

Global Energy Management System Implementation: Case Study

Egypt

Arabian Cement Company



ACC is 1st cement plant at Egypt certified with ISO 50001



Figure 1. Arabian Cement Company

Company Profile

Arabian Cement Company (ACC) was founded in 1997 by a group of Egyptian shareholders. ACC was established with the aim of building a cement plant with a capacity of 2.5 MTA producing grey cement for the local Egyptian market. However, due to market conditions, the project was halted for a while until September 2004, when the Spanish cement group Cementos La Union, decided to invest in ACC, resuming ACC's activities.

From that time forward, ACC started its path towards success. Moreover, in 2006 an important milestone was achieved by concluding a contract with the well-known multinational engineering Co: FLSmidth. The contract was concluded to construct the targeted clinker Greenfield plant.

Case Study Snapshot

Industry	Building Material
Product/Service	Cement
Location	KM 94, Kattameya, Ein Sokhna Old Road - SUEZ
Energy Management System	ISO 50001
Energy Performance Improvement Period	3 years
Energy Performance Improvement (%) over improvement period	8%
Total energy cost savings over improvement period	\$8.74 Million
Cost to implement EnMS	\$13.7 Million
Payback period on EnMS implementation (years)	1.3
Total Energy Savings over improvement period	(GJ) 1,048,890
Total CO ₂ -e emission reduction over improvement period	127,147

In 2008, after constructing the plant, and putting together an experienced management team, ACC board of directors decided to expand the plant by developing a second production line; aiming at increasing the production capacity of the plant.

Now, ACC has a production capacity of 5 million tons per year, producing high quality cement for the local and international markets.

ACC adopted and applied integrated management systems combining ISO 9001:2015, BS OHSAS 18001:2007, ISO 14001:2015 and ISO 50001:2011.

ACC has been continuously thriving to improve energy and environmental performance supported by a strong top management commitment. In 2015, the company participated in an energy benchmarking study for the Egyptian cement sector where the ACC was evaluated as the top performer within the sampled organizations. This has further motivated the top management in continuing the efforts towards more sustainable production.

In 2014, the Egyptian government has started a strategy for phasing out energy subsidies. This has driven ACC to put even additional efforts in improving their energy performance. ACC made the decision of partnering with UNIDO through the industrial energy efficiency programme where ACC received support in the implementation of an EnMS complying with ISO 50001.

Together with UNIDO the company was able to establish an EnMS that institutionalized a systematic approach in managing, monitoring and improving energy performance. These efforts were crowned by the certification through third-party auditing by TUV Reiland.

“Reducing energy use make perfect business sense as it reduces costs, reduces greenhouse gas emission and help with security of energy supply by reducing dependency on imported energy sources”.

—Sergio Alcantria, CEO

Business Benefits Achieved

The adoption of an EnMS at ACC has proven to have several direct and indirect benefits. The direct benefits can be summarized in the achieved energy savings and associated GHG reduction as follows:

- Total Energy performance improvement by 72,417 MWh representing 1.8% from the baseline (1.5% heat

consumption reduction, 4.4% power consumption reduction)

- Corresponding GHG reduction 127,147 tCO₂eq (15% from baseline)
- Other indirect benefits that ACC has achieved are:
 - Long term reduction in operation and maintenance costs through energy efficient design and procurement.
 - Reduced exposure to change energy prices and hence better competitiveness.
 - Better understanding of energy users performance impact resulting in an improved decision making process.
 - Improved operation efficiencies.
 - Improved maintenance practices.
 - Improved corporate image.

EnMS Development and Implementation

ACC top management realized that the best approach for implementing an effective EnMS is by involving all departments. Accordingly, roles and responsibilities regarding the EnMS were defined ensuring stronger engagement from energy performance key-influencers namely maintenance and Process & Production departments.

The energy team members demonstrate the strong top management commitment with the team consisting of a newly appointed dedicated energy manager and six (6) managers (plant manager, production, maintenance, projects, quality, AF). The implementation process has taken benefits from the implementation of previous management systems (i.e. 9001, 14001). As a result to this engagement ACC was certified in Jan 2016 and recertified in Jan 2017.

ACC's energy review lasted for 1 year and consisted mainly of the review of historic energy consumption patterns to identify the SEUs and drivers. The result of this review was the identification of specific baselines and EnPIs for each SEU. The steps taken were as follows:

- Review of historic consumption for 18 months to identify the total energy baseline
- Identification of SEUs representing more than 80% of total energy consumption
- Baseline calculation for each SEU

• Identification of drivers affecting energy performance for each SEU and the development of specific EnPIs through regression analysis of consumption vs. main drivers (e.g. production, TSR, etc.). An example for the relation between Specific heat consumption and alternative fuel total substitution rate (TSR) is shown below. In cases where production was identified as a single driver with a relatively low baseload, EnPIs were defined as specific energy consumption

Following the data analysis and the development of SEU-specific baselines and EnPIs, the energy team has collaborated with company staff on all levels for the development of energy saving opportunities list to serve as the basis for the development of a medium term action plan. The steps taken were as follow:

- Through an improved internal and external communication approach focused on energy performance improvement, the energy team was able to compile and extensive list of energy saving opportunities.
- SEU-specific baselines supported the identification of performance gaps that together with the list of opportunities provided the basis for the development of 3 years action plan.
- Top management has approved prioritization criteria for energy saving opportunities to be included in the action plan. These criteria included: cost, complexity, financial payback for medium/high cost interventions, etc.
- The action plan design ensured that for each action item estimated savings are calculated, implementation duration is set, responsible personnel identified and the means for monitoring and verification of estimated savings. For example non-complex no/low cost

interventions required no detailed analysis and a green light for implementation from ACC top management. As for medium/high cost or complex interventions a detailed assessment was needed to prove cost-effectiveness. Evaluation was done based on the following criteria:

Project Evaluation			
Criteria	Score	Weight	Total
Company Priority	50	25%	
Essential to Business	10		
Inline with ACC Strategy	10		
Lead to Cost Reduction	10		
Energy Reduction (based on LCC)	10		
Increase Revenues	10		
Financing & Budget	20	30%	
Source of Funding	10		
Components/Activities Costed	10		
Project Structure	60	20%	
Purpose / Objective Clearly Defined	10		
Target Well Defined	10		
Sufficient Justification Provided	10		
Implementing Contractor Identified	10		
Planned Phases	10		
Location Identified	10		
Project Management	80	20%	
Clear Obligations/ Commitments	10		
Does the Project Have Many Phases	10		
Inline with Best Allocation of Resources	10		
Compensation Required (Opportunity Cost)	10		
Work Plan Available (Timeline and Responsibilities)	10		
Means to Monitor Financial and Technical Progress	10		
Means to Evaluate Upon Completion	10		
Measurable Outcomes	10		
Stakeholder Involvement	40	5%	
BOD Feedback	10		
Shreholders Feedback	10		
Environmentally Friendly	10		
Communication System with Stakeholders in Place	10		
TOTAL	250	100%	

- The company objectives were defined following a bottom-up approach based on the SEU-specific targets set in the action plan. The objectives define energy performance improvement for a three years period for both electric and thermal consumptions.

ACC has focused on no/low cost measures implementation. This was supported by existing extensive metering system, software as well as the availability of in-house technical knowledge. However, some of the interventions were under the medium/high

cost category. The associated costs and payback for these interventions are shown in the graph below. UNIDO IEE programme provided technical assistance for EnMS development at no extra charges. The below charts illustrate energy saving achieved per opportunities, projects and its payback.

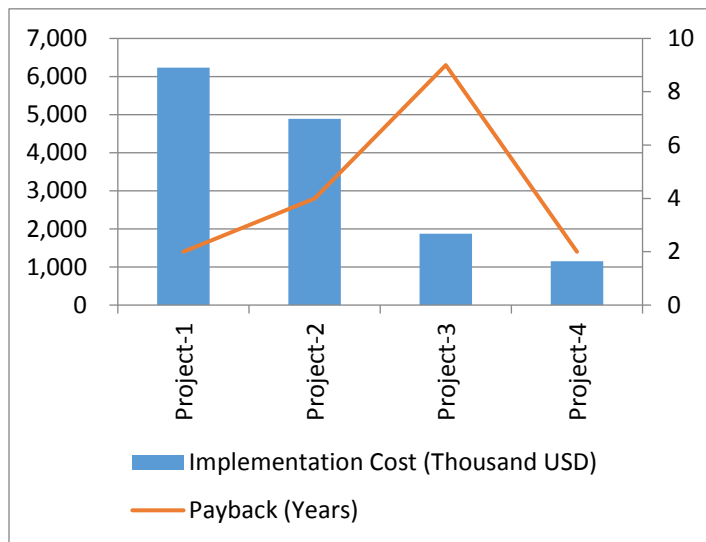


Figure 1. Projects Cost VS pay back

“It is worth to mention that Alternative fuel hot disk was an opportunity and challenge to ACC.”

— Sergio Alcantaria, CEO

For each SEU the energy performance was continuously monitored based on EnPIs derived from historic baselines. The effect of each intervention was evaluated based on estimated versus actual savings achieved. For example the hot disk project was evaluated based on SHC variation in accordance with varying TSR. The graph below shows the energy baseline for kilns specific heat consumption. Another graph demonstrates the reduction in GHG associated with the same project (17% reduction).

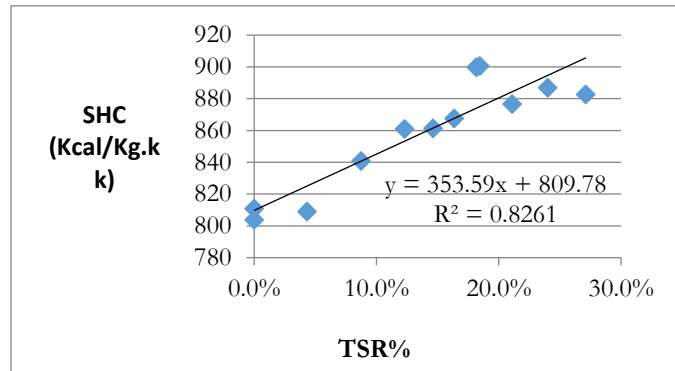


Figure 3. Regression analysis (SHC&TSR)

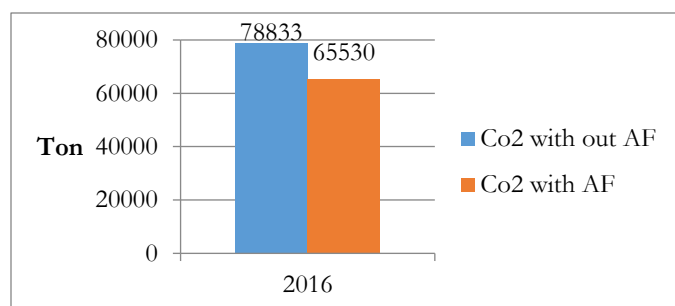


Figure 4. Co2 reduction at 2016

As a result of these specific EnPIs, ACC was able to validate the performance of the cement kilns after the installation of the hot disk and compare it the supplier's performance guarantee. The EnPIs has shown a reduction in SHC from 1000 to 800 kcal/kg.kk (12%).

Internal audits are scheduled on defined intervals to ensure that the continuous monitoring of all EnPIs as well as all other aspects of the EnMS is followed as intended. In the case of any deviations non-conformances and corrective actions are recorded and monitored. External certification by third party auditors is performed on a yearly basis.

Operation and control plays a major role in ACC EnMS. The aim is to ensure that all SEUs are operating at the most energy efficiency conditions that ensure the targeted productivity. The chart below shows ACC approach in optimizing control parameters. The optimized operational and control parameters are standardized, recorded and communicated to relevant personnel to ensure optimum energy performance. The chart shows the standard procedure for ensuring optimum operating conditions. ACC take the necessary

measures to maintain operational control and sustain energy performance improvement through the following:

- Scheduled meeting with energy team member to evaluate energy performance and set new actions to achieve targets.
- Scheduled meeting with energy committee to evaluate energy performance and challenge our targets.

ACC is well known for keeping everyone in the organization aware of the importance of management systems and EnMS is no exception. Staff awareness is continuously improved through:

- Regular awareness sessions conducted by the energy manager and external consultants such as UNIDO experts.
- Regular awareness emails and internal web portal posts communicating EnPIs.
- The use of sign boards to communicate energy objectives and targets and performance. In addition to raising awareness on energy management concepts.
- Ideas Box System
- Energy Violations System

Furthermore, ACC ensures that all staff has enough understanding of their impact on energy performance. For example:

- ACC has participated at the UNIDO technical programmes on electric motors system optimization and compressed air system optimization.
- ACC energy manager participated in a comprehensive technical training programme to further enhance his capacity on leading the efforts of the energy team (certified energy manager by association of energy engineers at Chicago).

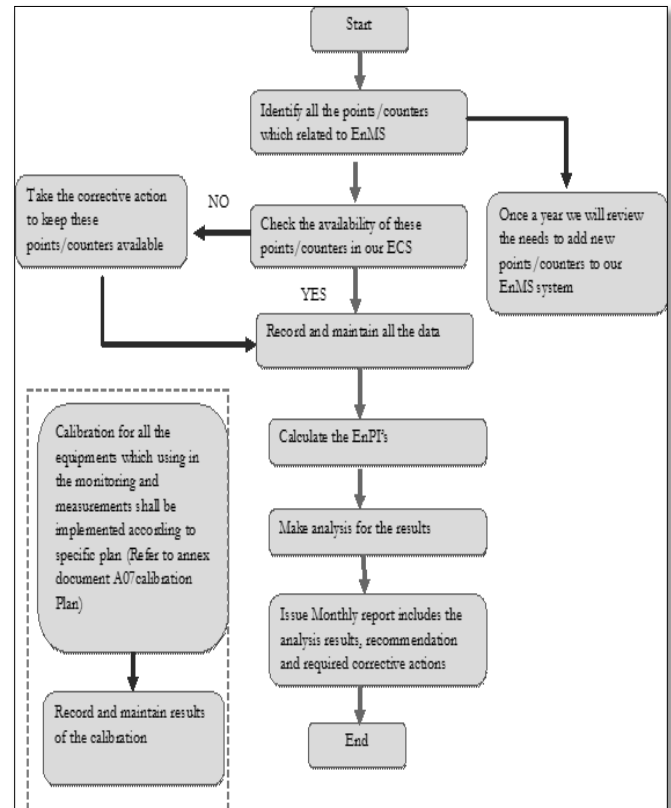


Figure 5. Monitoring, measuring and analysis procedure

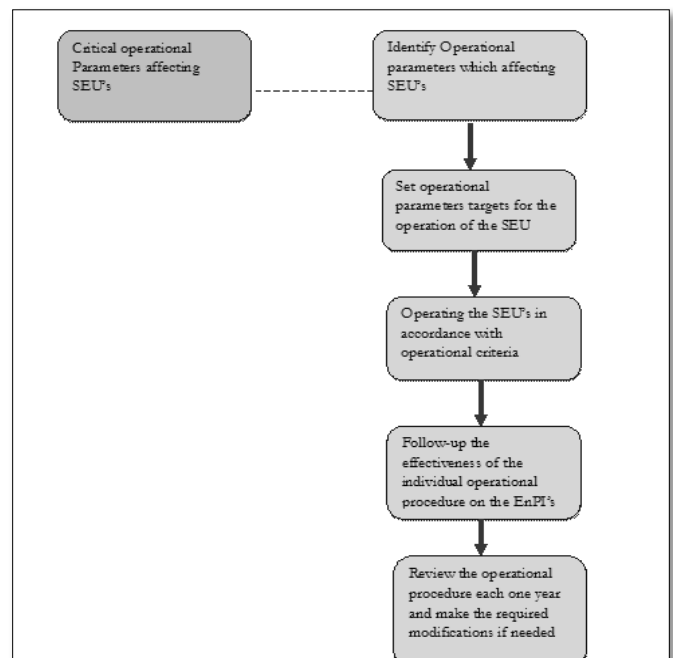


Figure 2. Operational control procedure

To ensure a proper monitoring of energy performance metrics ACC top management has allocated additional resources to support the existing measurement and monitoring system. For example new portable instruments were procured to be used in periodic energy audits such as:

- Portable gas analyzer.
- Thermo graph camera.
- Motor analysis device.
- Ultrasonic leak detector

Furthermore, UNIDO has played an important role for supporting these efforts by providing dedicated tools to monitor performance and to follow-up on the action plan implementation and its effectiveness.

Lessons Learned

Throughout the implementation of the EnMS at ACC, we learned that the main challenge is to institutionalize a cultural change regarding energy. At the early stages when the implementation was technical-focused results were not up to the top management's expectations. However, as soon as extensive efforts on capacity building and awareness raising were put to build an energy performance focused culture coupled with the allocation of adequate financial and human resources the result was a smooth and effective implementation of the EnMS. In turn, this demonstrates that top management commitment is the main key to success.



Figure 3. Energy team

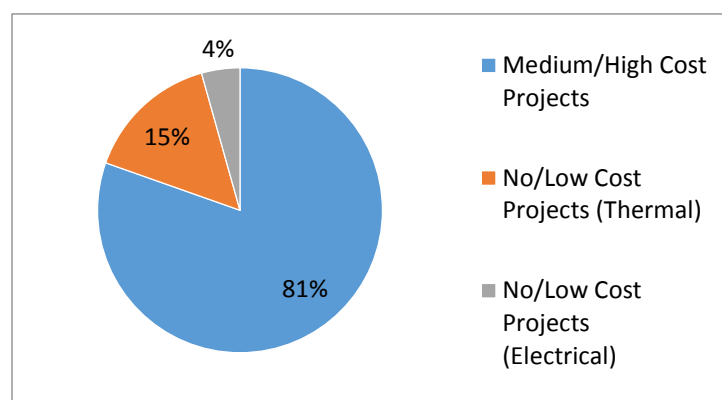


Figure 4. Saving Opportunities

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.