

Global Energy Management System Implementation: Case Study

Egypt

Ezz Al-Dekheila Steel Co. (EZDK)

EZDK is the first steel plant in Egypt to implement the Energy Management System ISO 50001.



Business Benefits Achieved

Due to steel manufacturing being one on the most energy consuming and one of the most polluting, EZDK has focused on implementing the Energy Management System ISO 50001 in order to save energy and reduce greenhouse gases. Energy Management has provided many benefits to EZDK, in addition to the reduction in energy consumption and CO₂ emission, the most important benefit is the cultural change of EZDK employees, which can reflect on their daily lives, which can save even more energy not just in our company but in the whole country in the long run. EZDK has managed to achieve a reduction of 4.6 % in the electricity consumption and a reduction of 3.8 % in the natural gas consumption for the years 2015 & 2016 based on the baseline of 3 years consumption (2011 – 2013). This translates to a total reduction in the energy consumption by 1,331,066 GJ or \$ 7,459,598 and 564,715 metric tons CO₂e reduction.

The implementation of the Energy Management System has given EZDK enough experience to complement its Environment, Health and Safety Management System (EHS), and it is EZDK goal in the future to integrate its EnMS and EHS to reach better performance levels and achieve higher efficiency.



Case Study Snapshot

Industry	Iron & steel
Product/Service	Production of Billets, Bars for Concrete Reinforcement, Wire Rod and Hot Rolled Dry and Pickled Flat Steel Coils and Sheets
Location	Alexandria, Egypt
Energy Management System	ISO 50001
Energy Sources	Electricity & Natural Gas
Energy Performance Improvement (%)	5.6 %
Total energy cost savings	2015: \$ 6,397,926 2016: \$ 1,061,672
Cost to implement EnMS	2015: \$ 2,897,143 2016: \$ 535,836
Payback period on EnMS implementation (years)	2015: 0.45 year 2016: 0.5 year
Total Energy Savings (GJ)	2015: 1,289,465 GJ 2016: 41,601 GJ
Total CO₂-e emission reduction	2015: 373,346 Tons 2016: 191,369 Tons

Company Profile

EZZ AL-DEKHEILA STEEL COMPANY - ALEXANDRIA S.A.E (EZDK), [previously, Alexandria National Iron and Steel Co. (ANSDK)], is an integrated iron and steel works located in El-Dekheila (15 km to the west of Alexandria city).

Alexandria National Iron & Steel Company - ANSDK (The old name of EZDK) was established in 1982 as a joint stock company among Egyptian public sector shareholders, a Japanese Consortium (JC) and the International Finance Corporation (IFC) to meet the local market need from reinforcing steel bars and wire rod according to the Egyptian and international standards.

EZDK plant occupies a vast area approximately 1,000,000 Sq. meters and the production areas are about 650,000 Sq. meters including long production facilities, Flat production facilities and auxiliary facilities.

The current facilities include the following:

- 3 Direct Reduction plants (DRPs).
- 2 Lime Calcining plants (LCPs).
- 1 Long Steel plant (LSD) including:
 - ❖ 4 Electric Arc Furnaces (EAFs) with capacity of 80 tons, 3 Ladle Furnaces (LFs) and 3 Continuous Casting Machines (CCMs).
 - ❖ 2 Bar Mills plants.
 - ❖ 1 Wire Rod Mill plant.
- 1 Integrated Flat Steel Plant (FSD) including 1 Electric Arc Furnace with capacity of 160 tons, 1 Ladle Furnace, Thin Slab Caster (TSC), Hot Strip Mill (HSM), Skin Pass Mill (SKP), Pickling Line (PKL) and a Steel Service Center (SSC).
- Various auxiliaries (Water and gases stations).

The current production capacity is 3 million tons of direct reduced iron, 2 million tons of long products (Rebars & wire rod) and 1 million tons of flat products.

Business Case for Energy Management

Energy's Role in EZDK Strategy:

Since EZDK has implemented its EHS system in the year 2004, we have strived to do our best for a cleaner and healthier environment. An Energy Management System clearly compliments this goal by reducing energy consumption which leads to a reduction of greenhouse gases emissions.

Drivers:

EZDK has thrived to implement an energy management system for several reasons, firstly energy represents approximately 20 % of the total expenses in the steel industry, thus even a small percentage of energy savings is worth hundreds of thousands of dollars per year. Secondly, this compliments and improves upon our goal of a cleaner environment.

Prior Energy Reduction Approach:

EZDK has always thrived to achieve energy savings through various investments and projects in all plants even on insignificant energy uses, this led to wasted resources and money without achieving the desired energy savings.

By implement ISO 50001 EnMS, it provided EZDK with a systematic approach to energy saving, this includes focusing efforts on significant energy users with low cost and high gain energy reductions, also an EnMS facilitated the cultural change of EZDK employees to the better.

“EZDK always strives to be the best in the iron and steel sector. Implementing the Energy Management System ISO 50001 guarantees that EZDK is always in the lead in terms of energy consumption and preservation of the environment”

—Saad Abdel Naby, Energy Team Manager – Management Level

EnMS Development and Implementation

EZDK decided to implement ISO 50001 as a recommendation from our Environment section as a way to decrease greenhouse gases emissions, in addition to its obvious benefit of energy saving.

Organization:

The most important factor of any EnMS success is Top Management commitment. Starting from the Energy Policy, which is defined by Top Management, and communicated to all employees' levels. This Energy Policy is reviewed annually during a management review meeting. An energy team was formed from all plants in order to cover all boundaries of EZDK scope. Two selected senior engineers were trained as energy experts by UNIDO. These two experts then trained the rest of the energy team, which in turn began training employees at site level. The energy team made use of the preexisting documents and procedures from the already implemented ISO 9001 & ISO 14001 to cope with the requirements of ISO 50001. An energy manual was issued to cover the planning, operation and checking in order to achieve the desired continuous improvement and the targeted energy savings.

Energy Review and Planning:

EZDK energy team has planned and documented the energy objectives, targets and action plans from the beginning of 2015 to the end of 2017.

EZDK has 2 Significant Energy Uses (SEU), Natural Gas and Electricity. The three Direct Reduction plants consume 80% of the natural gas total consumption "Figure (1)", while the five Electric Arc Furnaces consumes 61% of the total electricity consumption "Figure (2)".

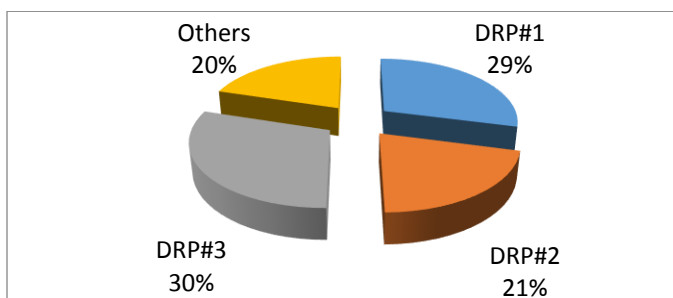


Figure (1): EZDK percentage distribution of natural gas users.

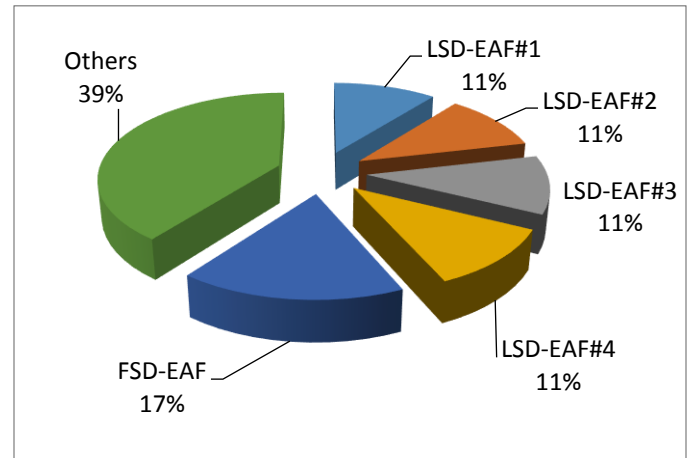


Figure (2): EZDK percentage distribution of electricity users.

After identifying the SEUs, EZDK energy team began to identify the variables and drivers affecting each SEU. The coefficient of determination (R^2) indicates the degree of acceptance of the drivers or if it needs additional studies and analysis to determine other drivers. Then using these drivers to establish our baseline for each plant in order to predict the future energy consumption based on corresponding drivers. After which the actual energy consumption is compared to the baseline energy consumption. This comparison is used to determine 3 Energy Performance Indicators (EnPIs), which are the Energy Intensity Index (EII), the difference between actual and expected (Excess) and the Cumulative Summation of energy saving (CUSUM).

After the EnPIs were calculated, EZDK energy team began to seek for energy saving opportunities and each plant began to offer suggestions for energy saving projects. Action plans were made for each project and also carrying on the ongoing projects that began before even implementing the EnMS, such as: Static VAR Compensator (SVC) for EZDK Substation. The predicted energy savings are then established as our energy objective and target from the beginning of the year 2015 to the end of the year 2017. EZDK energy objective is to reduce electricity consumption by 3.2% and reduce natural gas consumption by 4% by the end of the year 2017 "Table (1)".

Electricity				
Year	Planned Savings (GJ)	Actual Savings (GJ)	Planned Percentage	Actual Percentage
2015	110,254	155,464	1.5%	1.7%
2016	67,219	215,114	0.9%	2.9%
2017	246,153	Going on	6.0%	Going on
Total	423,626	370,578	8.4%	4.6%
Natural Gas				
Year	Planned Savings (GJ)	Actual Savings (GJ)	Planned Percentage	Actual Percentage
2015	696,582	1,134,001	3.9%	5.3%
2016	91,328	- 173,513	0.8%	- 1.5%
2017	654,610	Going on	5.6%	Going on
Total	1,442,520	960,488	10.3%	3.8%

Table (1): EZDK energy objectives & actual results.

Financing:

Each year in October and November, each plant prepares a business plan and budget plan, including all planned energy projects, for the following year company budget. Each project must have a complete feasibility study and Top Management approves the most feasible projects for the company in the following year.

“Due to the Iron & Steel industry being one of the heaviest energy consuming industries, implementing No-Cost & Low-Cost can save a lot of energy which translates to millions of dollars in cost savings”

—Mohamed Salah El-Mokadem, Energy Team Manager –
Technical level

Cost-Benefit Analysis:

EZDK energy team has devised a weighting matrix “Table (2)” to be able to assess and priorities the suggested energy projects. Taking into consideration the cost of the projects levels and the expected saving levels (LE = Egyptian Pounds).

Cost level		Saving level	
5	No cost	5	> 3 M. LE
4	Low cost	4	2 ~ 3 M. LE
3	Medium cost	3	1 ~ 2 M. LE
2	High cost	2	0.5 ~ 1 M. LE
1	Very high cost	1	< 0.5 M. LE

Table (2): Weighting matrix for assessing energy projects.

EZDK energy team has decided to begin implementation of “No cost” energy projects with high energy savings, after which “Low”, “Medium” & “High cost” energy projects will be implemented in that order taking into consideration the level of energy saving of the project.

A simple cost-benefit analysis for the years 2014, 2015 can be viewed in “Table (3)”.

	Cost	Savings
2015 Projects	\$ 2,897,143	
2015 Savings		\$ 6,397,926
2015 Payback	0.45 year	
2016 Projects	\$ 535,836	
2016 Savings		\$ 1,061,672
2016 Payback	0.5 year	

Table (3): Simple Cost-Benefit analysis.

Determining Energy Performance Improvements:

EZDK methodology for determining energy performance improvements depends mainly on the Energy Tool developed with the assistance of UNIDO, EZDK methodology includes the following:

- Accessing energy bills and energy sub-meters data.
- Trending and data analysis are employed.
- Comparing actual energy consumptions with planned consumptions.
- Reviewing each SEU, and their affecting variables and drivers.
- Reviewing each individual energy project, including their energy consumptions, energy savings and operational parameters and comparing them to the baseline to assess the value of the energy performance improvement.

Validating Energy Performance Improvements:

EZDK employs the annual internal audit as the main tool for validating energy performance improvements. EZDK has a comprehensive internal audit system that is implemented by the Quality Assurance Department. Each plant is audited thrice annually. The internal audit is carried out by qualified lead and internal auditors who are not related to the personnel implementing the EnMS to prevent any bias in the audit results. The lead auditors were trained by UNIDO as certified Energy Experts.

Before any internal audit is conducted, each Energy Team member is responsible for reviewing the energy consumptions, energy savings and the energy projects in his assigned area.

In addition to the internal audit, EZDK has a system for calibration of any and all measuring equipment, including all electrical energy meters and natural gas flow meters. This gives confidence to all energy readings and any analysis or trending done with these reading will give consistent results.

An annual Energy Management Review is conducted using the results of the internal audits, the trends made using the energy readings, data analysis are all presented to the Top Management, so Top Management can give their inputs according to the current situation.

Operational Controls for Sustaining Energy Performance Improvements:

EZDK employs several control measures for sustaining energy performance improvements, including procedures that supplement the EnMS, detailed work instructions for each plant that lists all parameters that affects the energy consumptions and various record sheets for data logging.

Two highly experienced engineers from EZDK has been trained by UNIDO as Certified Energy Experts, these two experts are responsible for training the rest of the energy team, and each member of the team in his own area is responsible for training the personnel at site level through periodical refreshment energy management training .

Professional Expertise, Training and Communication:

UNIDO has been assisting EZDK through the IEE (Industrial Energy Efficiency) program; by means of training our two energy experts, performing a pre-certification audit and providing specialized training for our energy team members, such as: Electrical motors optimization training and Compressed air systems optimization training.

Before the implementation phase, several EZDK engineers conducted a visit to VDM Metals Group,

Germany, where they have an extensive experience in EnMS, and presented their findings with the Top Management, and Top Management was convinced to implement the EnMS and the energy team was formed.

All plants' employees to the shop floor level are trained by the energy team through periodical refreshment training. Also several awareness posters are posted in key locations around the facilities to increase the awareness of employees and implant the energy saving culture in their daily lives.

EZDK has a Continuous Improvement Department which implements Lean Management throughout the company, also it implements a proposal system where employees from all levels proposes an improvement to the equipment or system with bonuses and incentives given to the employees with the best proposals.



EZDK Energy Experts receiving EZDK's Recognition Award from UNIDO for implementing ISO 50001 EnMS

Tools & Resources:

EZDK uses a customized energy tool developed with the assistance of UNIDO for analysis and trending for the continuous improvement of the EnMS.

EZDK makes use of a sub-metering system for both electricity and natural gas. Each SEU, either electricity or natural gas, has its own sub-meter in order to get accurate actual energy consumption readings and not rely on estimated energy consumption figures. EZDK network of sub-meters is constantly expanding through continuous investments to include non-SEUs. As a future investment, EZDK will apply an Online Energy monitoring system for real time monitoring and trending with alarms for higher-than-normal consumption.

EZDK Energy Team has extensive knowledge and experience in Management systems since EZDK was certified in ISO 9001 since 1998 and ISO 14001 since 2007, this made it easier for the energy team to devise the system as a whole and prepare the supporting procedures.

In addition to this, EZDK's Continuous Improvement Department always tries to implement Lean Manufacturing throughout the company through various training sessions and workshops on Lean Management for employees

Lessons Learned

- **Top Management commitment is a must:**

Without Top Management commitment there is no system, so before you even begin the implementation phase of your EnMS, you have to get the commitment and support of the Top Management.

- **The biggest obstacle is changing the employees culture:**

The toughest challenge you will face is changing the employees' mindset, as people can be set in their ways, this can be done through periodical trainings,

encouragement, incentives and employees engagement.

- **You have to utilize outside help:**

Energy Management Systems are relatively new; this means that even if you have previous experiences with other Management Systems, such as ISO 9001 or ISO 14001, you have to utilize some outside professional expertise, even if you have to pay for it, the gains far outweighs the costs.

- **Large investments are not always needed:**

You can save a huge amount of energy at no cost at all through modifying operational parameters or operating procedures, or Low Cost through small modifications of your existing systems and equipment. After you exhaust your No Cost and Low Cost options, then you can start to make High Cost investments.

- **Time and dedication are needed:**

Don't expect instantaneous results when you start implementing your EnMS, the results are cumulative and should take a while to really shine. Dedication is a must from all employees and especially the Energy Team to really make a difference.

Keys to Success

- Top Management commitment.
- Dedicated Energy Team
- Employees' engagement.
- Pre-assessment and internal audit.
- Utilizing outside professional expertise.
- Sub-metering network.

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.

