaking EnMS implementation was the pressing need for active energy management since it is essential for taking full advantage of the energy efficiency potential, maximizing cost savings and long-term achievements. Energy consumption has a large financial impact on a yearly basis, the majority of costs belonging to HVAC systems. Therefore, it is the general opinion that by following the EnMS/ISO 50001 principles, savings of up to 30% can be achieved through reduction of energy consumption while simultaneously maintaining the quality of product as well as the occupational health and safety standards.

Snapshot	
Industry	Pharmaceuticals, Cosmetics, Botanicals
Location	Skopje, Republic of North Macedonia
Energy Management System	ISO 50001
Energy Performance Improvement Period	2016 –2017
Energy Performance Improvement (%) over improvement period	6.24 %
Estimated energy cost savings over improvement period	60,000 Euro/year
Cost to implement EnMS	160,000 Euro
Total Energy Savings over improvement period	1.185 MWh/year
Total CO <sub>2</sub> -e emission reduction over improvement period	214 tCO <sub>2</sub> -e

#### Business Benefits Achieved

The benefits experienced by Alkaloid AD as a result of EnMS implementation include:

- ✓ a change in energy reduction approach,
- ✓ improved company's image,
- ✓ reduced environmental impacts and carbon footprint i.e. lower CO<sub>2</sub> production,
- ✓ eased decision-making when selecting and implementing priority no/low-cost energy saving measures,
- ✓ reduction of its own electricity consumption, maintenance and associated costs,
- ✓ increased production and quality of product, and
- ✓ improved operational control.

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Table 1 shows the direct benefits realized by Alkaloid AD in 2016 - 2017 through the implementation of energy management system.

Table. 1. Energy Efficiency Improvements and Benefits

Energy savings	585 MWh/year natural gas <b>600 MWh/year electricity</b>
GHG emissions reduction	214 tCO <sub>2</sub> -e
Estimated energy cost savings	60,000 EUR/year
Other non-energy benefits	Improved company's image and environmental footprint

## EnMS Development and Implementation

The following section highlights key aspects of Alkaloid's approach to energy management.

**Top management commitment:** The Top Management of Alkaloid was highly committed to the reduction of energy costs, providing the necessary support to the energy team, making it a key part in the EnMS implementation phase, and strengthening the commitment with time. The Energy policy was created according to ISO 50001 requirements. The Scope and Boundaries were clearly defined in four (4) phases. The first phase included measures for reducing consumption of electricity, gas and water in one facility. The second phase included logistics and raw materials in the same facility. By finishing this phase, Alkaloid will be the only company in the Republic of North Macedonia which will treat its raw materials (half-products) by taking the energy aspect into account. The third phase will include replicating the process in the remaining facilities; the fourth phase envisions replicating the processes in Alkaloid's facilities abroad.

**Roles and Responsibilities (RnR):** The RnR were clearly defined during the Commitment phase. This aspect of

the process will be completed once the suggestions from the international consultants, the team members as well as all the employees (after the Awareness campaign) are checked and accepted. The energy team has a clear picture of the process and of the importance of ISO 50001 in the company.

**Energy Performance Indicators and Baseline:** After the Significant Energy Uses (SEUs) were identified, the Energy Performance Indicators (EnPIs) were developed identifying and taking into account relevant variables, the baseline was agreed and signed, with projected future energy usage.

**Energy Savings Opportunities with costs-benefits analysis:** The ESO list was populated by several energy saving opportunities. These opportunities achieved 6.2% reduction of energy consumption, however, due to an incomplete EnMS, i.e. small number of measurement points for electricity consumption, control meter for gas, compressed air, water in the initial stage, not all measures have been taken into account. The further development of a Measurement plan has already proved the possibility of 100.000 EUR yearly savings.

**Training and competencies:** Prior to the EnMS programme, the company did not hold annual energy efficiency training programme for the personnel. As of 2016, a group of three (3) employees has started the UNIDO EnMS expert training. As of January, 2018, a new Energy Management department has been formed, focusing exclusively on Energy, Energy Efficiency and Energy Management, with two (2) new employees in the EUREM trainings.

**Procurement:** Previously, the company used a Life Cycle Cost analysis for energy related procurement, however, this practice improved after the EnMS implementation.

**Third-party certification:** Alkaloid has implemented both national and international management systems

standards such as ISO 9001 Quality management system, ISO 140001 Environment management system, as well as the HACCP management system; however, ISO 50001 was not implemented prior to the EnMS programme.

## Resources and cost-benefit analysis

Table 2 summarizes the cost-benefits analysis of EnMS implementation in 2016 - 2017. Alkaloid invested approximately 160,000 Euro in energy saving measures in the reporting period, which resulted in energy cost savings equal to 60,000 Euro per year. In addition, approximately 5,100 Euro are saved annually thanks to non-energy benefits of the energy saving measures implemented. The overall payback time is approximately 2.6 years.

Table 2. Cost-benefit analysis (2016-2017)		
<b>COST</b> [EUR]	staff time [person/day]	5/18
	International + National Expert support* [person/day]	1/72
	Low-cost EE measures [EUR]	56,000
	Other Expenditures [EUR]	/
	<b>Total cost [EUR]</b>	<b>160,000</b>
<b>BENEFITS</b>	Energy savings [MWh]	1,185
	Energy saving rate	6.24 %
	<b>Energy cost savings [EUR]</b>	<b>60,000</b>
	Non-energy benefits [EUR]	5,100

\* In the UNIDO EnMS CBI programme, the cost of direct technical support of international experts and national consultants to partner enterprises is covered by UNIDO's technical assistance project.

In addition, in 2018 one measure was implemented costing approximately 2,500 Euro. This measure resulted in savings of approximately 700 MWh/year and 15,000 EUR/year, hence having a payback time of 0.3 years.

## Most significant projects implemented as a result of the EnMS

The Energy Saving Opportunities (ESO) list of Alkaloid comprises of several energy saving measures which are mainly part of improved operational control, maintenance practices and steam system optimization, as well as some investment measures.

Table 3 shows an overview of the most important energy saving measures implemented or planned and associated energy and cost savings.

## Drivers to Success and Behavioral Change

The following elements were instrumental to drive successful EnMS implementation:

- EnMS tools were instrumental in identifying Significant Energy Uses (SEUs). These SEUs are classified in several different categories such as: **Research and Development** with equipment including microscopes and centrifuges, electric mixes, sterilization, incubators, analysis equipment; **Offices** with equipment including computer, fax machines, photocopiers, printers, water heating; **Bulk Manufacturing** with equipment including centrifuges, ventilation for clean rooms and fume hoods, incubators, dryers, separation processes; **Formulation, Packaging & Filling** with equipment such as mixers, motors; **Warehouses** with equipment such as forklifts etc. Collecting relevant data for the variables helped in creating accurate regression models, as well as identifying energy saving opportunities and targets.
- One of the main drivers and goals was the commitment towards energy savings, to take full advantage of Alkaloid's own energy efficiency potential, maximize the cost savings and achieve long-term benefits.

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- Another key driver was the energy consumption data. HVAC systems are a big consumer in Alkaloid, and it was estimated that 30% of energy savings can be achieved through the implementation of EnMS in the company.
- The decision for participation in the project was made by the top management, showing dedication and commitment to energy savings.
- Additionally, encouraged by the EnMS guidelines, an energy review is conducted annually in the company providing basic monitoring of energy consumption.
- The planned objectives included detailed energy audits and consumption analyses for 2015 compared to the previously monitored EnPIs, reducing energy carriers' consumption in 2016, effective trainings and awareness

campaigns in 2017, modification of processes, technologies and equipment related to the SEUs in order to reduce the energy carriers' consumption until 2020.

- The planned targets included reducing energy carriers' consumption for 66 MWh in 2016 in the entire facility (all SEUs) and conducting related trainings for 150 persons in the departments that significantly affect energy use and consumption in 2017.

## Barriers and Lessons Learned

Until the EnMS consolidated, various barriers were encountered, such as:

- Lack of time because at the beginning energy savings were not the company's main priority,

Table 3. Main energy saving measures implemented

ID	Description of measure/project/ action	Service	Estimated/Actual (Annual) Savings		Total Cost (euro)	Payback (years)
			Energy [MWh]	Cost (euro)		
1	Optimization of working schedule, i.e. collective summer holiday (installation and equipment suffered less wear during collective summer holiday for Ampule Department which is the largest process steam user).	Steam	105 (natural gas)	3703 (+200 the following implementation year)	Nearly 160,000 in project costs in total (capital costs included)	/
2	Steam trap management and boiler use optimization according to capacity	Steam	480 (natural gas)	16,930 (+780 the following implementation year)		/
3	Replacement of old windows in HQ building (benefited to better working climate and productivity, and a larger working space, i.e. possibilities for more employees in the same place, and more space with normal working conditions in the building)	Insulation	600* (electricity);	2532		/
4	Insulating a valve in the boiler room (steam installation)	Steam	711	15,000	2458	0.3
5	Control of gas meter (further planned measure)	Steam	/	~ 100,000	/	/

however, after initial meetings, management was fully committed to the implementation of EnMS.

- No preventive or corrective actions were being taken to reduce energy consumption, which was also a result of the employees' low awareness of the importance of energy efficiency and possible reduction options. Most of them had their usual daily responsibilities which increased their reluctance in participating in the programme and undertaking new activities and obligations.
- The company had low capital budget for energy saving opportunities, since there were other priorities first.
- There was lack of competence in certain areas of energy management (i.e. regression models), as well as a certain lack of interest for hiring external consultants for identifying energy saving opportunities.
- The company had no Energy Manager already assigned.

During the EnMS implementation the following measures were carried out to overcome these barriers:

- Regarding the lack of human resources, responsible and focused personnel was appointed to identify energy saving opportunities and collect ideas from the employees on regular basis, track and monitor energy and water consumption, initiate projects, as well as report to middle and top management.
- An Energy Policy was published and communicated between all sectors of the company.
- Appropriate trainings are held regularly for educating and raising awareness for energy management benefits, especially disseminating

knowledge that even if energy costs within the total costs are relatively low, the risks from material, financial or human cost can still be high. Energy management significantly reduces these risks.

- Trainings were also held for achieving the needed competence of the employees, especially considering that EnMS tools include building regression models which then need to be applied for energy performance measurement. Trainings were held in order to raise awareness that energy systems are a fundamental part in any facility, which influences the product quality, and thereon, it impacts the good manufacturing practice and quality management.
- Capital budget for energy saving opportunities was planned to be allocated in the company's budget planning phase. The importance of energy saving opportunities, of regression analyses, and of analyzing measured results in order to track credible EnPIs was presented to top management.
- In order to achieve the target savings, a long list of savings opportunities was built, with most of the low/no cost measures being implemented. Cost effectiveness was achieved through gradual improvement.
- Consultants were invited to propose solutions for energy saving opportunities. Additionally, incentives, monetary awards and motivation schemes were planned to be introduced for the three best ideas for energy savings on a quarterly basis.
- The consultants were willing to help in weak areas, as well as transfer their knowledge and experience in order to help personnel complete their tasks faster.

- Building up people’s awareness through campaigns, as well as trainings and courses for improving competence.

### Results and Conclusions

Alkaloid realised the following achievements during the EnMS implementation:

- Reduced GHG emissions and carbon footprint. Compliance with ISO 50001 will allow Alkaloid AD to meet current and future voluntary and/or mandatory energy efficiency targets or GHG emissions reduction legislation, as well as all other relevant legal requirements.
- Increased energy and cost savings by reducing energy costs through a structured approach to managing energy consumption.
- Increased competence in the field of energy efficient equipment and its handling. Alkaloid AD plans to align the EnMS with the existing management systems for additional organisational benefits.
- Increased level of understanding of the EnMS in terms of non-linear regressions, multivariate analysis (i.e. accounting for multiple relevant variable that influence energy consumption) and multi energy carriers.
- Increased awareness among staff members and increased participation in the implementation of improvement projects.
- Improved corporate image.
- Improved operational efficiencies and maintenance practices.

- Criteria for maintenance of the significant energy uses were established with appropriate guidelines.
- The company carries out regular monitoring, periodic measurements and analysis of the energy performance and related key drivers and operating parameters. The EnMS tools have provided the incentive for proper operational control at the desired level.
- Building on Alkaloid’s work on EnMS in 2015-2017 and the positive results achieved, a new Energy Management department was created in 2018, completely focused on Energy, Energy Efficiency and Energy Management. The Department comprises the Energy manager as wells as two (2) new employees (in the EUREM trainings), and is expected to further expand in the coming years.

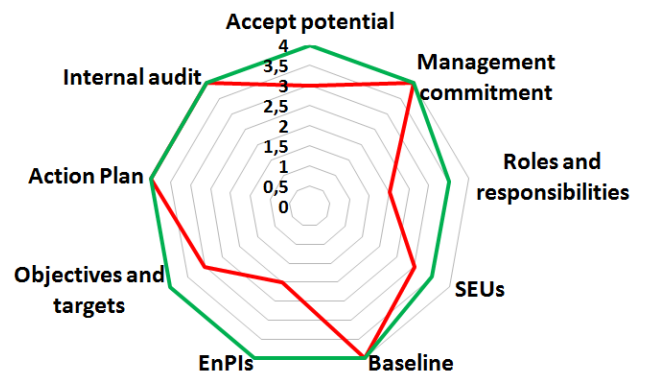


Figure 1. Improvement of energy management practices in Alkaloid after EnMS implementation



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## Annex: What is an Energy Management System (EnMS)?

Energy Management Systems offer organizations a systematic approach to manage energy use. It is about actively managing people, energy information, technology and day-to-day operations in order to improve energy performance.

Energy Management Systems entail

- ✓ Securing top management's commitment to support the change, provide necessary resources and establish accountability among employees involved,
- ✓ Establishing a set of business processes to ensure optimum use of available resources, cooperation between departments to achieve a common goal and clear roles and responsibilities for all personnel involved,
- ✓ Identifying Significant Energy Users and developing Energy Performance Indicators,
- ✓ Developing action plans to improve energy performance,
- ✓ Training and raising awareness within the company's personnel,
- ✓ Review and continuous improvement of energy performance and of the management system itself.

EnMS in line with ISO 50001 are based on the Plan-Do-Check-Act cycle for continual improvement, illustrated in Figure 2.

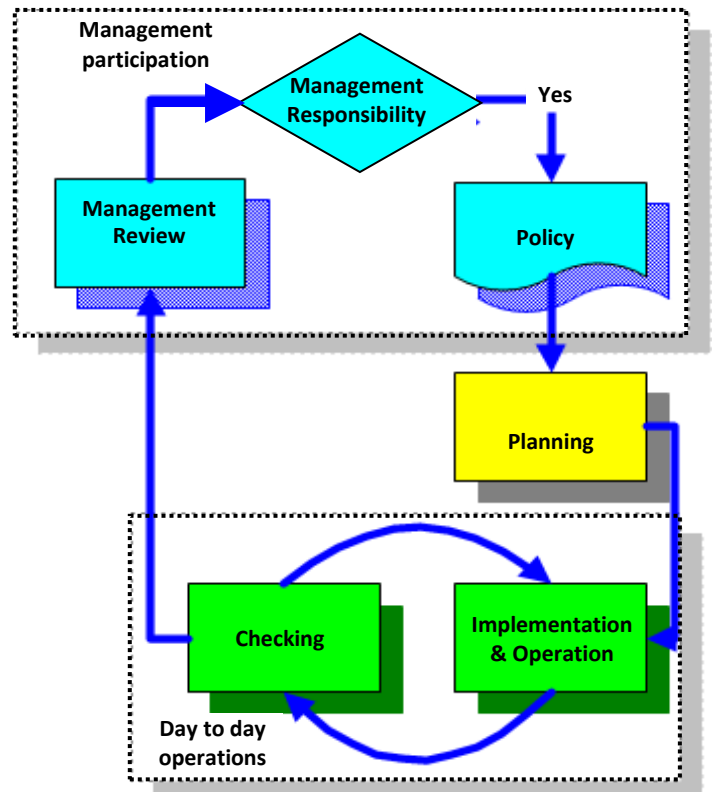


Figure 2. ISO 50001 EnMS Structure (Source: UNIDO EnMS Programme)

### What EnMS can achieve: non-energy benefits

While the main goal of EnMS is to improve an organization's energy performance, save energy and reduce costs, well-implemented energy management can deliver a wider set of **non-energy benefits**. Improving energy efficiency can, for instance, reduce water and raw material consumption as well as emission of pollutants. It can also lead to higher productivity and competitiveness, improved products and processes, reduced unplanned downtime, lower O&M costs and longer equipment lifespan. Ultimately, systematic and good management of energy resources offers a tool to improve energy security and business resilience and can result in a better working environment for employees. When integrated into energy efficiency assessments, non-energy benefits help strengthen the business case for EnMS and energy efficiency, better inform investment decisions and substantiate the strategic role of energy management and efficiency in industrial enterprises.