

Global Energy Management System Implementation: Case Study

Egypt

ELARABY Company for Trading and Manufacturing

"ECTM" is one of the six ELARABY industrial companies that are ISO 50001 certified.



Figure 1: ELARABY for Trading and Manufacturing Company

Company Profile

ELARABY Group; an Egyptian joint stock family enterprise, established in 1964 and engaged in both manufacturing and marketing engineering products; which contributes to the development of the Egyptian economy. ELARABY is dedicated to providing high quality products that incorporate high technology, in order to satisfy the needs and expectations of the consumer.

ELARABY started by Home Appliances (HA) trading and now it consists of 6 industrial companies, including 27 factories manufacturing 127 final products. Ten Trademarks products such as Sharp, Toshiba, Philips, Tornado, La Germania, Hoover, Hitachi... etc. are produced in these factories. All the 6 companies are ISO 9001, ISO 14001, ISO 18001 and ISO 50001 certified.

ELARABY Company for Trading and Manufacturing (ECTM) consists of the following:

- 2 Plastic Mold Factories
- Foam Factory for Packing

"Natural resources are limited; we have to do our best to keep them safe and secured for the coming generations by consuming less."

—Mahmoud Elaraby, CEO

Case Study Snapshot

Industry	Engineering Industry
Product/Service	Small Home Appliances (electric fans, irons, vacuum cleaner... etc.)
Location	47 Km Cairo – Alex agriculture road , Egypt
Energy Management System	ISO 50001
Energy Performance Improvement Period	3 years
Energy Performance Improvement (%) over improvement period	19%
Total energy cost savings over improvement period	1,743,338 \$USD
Cost to implement EnMS	654,625 \$USD
Payback period (years) on EnMS implementation	1.1
Total Energy Savings over improvement period	166,410 GJ
Total CO₂-e emission reduction over improvement period	7,901 tons

- Total Area is 140,000 m²
- Annual Final Product is over 5 million final products
- Local market share about 35 %
- ELARABY exports several products to several markets

- 2 Factories for manufacturing and assembly
- A Central Workshop (electrical, mechanical components, molds and carpentry)

Due to the strong competition in the local market regarding the quality and the cost of the concerned products. ECTM developed a strategy to increase its market share by focusing on 3 main points to reduce production cost without affecting the products quality; namely, material cost, energy cost, and manpower cost (productivity). Accordingly, in 2008, ECTM started to consider improving energy consumption by implementing energy saving projects.

In order to ensure sustainability and continuity of energy conservation program, at the beginning of 2015, ELARABY decided to partner with the Industrial Energy Efficiency (IEE) Program-UNIDO applied in Egypt. UNIDO provided support to apply and implement Energy Management System (EnMS) according to the guidelines of ISO 50001. The support continued until certification audit by TÜV Nord in July 2016.

The EnMS helped ECTM in setting a systematic sustainable approach and methodology for continuous improvement through identifying and prioritizing the saving opportunities; laying out action plans and setting objectives and targets. Measuring and monitor energy performance improvement and comparing with objectives and targets.

Business Benefits Achieved

There is abundance of benefits associated with the implementation of EnMS according to ISO 50001/2011; in which ECTM has felt the improvement in energy performance, either by direct or indirect energy saving. The following represents the implemented direct energy saving opportunities:

- Total Energy performance improvement by 46.23 GWh representing 19 % from the baseline (19.5% Electrical energy saving and 18.5% Natural gas saving).
- The total energy cost saving is 1,743,338 \$USD.

- The electrical energy saving is 18, 98 GWh.
- The electrical energy cost saving is 1,178,694 \$USD.
- The natural gas energy saving is 27.24 GWh.
- The natural gas energy cost saving 564,644 \$USD.
- Corresponding GHG reduction 7,901 Ton CO2 equivalent (18.5% from baseline).

For the indirect saving opportunities, ECTM has achieved the following:

- Long term decline in operation and maintenance cost by applying energy efficient design.
- Optimization of maintenance and operation processes.
- Enhancing operation efficiency.
- Change the employees' culture and understanding by raising awareness of energy management and importance of conservation of resources through training and awareness sessions.
- Utilizing energy saving methods which lead to continuous improvement.
- Improving ECTM image in the society.

EnMS Development and Implementation

In 2015, when started adopting the approach of ISO 50001 for EnMS, ECTM top management realized that it is more effective to form an energy team where all departments are involved and each team member has a well-defined roles and responsibilities to ensure commitment. All departments (production, planning, maintenance, quality and other departments) are actively participating in the system; in addition to the full support from the top management.

The top management assigned a management representative, general energy manager and the energy team that consists of:

- Maintenance engineer (an internal energy manager)
- Production engineer
- Planning engineer, with total of 20 members for all team.

Energy team is responsible for reviewing and controlling energy consumption, sharing ideas regarding the production processes, review new designs, set criteria for purchasing new equipment, and implement awareness sessions by providing training and capacity building. In addition to the above-mentioned responsibilities, the energy team was responsible for:

- Reviewing the energy sources; electrical, natural gas, water and diesel.
- Provide a historical data from governmental bills and SCADA system for the last three years to determine energy consumption and identify the scope and accordingly, it was found that electricity and natural gas consumption covers 80% of the total energy consumed.
- Decision was taken to implement the EnMS for both electricity and natural gas.
- Base period was chosen to be 2014 due to the availability of accurate consumption data, production stability.
- Installed sub meters (300 meter) to identify the SEUS consuming 80% of the total consumption for both electricity and natural gas.
- For each SEUS, drivers were identified and a baseline was developed using regression analysis,
- Drivers affecting the energy consumption included production, temperature, pressure... etc.

Energy saving opportunities were identified through the following:

- Production and maintenance reports
- Internal communication (suggestion, brain storming sessions, work experience, R&D... etc.)
- External communication (industry journals, internet search, researches, seminars, exhibition visits... etc.).

Identified saving opportunities were prioritized using a set of criteria, including, but not limited to the estimated saving, capital cost, associated risk, project time schedule, and payback period.

“Energy saving is a living approach.”

—Mahmoud Elaraby, CEO

The selection and prioritization criteria is based on a scoring system to weight the opportunities to be scheduled through an action plan which determines the time for implementation, capital cost, payback period, the responsible personal and monitoring and verification for the estimated saving.

The above mentioned action plan was submitted to the top management for approval, modification, and/or recommendation for further improvement.

Implementation of EnMS started in March 2015 for one year plus 4 months for preparation for ISO 50001 certification in July 2016.

ECTM identified its objectives and targets based on a preliminary estimated savings calculations from the identified saving opportunities. The objective was defined to improve in the energy performance for both electricity and N.G. by setting a target of reducing their consumption by 19% during a period of three years.

To achieve the target, ECTM divided the saving opportunities into no cost, low cost, medium cost and high cost in reference to the developed selection and prioritization criteria.

No cost opportunities were the first implemented since ECTM is keen on raising the staff awareness and carry out continuous measurement and monitoring on its performance on a regular basis, as well as the beneficial management decisions. In addition, to these opportunities, ECTM implemented some opportunities of low and medium cost as well. **Figure 2** below shows the energy savings achieved per type of opportunity (project) and their payback period.

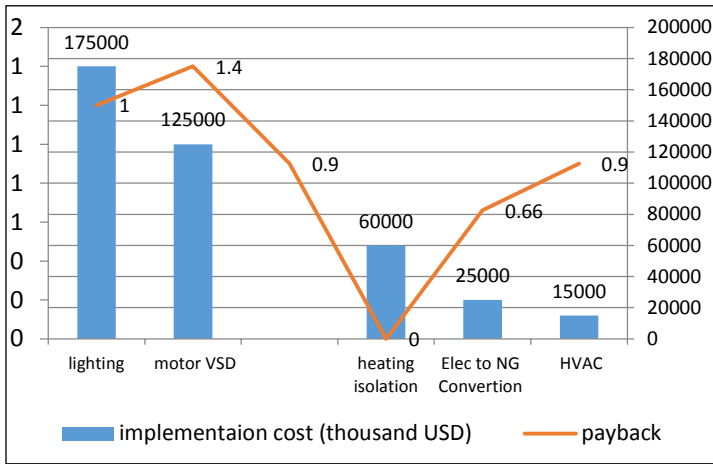


Figure 2: Projects Cost VS Payback period (per year)

One of the identified SEUs in ECTM was the plastic injection machine factory; where the electricity consumption driver was found to be the production weight (kg) as shown by regression analysis, **Figure 3**.

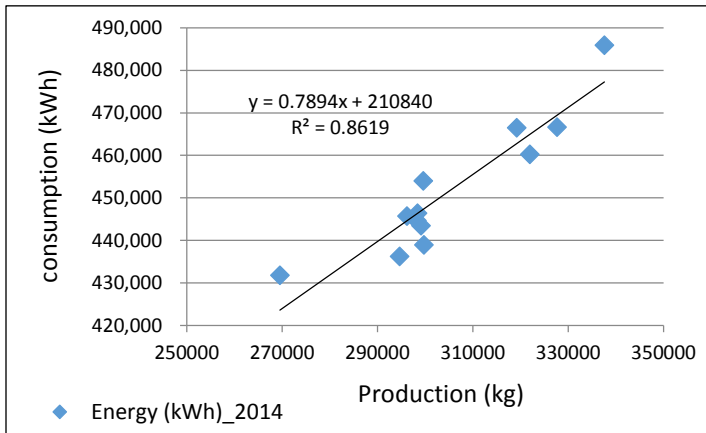


Figure 3: Energy consumption per products weight regression analysis (kWh/Kg)

Saving opportunities for plastic injection factory are:

- Insulation heating barrel,
- Using VSD,
- Introducing of electrical injection machine instead of hydraulic
- Machine loading refers to consumption rate

Figure 4 shows installation of VSD in the control panel, and **Figure 5** shows installation of insulation for heating barrel.



Figure 4: Installed VSD panel



Figure 5: Installed Insulation heater

Through EnMS System, the energy team continues monitoring and analyzing the results of electricity consumption records through SCADA system, to check the performance improvement using the EnPI driven from the baseline. The evaluation was based on the comparison between the estimated and actual savings as result of implemented opportunities.

Figures 6 & 7 show the electricity baseline of the injection plastic machines; where **Figure 5** presents the consumption before implementing the saving opportunities, while **Figure 6** measures the improvement performance that indicates the saving in the electricity consumption is 48%.

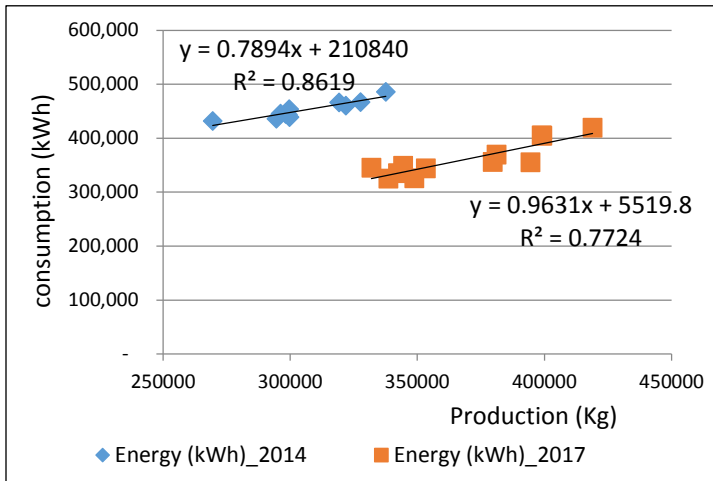


Figure 6: kWh/kg in 2014 and 2017

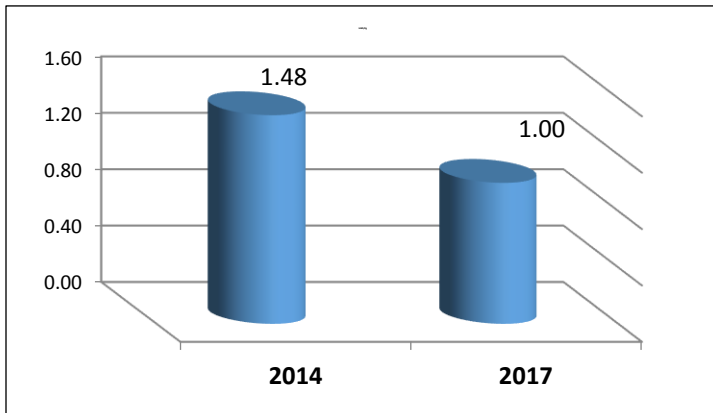


Figure 7: kWh/ kg in 2014 and 2017

All EnPIs are reviewed and checked through predetermined periods and on a regular basis; monthly, quarterly, annually, to check the improvements and tackle any deviation that are simultaneously monitored and recorded. Internal audits are conducted every 6 months, in addition to, the annual revision by the certification body.

Providing ideal operation and control conditions are the essential part in implementing the EnMS for all SEUs to achieve energy efficiency without compromising the product quality and/or the productivity target, this done by determining the critical parameters for the operation process, and checking the measuring devices calibration.

One of the identified critical parameters was the heating temperature for the injection machines. Consequently, the energy team with the support of the production team and the quality assurance team set the optimum values for the heating temperature.

This was applied for all other processes; new and old through work instructions, training & awareness sessions for the SEUs operators. Additionally, TPM programs were applied.

All results were published to spread over the culture of energy saving.

ECTM strives to ensure that everyone in the organization is fully aware of the EnMS and its importance. This is done by regular internal and external trainings and awareness sessions, publishing awareness posters throughout the company, attending energy management seminars... etc.

One of the external trainings was carried out by the UNIDO team in 2015; where the selected team were qualified and certified as energy managers and giving them the responsibilities of being internal auditors and energy trainers. In addition, the company participated in UNIDO programs for energy efficiency such as motor system optimization and compressed air system optimization. Also, the company participated in training to study energy applied cases in Germany.

Moreover, ECTM applies an encouragement system to encourage the employees to offer their suggestions and proposals by giving bonuses and incentives for ideas that improve the efficiency of the equipment and/or the system performance.

By the end of 2017, ECTM was able to measure and control its energy performance through the following installed equipment:

1. 300 energy meters
2. 20 air flow meter
3. Thermo-graph camera
4. Power analyzer
5. Motor analyzer tester

- 6. Pressure transmitter
- 7. Temperature transmitter

Lessons Learned

When ECTM started setting objectives to reduce the energy consumption in 2008, it was the responsibility of the maintenance team alone which was changed to all the departments responsibilities for adopting the ISO 50001.

Implementation of EnMs at Elaraby had a lot of challenges. The hardest barrier was to change people culture towards the approach of energy saving.

At first, there was much appreciation of the importance or the magnitude that the organization is able to save; however, once the result started to be seen, the mindset started to change for almost all employees towards the EnMS. Ultimately, all the 5000 employees are now working, thinking and saving energy.

Keys to Success

- True commitment and support from the top management.
- Continuous training on acquiring new knowledge.
- All members believe the same targets.

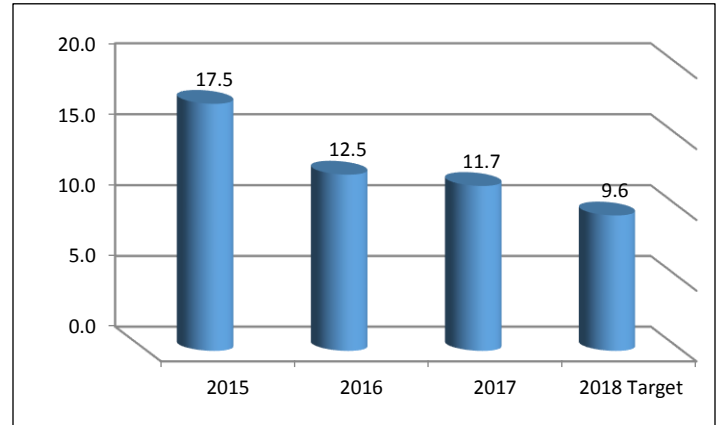


Figure 8: Elect and natural gas (kWh/product)



Figure 9: ECTM Energy team

Through the Energy Management Working Group (EMWG), government officials worldwide share best practices and leverage their collective knowledge and experience to create high-impact national programs that accelerate the use of energy management systems in industry and commercial buildings. The EMWG was launched in 2010 by the Clean Energy Ministerial (CEM) and International Partnership for Energy Efficiency Cooperation (IPEEC).

For more information, please visit www.cleanenergyministerial.org/energymanagement.

