Global Energy Management System Implementation: Case Study

United Arab Emirates

ENOC Lubricants & Greases Manufacturing Plant (ELOMP)

ELOMP recently constructed a new office building with many energy efficiency aspects such as VRF HVAC system, LED lighting, atrium for day light etc.

Mr. Mohammed Yunus (Plant Manager, ELOMP) accepting "Most Engaged Energy Manager" Award on behalf of Mr. Mohammad Sadek (Director Lubricants Marketing) during ENOC EHS & Energy Awards Ceremony in May,14

Business Case for Energy Management

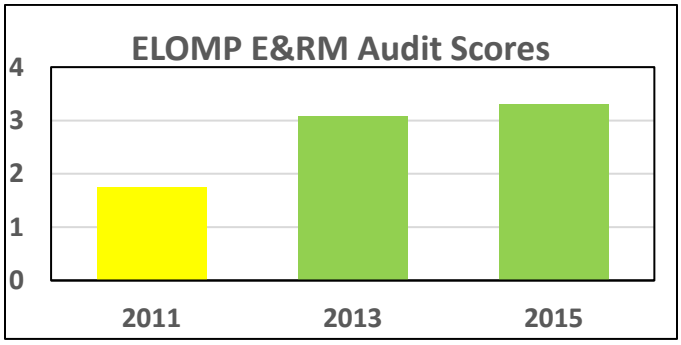
ENOC Lubricants & Greases Manufacturing Plant (ELOMP) is a wholly owned subsidiary of Emirates National Oil Company (ENOC). The Plant located in the Emirate of Fujairah is spread out over an area of 63,500 m^2. It has annual production capacity of 250,000 MT of mineral and synthetic lubricants based oils, Coolant, Turbine Oils, Brake Fluid and 5,000 MT of grease. ELOMP has 82 oil tanks for raw material and finished products, making it one of the largest lubricants plants in the Middle East and Africa.

The products are produced by blending the raw materials using advanced and sophisticated Blending systems such as - Simultaneous Metering Blending (SMB) and Automatic Batch Blending (ABB). The blending controlled by SCADA based LUBCEL software. The system can accurately control the addition of components measured using load cells and/or Mass Flow meter. The system controls a large range of other devices such as mixers, heaters, pumps, valves and pig stoppers, as well as metering pumps (for PPM components).

Case Study Snapshot	
Industry	Oil & Gas
Product/Service	Lubricating oils & grease
Location	Fujairah
Energy Management System	ISO 50001
Energy Performance Improvement Period	2015 to 2016 (2 years)
Energy Performance Improvement (%) over improvement period	12% (average of 2015 & 2016 over 2014)
Total energy cost savings over improvement period	330,000 USD (for 2 years)
Cost to implement EnMS	40,500 USD
Payback period on EnMS implementation (years)	0.21 years
Total Energy Savings over improvement period	8000 (GJ for 2 years)
Total CO_2-e emission reduction over improvement period	576 (Metric tons for 2 years)

In 2008, in line with UAE's vison for a sustainable economy and reduction in CO_2 intensity, ENOC (a Dubai Government Company) developed its EHS KPI policies

which included targets for reduction in energy consumption and development of Energy & Resource Management systems (E&RMS). ENOC's E&RMS was in line with ISO 50001 and mandated for all business units and a minimum score of 3 out of 4 was required of all companies. As part of the ENOC Group ELOMP is bound to comply with the Group's policies with respect to Energy and Resource use. ELOMP's performance in the E&RMS audits is provided below:



In addition to the requirement for an E&RMS, additional requirement to develop and submit an E&R use reduction plan was mandated for all business units of ENOC. The plan could cover electricity, fuels and water but not consumables or raw materials. The KPI for this was set as percentage achievement against the plan.

Prior to ISO 50001, ELOMP's approach towards energy management and reduction was initially focused on attaining high scores in their energy related KPI's. Hence the management systems were focused only on achieving a score over 3 and the efficiency improvement efforts quick wins such as changing lights to LED etc. There was no focus on improving plant efficiency. However, having achieved a score of 3, ELOMP decided to attempt ISO 50001 as the first company in the group to do so.

The main reasons for the decision to implement ISO 50001 were as follows:

- Energy and cost savings
- Improving brand image in the highly competitive lubes market
- CO_2 reduction to improve standing amongst government authorities
- Improve employee morale and comfort through reduction in waste heat from fired equipment

The approach to reduce energy use changed following their decision to implement ISO 50001. As a first step, several personnel were provided training by the Energy Institute, UK on energy management, benchmarking and efficiency improvements. Also, internal audit training was also provided. These trainings resulted in competency development which did not exist earlier. Along with the training, an internal audit against ISO 50001 and an energy audit of the whole facility was carried out by specialists from the ENOC Group.

Based on the results of the above audits, corrective action plans for closing gaps in the management system were developed and at the same time, significant aspects were identified and based on priority criteria action plans developed. Following this, ISO 50001 certification audit was carried out by DNV-GL and certificate awarded.

Following the success of the action plans and the benefits achieved, ELOMP initiated a detailed energy audit with independent consultant Global Engineering. This audit covered the entire plant operations including: air-compressors and refrigerated air dryers; process pumps; thermic fluid heater; outdoor lighting; indoor lighting; office air-conditioning; and other significant energy users. The action plans from this audit were implemented from 2014 onwards for continual improvement.

"Implementing ISO 50001 systems has been an eye opener to us at ELOMP as it made the process of identifying savings opportunities systematic and stream lined"

— Mohammed Sadek, Director Lubes Marketing

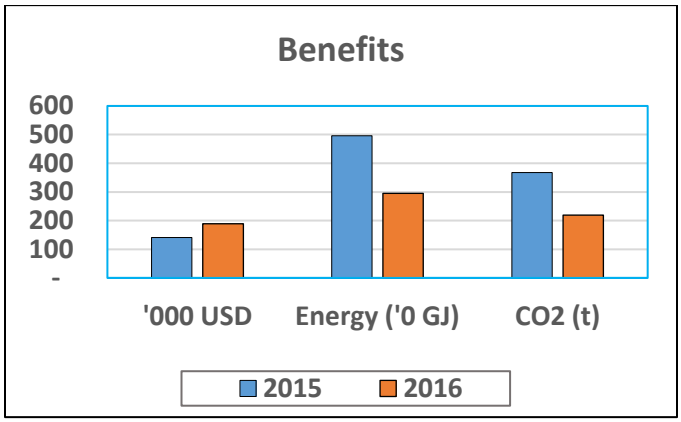
Business Benefits Achieved

Prior to implementation of ISO 50001, the approach to energy savings was to address easy to do and highly

visible projects such as LED lights. Also, the baseline and energy use segmentation was carried out using connected loads and not actual usage. Following ISO 50001 certification, as a part of continual improvement, a detailed energy audit for electricity was carried out by external experts from Global Engineering.

Based on the above, the plant areas and utilities including compressors and thermic fluid heaters were targeted. The improvement plans were implemented from the middle of 2014 onwards.

The resulting annual savings in cost and energy and reduction in CO_2 emissions for 2015 and 2016 from the base year of 2014 is depicted in the chart below.



One of the main projects taken up was the switch of electricity source from self-generation using DG sets to grid connection. This resulted in considerable savings in primary energy and CO_2 as the grid electricity is from natural gas fired combined GTs of >52% efficiency as compared with diesel fired gensets of 32% efficiency. This also resulted in considerable savings in consumables and maintenance manpower.

EnMS Development and Implementation

By 2013, almost all of ENOC Group companies had achieved ISO 9001, 14001 and OHSAS 18001 certification. Hence ELOMP decided to stand out by getting certified to ISO 50001 as well. ELOMP was the first company within the ENOC Group of companies to achieve ISO 50001.

Organizational

In line with UAE vision for a green and sustainable economy, ENOC top management starting from the CEO had always supported energy management and efficiency improvement. The Group energy policy was issued in 2010 along with mandatory requirements for implementation.

Following the issue of the above, ENOC Energy Steering committee and Technical committee were set up. The steering committee was chaired by the Executive Director (EHS and Corporate Affairs), a member of ENOC Executive Committee. This committee consisted of all business unit heads and was responsible for setting policies and providing guidance.

The Technical Committee on the other hand was chaired by the Group EHS Director and consisted of engineers from operations, maintenance or EHS departments of each business unit. This committee was primarily involved in identifying opportunities for improvement on the ground, sharing knowledge among the business units and bringing new technologies though supplier presentations.

While the group level committees provided overall direction to the whole group, ELOMP developed their own Energy Committee consisting of the Plant Manager and all department heads and chaired by the Lubes Marketing Director. This committee was responsible for approving final improvement plans and allocated the resources for the same.

The EHS head of ELOMP was designated the Management Representative for EnMS and assigned the required roles and responsibilities for the same. Technical assistance to him was provided by the Maintenance Head. This committee was responsible for steering ELOMP to ISO 50001 certification in 2013 and subsequent recertification in 2016.

Energy review and planning

While planning for ISO 50001 certification, the primary energy source was diesel which was used to generate

electricity as well. Diesel was then used for three purposes viz. electricity generation, fuel for two furnaces and fork lift trucks. Diesel use for generation was directly proportional to kWh generated.

ENOC Energy Technical Committee

Other than what was used for lighting and office, the entire electricity and diesel use were solely dependent on production volumes. Lighting and office use electricity over a year was approximately constant. Hence the Energy Intensity was determined to be liters of diesel per ton of lubes output (grease production is low and relatively constant). The initial baseline of 2013 was established based on diesel use and lube output for 2013.

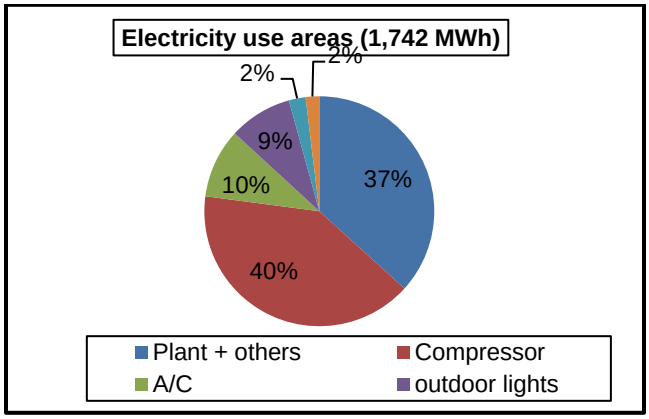
For initial certification, improvement projects were limited to lighting upgrade and behavioral intervention and energy intensity for this was based on the area and required illumination levels.

"Apart from the commercial benefits The Energy Management system brings, we believe our contribution towards clean and safe environment through reduced carbon emission holds more value that will have an impact on future generations"

— Mohammed Yunus, Plant Manager, ELOMP

Following the certification, in 2014 a detailed energy audit was carried out and the results are provided below:

The largest variable electricity users were the compressor and plant. For both the plant and compressor, the energy intensity was a function of lubes



production. Improvement plans for reducing electricity use were developed and implemented from mid-2014 onwards. One major plan was to switch to grid electricity of 52% efficiency in 2015 from DGs which were 32% efficient.

Other than diesel use for electricity generation (67%), it was also used for thermic fluid heaters (29%) and fork lift trucks, the usage again depending solely on the production volumes. The improvement plans for electricity were based on the above. Further improvement plans for the thermic fluid heaters being 29% primary fuel use were also developed and implemented.

Financial resources for large improvement projects were allocated through the annual budgeting process and for smaller projects through a specific budget item in the maintenance budget titled "energy improvement".

The initial certification process required dedicated efforts for about a year. By the time of recertification in 2016, Energy Management had already matured and had become a habit in all activities. No further dedicated time required as it was a part of Maintenance and EHS planning.

Cost-benefit analysis

The cost to implement and maintain the EnMS consisted of mainly two parts viz. develop, document and audit systems and actual cost of implementing improvement projects.

System development cost consisted of maydays spend by internal staff and staff from ENOC Group Sustainability, cost of plant energy audit by third party and certification costs, for a total cost of USD 40,500. The payback on this is approximately 2.5 months.

Implementation costs for energy projects since 2013 was USD 1.4 million and savings in 2016 (following a full year) was USD 189,000 for a payback period of 7.4 years.

Approach used to determine whether energy performance improved

Regression analysis of monthly production data had shown that energy use was directly dependent on production volumes. Hence, energy savings were determined based on total annual energy use adjusted to energy use and volume for the revised base year of 2014 due to expansions carried out.

Energy use during the performance period included the effects of switching electricity used from self-generation to grid electricity. This was accounted for by taking into consideration energy savings and CO_2 reduction from the switch to a 52% NG fired grid electricity from an earlier 32% diesel fired self-generators.

Savings accrued in USD was calculated based on actual measured savings for each of the 8 main energy savings projects implemented in 2015 and 2016. The savings for each year for each project was based on actual cost of energy (diesel or electricity) for the year and reduction in maintenance and consumables costs such as for the self-generation using gen-sets.

As the occupancy levels of buildings and plant, working hours and ambient temperatures remained constant over a year these were not considered in normalization of the results.

IPCC values as provided by the Dubai Carbon Centre of Excellence (DCCE), a body formed by major energy users and suppliers of Dubai was used were required for fuel energy content and CO_2 intensity of fuels. Additionally, Grid emission factors were also obtained from DCCE data. Data on electricity generation efficiency were based on available data on the utility provider and actual data from self-generation.

Approach used to validate results

Energy use for each of the planned energy use reduction projects were either measured directly or calculated from engineering principles such as from pump performance curves, compressors leak test etc. by a third-party energy auditing company prior to implementation. Following implementation, were relevant measurements over a period of time were used to validate the expected results.

Some projects such as energy use reduction from replacing all the electric driven exhaust fans in the plant area by natural draft turbine ventilators did not need any full measurements as each fan was identical and on for the total shift working time. Sample energy use of selected fans over a short period of time was all that was required to validate the results.

Steps taken to maintain operational control sustain energy performance improvement

The steps taken to sustain energy performance and instill creativity and motivation of employees are taken primarily at the ENOC group level and cascaded down to the business unit level. Some of these steps are summarized below:

- Business unit KPIs for energy use savings reported and monitored by ENOC Group on a quarterly basis
- ENOC annual energy awards in different categories for categories such as manager, technician, business unit best energy project etc.
- Periodic energy awareness and technical trainings
- Regularly scheduled ENOC energy steering and technical committee meetings
- Publication and mention in ENOC bi-annual energy report
- Special cash awards for best implemented energy saving suggestion in ENOC suggestion scheme

Development and use of professional expertise, training, and communications

ENOC Group has tie ups with several professional organisation to provide training and also develop methodologies for energy savings and carbon abatement. These include Energy Institute (EI), UK, DCCE, ENOC group Engineering Department and Sustainability office and Ernst and Young (EY) Sustainability division.

EY and EI are regularly engaged by ENOC to conduct trainings in Energy management as well as on energy intensive equipment such as HVAC, pumps, compressors fans, fired equipment etc. DCCE is engaged in identifying new suppliers and technology and developing tools for determining carbon abatement. Additionally, external energy service companies are used by ELOMP for audits and validation.

Employee engagement of ELOMP is encouraged at ELOMP as described in the previous sub-section.

Tools & resources

Prior to implementing ISO 50001, ELOMP already had several years' experience in systems such as ISO 14001, 9001 and OHSAS 18001. Hence many of the procedures and practices of these systems were utilized in their ISO 50001 system.

Other tools and resources used in the implementation are described in the previous two sub-section of this report

Lessons Learned

One of the primary barriers to implementing an EnMS is

management reluctance due to lack of application of mind towards business benefits that would accrue indefinitely over time without any further effort. Management is focused on increasing production, revenue and profitability, all of which they relate to immediately reducing costs and increased sales. Hence, energy efficiency projects were always considered a cost increase with no impact on revenue and sales. We at ENOC have overcome this inertia by including energy efficiency and forming it as a business plan in all our business units' Balance Score Cards for a high weightage of 5%. Additionally, the efforts have been facilitated by providing facilities for training, supplier interaction, Group finance support etc.

While plant personnel are competent in operations and maintenance, they are not focused or interested in peripheral activities such as utilities. During the initial energy review, we at ELOMP noted that a bulk of energy costs were due to utilities such as compressors and thermic fluid heaters . The 5% in BSC of ELOMP motivated them to look and see the potential for savings in energy cost and improved long term consistent profitability.

Management systems as with ELOMP, traditionally were implemented and certified for certification sake and going to press without much resulting improvements. However, at ELOMP, due to EnMS related grading system, the EnMS' effectiveness was ensured.

Keys to Success

- Achieve management and employee buy-in.
- Cast energy efficiency as a business objective
- Link energy conservation to profitability

  Provide adequate incentive (5%) for energy initiatives in the balance score cards (BSC) of employees, management and business unit.