Global Energy Management System Implementation: Case Study

Republic of Macedonia

Vardar Dolomit dooel

Achievement by company

Dolomite producing facility

"The EnMS is a perfect tool for every company which recognizes that energy saving enhances business opportunities and maximizes competitiveness."

—Remzi Abdulai - General Manager

Business Case for Energy Management

- Vardar Dolomite is company specialized for producing sintered dolomite and dolomite based refractories. Production of sintered dolomite is energy intensive process and the cost of purchasing energy represents an important part of the company's production costs.
- **Primary driver** for implementing EnMS (energy management system) was opportunity to reduce financial impact on production costs by decreasing energy consumption, without compromising high quality, occupational health and safety.
- **Other drivers** that contribute for EnMS implementation were: good company reputation, sustainability, environment care, compliance with legal requirements related to energy etc.
- Availability of high-quality training and EnMS Implementation support from GEF-UNIDO Project "*Catalyzing market transformation for industrial energy efficiency and accelerate investments in best available practices in Macedonia*" was crucial for successful implementation. A key moment for the achieved savings was competitive spirit among the companies participating in the project.

Case Study Snapshot	
Industry	Refractories Production
Product/Service	Dolomite based refractories
Location	Gostivar, Macedonia
Energy Management System	ISO 50001
Energy Performance Improvement Period	1
Energy Performance Improvement (%) over improvement period	3%
Total energy cost savings over improvement period	68 375 $USD
Cost to implement EnMS	18 450 $USD
Payback period (years) on EnMS implementation	0.27 years
Total Energy Savings over improvement period	3 527 (GJ)
Total CO_2-e emission reduction over improvement period	125 000 t CO2

- Implementation of EnMS brings big differences in company's **energy reduction approach**. Almost all energy reduction measures realized **before EnMS implementation** can be explained with following statements:
    - Low investment projects
    - Replacement of equipment that has lower efficiency with equipment with higher efficiency
    - No measuring and verification of achieved savings
    - Poor monitoring or no monitoring at all of implemented ideas after implementation
- **After EnMS implementation** approach to energy reduction is completely different
    - Priority of implementing no cost measures whenever they are applicable, prior to make any investments
    - Our field of inquiry, while searching for ideas for energy reduction, besides the equipment, has expanded both to the processes and to the staff.
    - We are focused on whole system efficiency instead of single system parts efficiency
    - We measure achieved savings whenever it's applicable, or at least we verify them through the mathematical model for monitoring energy performances
    - Energy performance of every significant energy user is monitored at weekly intervals

Business Benefits Achieved

Year 2017 was very successful for our Energy Management System and for Company in general. We achieved savings that not only satisfied but also exceed our expectations.

- We achieve savings of **260 629 kWh of electricity** or **7.92%** from the 2016 annual electricity consumption. Taking into account average electricity price for 2017 this savings worth **20 763$**
- **Reduction of light fuel oil** consumption was **24 134 liters** or **5.92%** from the previous year consumption. Calculated with current light fuel oil price this savings are **23 168 $**
- Last but not least, we achieve **41 670 kg** heavy fuel oil consumption reduction, or **1.89%** from previous year consumption. Calculated with current heavy fuel oil prices this savings are **24 474 $**
- Calculating the sum of savings from all energy sources we get that **total annual savings** in 2017 was **68 375 $**

EnMS Development and Implementation

Our company holds ISO 9001 Certificate from 15.02.2006 and ISO 14001 from 07.01.2008 so implementation of ISO 50001 was logical course of events. As I mention before, Implementation of EnMS in Vardar Dolomit was supported by the GEF-UNIDO Project. This project provides all necessary training for 2 national consultants involved in EnMS implementation and one company representative. Trainings were divided in 4 phases: Building commitment, Planning, Implementing and Checking

Organizational

Implementation process began in 2015 and lasted until end of 2016. We finished 2017 as first year of fully implemented system with respectable savings and with successfully passed certification audit. ISO 50001:2011 Certificate was issued on 22nd January 2018

- From the very beginning we have ***Top Management support*** and I thing this was crucial for smooth and ontime EnMS implementation
- As I mention before Vardar Dolomit already has 2 **ISO standards** in place so for the folowing EnMS requirements we already have established practice and we just need to make small adjustments related to energy:
    - Top Management Responsibility (4.2.1)
    - Competence Training and awareness (4.5.2)
    - Communication (4.5.3)
    - Documentation (4.5.4)
    - Nonconformities, corection, corrective and preventive actions (4.6.4)

  - Control of records (4.6.5)
  - Management Review (4.7) e.t.c
- Some of the EnMS requirements althow well known from before, demanded bigger changes toward energy
  - Policy (4.3) – We have build completely new Energy Policy
  - Legal and other requirements (4.4.2)
  - Competence Training and awareness (4.5.2)
    - Energy Manager passed complete EnMS implementation training
    - Another 2 Energy Team mebmers attend EnMS user training
    - All current employees attend at least on 1 Awareness building presentation and this kind of presentations are organised at regulary
    - New workers must attend Awarenes building training as part of their training period
    - All achievments are comunicated within all company levels
  - Internal Audits (4.6.3)
    - First internal audits were done by national EnMS consultants, now we have onsite trained internal auditors
- What was relatively new and moreless unknown in EnMS, and therefore a bigger chalenge for whole **Energy Team** were the folowing topics
  - Energy Review (4.4.3)
  - Energy Baseline (4.4.4)
  - Energy Performance indicators (4.4.5)
  - Energy Objectives, energy targets and energy management action plans (4.4.6)
  - Energy Efficient Design (4.5.6)
  - Proqurement of energy services, products, equipment and energy (4.5.7)

  Some more details about overcoming chalenges from above mentioned topics you can find in the folowing sub-headers

Energy Review and Planning

- First **Energy Review** was done in all facilities at once at the beginning of EnMS implementation. This was done mainly to get basic understanding of energy use and energy consumption but we also get interesting **energy saving oportunities** as output from this review . Now we have practise that in each facility in the company, energy review must be done at least once per year. In the review team at least one facility employee must be included and that employee must be different in each next review.
- We also use employee interviews and other tupes of communication tehniques for collecting **energy saving oportunities.** Also we review successful ideas from other companies and we evaluate their applicability in our company. All **energy saving oportunities** collected with above mentioned techniques are recorded in our **ECO List** (energy conservation opportunity list).
- For all opportunities from **ECO List** we prepare basics calculations of investment costs (if needed), energy saving potential, and basic estimates of feasibility. Regarding **energy saving budget** for next year we chose which opportunities will be approved and from their energy saving potential we calculate next year saving target. This is how we define our **Objectives, Targets and Action Plans**
- **Setting the Baseline** was really big challenge and was given the necessary attention but due to close relation it will be explained together with Energy Performance Indicators in next sub-header

"Putting EnMS in place give us opportunity to quantify achieved energy savings with acceptable accuracy which is best tool for gaining Top Management Support."

—Zlatko Gjurchinoski - Energy Manager

Approach used to determine whether energy performance improved

First step to compare performances is to define **baseline** for comparison. On our UNIDO training we were trained to use following methodology for defining baseline and for monitoring energy performances. First all necessary data (monthly energy consumption, monthly production and all other relevant variables that affect energy consumption) for a certain time period (from 1 to 3 years) are collected. Using the obtained data in the Microsoft Excel we do a mathematical regression analysis by means of which we get a mathematical dependence between the energy consumption and the independent variables. By entering the values of the independent variables for the current month in the above-mentioned mathematical relation, we get the **Energy Baseline** for the current month. This value is also known as **Expected Energy Consumption** for current month. If Consumed Energy is lower than **Expected Energy Consumption** that means that **Energy Performances** for current month are improved and vice versa.

- In *Vardar Dolomit* we have applied exactly the same methodology with the difference that we monitor the energy performance instead of monthly on a weekly basis.

Cost – Benefit analysis

- For maintain EnMS in 2017 about 1000 labor hours were spend. Multipliet with the average bruto payment per labor hour in our companiy of 6.78 $/h , this is about 6100 $ annual labour cost.
- Most of the implemented ideas were low and no cost and total amount of investment In energy eficient project in 2017 was about 12350 $
- If we devide sum of money spend for labor hour and investment in energy efficient projects (6100+12350) with annual energy savings for 2017 of 68375 $ we get payback period of only 3.3 months
- This has motivated the company to significantly increase the budget for 2018 and it amounts about 100 000 $!

Approach used to validate results

For validating achieved results we use different methodology regards of what is applicable. Here are some different examples

- When we want to validate achieved results for a significant energy user that has regression model with strong corelation, we compare expected savings from implemented energy savings opportunity and savings calculated with regression model
- For validating energy savings for smaler energy user that don't has oun regression model (for example single production machine) we look for 2 intervals (1 before and 1 after implementation of energy saving measure) with as close as possible external parameters, and we compare their energy consumption.
- For some consumers that are difficult for direct measuring (for example electricity used for lighting in whole company) we use only calculations for predicted savings
- Last but not least we use final verification of models by comparison of savings calculated from the overal model for that energy source with sum of savings calculated from models of all significant energy users of that energy source

Steps taken to maintain operational control and sustain energy performance improvement

Operational control is very important part of EnMS although it is very often neglected. Sometimes

significant energy savings can be achieved with proper operation control. We have few instruments that help us to maintain operational control at desirable level

- We have established maintain criteria for every significant energy user that has guideline what needs to be checked and when (preventive maintenance)
- Second and also very importante we monitor energy performance at weekly level, and if there are some deviations from projected energy performance we made investigation to find reason for that deviation.
- We organize training for eficient operation control for empolyees that operate significant energy users on predefined intervals, and every new employee in the company must pass energy efficient operation training in the first three months

Development and use of professional expertise, training and communications

- EnMS implementation was supported by 2 UNIDO trained National consultants and 1 also UNIDO trained company representative. During implementation few presentations for raising energy awareness off employees were organized.
- We have one expertise from 1 international and 2 national Consultants for combustion optimization There expertise help us to define critical operation parameters of our oven properly. This leads to significant fuel savings of 5,9% (24000 liters) without any investments!
- In order to gain employee's commitment, all achieved benefits of EnMS are communicated within and outside of the company
- As I mention before first internal audits were done by independent national consultants. This help us a lot because they see the whole system from completely different and subjective perspective so to all the irregularities noted by them, we approached with due diligence and we have corrected them. Of course we took all appropriate steps to prevent them from reoccurring.

Tools and resources

- Prior to implementation of EnMS we already have installed electricity metering in 16 points within company. Althow from this point of view I prefer first to implement EnMS and then to instal metering equipment only on neccesserry places according to **Measurement Plan** , we sucessfuly use existing equipment as additional tool and we also add additional value to this equipment.
- Another usefull tool that we have used during implementation and we still use some modified version of it, was UNIDO tool. This is ectually an excel file with remarks and short guidelines about all necesserry things that need to be done for successful implementation of EnMS.
- Between resources that we have use during implementation we can count, employee knowledge gained during QMS and EMS implementation, engeneering knowledge from our engineers, and positive practices from other companies within UNIDO Project.'

Lessons Learned

Lessons learned and keys to Success

From our experience we have gained during implementation and operation of EnMS we want to share with others following learned lessons:

- Do not equate energy savings with energy efficiency investments. There are plenty of ideas for energy savings that don't need investments. You can find this kind of possibilities in every company if you reassess the people behavior and operational control or if you challenge critical operational parameters.
- Don't force big project from the very beginning. Start with simple ideas that are easy to implement and easy to monitor. Don't forget that it is crucial for gaining top Management Support to save and to verify savings. This is important for to keep your focus on EnMS as well.
- Don't neglect importance of changing people behaviour, but keep In mind that this isn't neider easy or fast. Start with changing your behaviour rather than behaviour of others. Whith this you'll give positive example to others and second you'll understand why they resist changes. Before you change something, first explain to people why this change is necessary and what will happen after we make that change. ***Remember that people are not afraid of changes, people are afraid of unknown things***
- When you compile an energy team, it is desirable that you have competent persons in each area that is encountered in your company. This is necessary but not the most important. Most importantly, the team is composed of valuable enthusiasts who know their roles and who can work in a team. It will be much easier to deal with insufficient competence than with an insufficient motivation!

Keys to Success

- Gain and maintain ***Top Management Commitment***
- Always ***communicate*** good and even bed results. Even from negative results you can learn positive lessons
- Invest in ***knowledge, competence, and awareness!,*** They aren't like medal that you receive once and you keep it for life, they are rather like plants which need permanent care.
- Ask ***questions*** to everybody and listen their ***answers.*** Keep your mind open for new ideas.
- Believe in yourself but always ask your team for opinion
- Be focused on achieving your goals
- ***Work, work and work***