Global Energy Management System Implementation: Case Study

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JK Cement Ltd.

Build Safe

"None of us is stronger than the systems like ISO 500001. Let's explore and conserve energy together."

—Yadupati Singhania (Chairman and MD)

Case Study Snapshot	
Industry	JK Cement Works, Mangrol
Product/Service	Cement Manufacturing
Location	Mangrol
Energy Management System	ISO 50001
Energy Performance Improvement Period	FY 2016-17
Energy Performance Improvement (%) over improvement period	8.2%
Total energy cost savings over improvement period	3357797 USD
Cost to implement EnMS	1214175 USD
Payback period (years) on EnMS implementation	4.34 Months
Total Energy Savings over improvement period	(637851 GJ)
Total CO_2-e emission reduction over improvement period	(49026 Metric tons)

Business Case for Energy Management

1.1 Organization Profile/Business Case:-

JK Cement Works Mangrol Commenced commercial production in Dec'2001 with a capacity of 0.75 MnTPA. It is situated close to Nimbahera plant (10kms away) - offers it significant synergy benefits like assistance from technical & commercial staff of Nimbahera Complex.

The Company has set up a 1.5 MnTPA Brown field Cement plant at Mangrol. The unit is located at a distance about 12 Km. from J.K. Cement Works, Nimbahera, and this unit will have a capacity of 5000 Tons per day.

Equipped with state of the art machinery and systems, the plant will be energy efficient and pollution controlled with outlet emission level < 30 mg /Nm3 - much less than the allowed limit of the Central Pollution Control Board.

A fully automatic Robo lab, appointed for quality improvement of raw mix and cement, will take samples automatically and will check and give correction for a better quality of the product.

Motivations for energy and Climate sustainability efforts and Goals: - Our organization is constantly improving upon environmental footprint and contributing towards more inclusive growth of the society in which we operate, besides delivering on the economic front.

We are building a sustainable environment for our future generation by giving back to the nature and society. We want to help all people who are directly or indirectly associated with us.

At J.K. Cement, our focus is to take initiatives which will help us reduce environmental de-gradation and improve climatic condition in the long run. Moreover, we are also taking steps to optimize resources and improve efficiencies as a part of energy management efforts.
For energy conservation various efforts have been made like modifications, process optimizations, implementations of new technologies, up gradation etc.
Drivers: - Energy management programs implemented for reduction in specific energy consumption (Thermal as well as Electrical). Energy management programs are the need of the hour. These conservation measures provides to further meet the PAT norms, reduction in CO2 emissions and ultimately motivates the employees under the initiatives of cost reduction.
Energy management program has led our organization to operate plant in highly efficient manner which reflects in our year to year increase in brand value. Energy management program covered under EnMS ISO 50001:2011.
Energy Reduction approach: - Energy consumption is monitored daily and review is done for deviations. Review of energy consumption is done jointly in daily PD meeting and actions are taken accordingly to reduce deviations in minimum time. External Audits are also conducted for further potential for conservation.
OCCUPATIONAL HEALTH & SAFETY
We believe in 'Zero Harm'. Our vision is to improve health and safety standards of people who are working with us in the capacity as employees, contractors or in any other role. Efforts are taken to minimize activities which may affect the health and safety in working place or adversely impact the life of communities living near our plants. To promote this, we are encouraging the use of renewable resources as well as recycled waste. Further, steps are taken for optimum utilization of plants, with least disposal of harmful gases in environment.
J.K. Cement Works, Mangrol is committed to -
Produce blended cement and provide services to the satisfaction of our customer with due consideration to legal and other requirements.
1. Improve continually the effectiveness of Integrated Management System, which includes quality management system, environmental management system, Energy management System and Occupational health and safety.
2. Minimize and / or control environmental impacts, Significant energy uses and Hazards associated with its operations at Mangrol.
3. Prevention of injury and ill health.
4. Inculcate a working culture with emphasis on prevention of pollution, minimizing and controlling waste generation, Safe work practices and optimize consumption of resources/Energy.
JK Cement Works, Mangrol is certified with

- ISO 9001:2008 - Quality Management System
- ISO 14001:2004 - Environment Management system
- OHSAS 18001:2007 - Occupational Health and Safety Management System
- ISO 50001:2011 - Energy Management System

Business Benefits Achieved

1.2 Business Benefits (Summary):- BY the implementation of EnMS ISO 50001:2011 various cost benefits are received along with conservation of energy which is reflected by awards for energy conservation initiatives, reduction in Environmental emissions like CO2 emissions. Various jobs done under EnMS are mentioned below for the benefits achieved by EnMS implementation:-
1. Replacement of main fuel by various kinds of AFRs like Agrowaste, Liquid mix waste, Solid mix waste, Fiber mass, ETP sludge, Carbon black by which we save approx. 13299 Ts. Petcoke in FY 2016-17 (1389443 USD Saved).
2. Increase in use of Pond Ash Consumption in FY 2016-17 and saved 995992 USD.
3. Regulation of grinding aid dosage in Cement mill-3 Rebuilding of roller surface profiling periodically, Grinding media composition optimization, improved separator maintenance, PSD analysis of product, Improvement in Clinker chemistry by which we save 53.18 Lakhs kWh in FY 2016-17 (322832 USD Saved).
4. Modification of interlocks to reduce idle running hrs. Of equipments, Improvement in PRI in Raw mill-3 and

kiln-2, VFD installation in kin feed elevator and rotary air lock, Improved maintenance of Kiln, Cross bar cooler, raw mill separator vanes modification by which we save 21.71 Lakhs kWh in FY 2016-17 (131785 USD Saved).
5. Optimization of Burner Momentum, Optimization of excess Air, Optimization of Raw Mix chemistry, Optimization of Process Parameters, Optimization of PID Controls by which we save 4650 Ts Petcoke in FY 2016-17 (485793 USD Saved).
6. Installation of energy saver panel by which we save 0.66 Lakhs kWh in FY 2016-17 (5694 USD Saved).

EnMS Development and Implementation

1.3 Organizational:-

In JK Cement works, we are improving our performance by various performance improvement systems like UDAAN, MASHAAL, NIRMAAN, etc. which are the key improvement plan for energy conservation. Various KPIs for energy conservation are taken targets for EnMS. All manufacturing excellence drives are developed by various idea generations sessions, brain storming sessions, team building to achieve the targets taken in EnMS 50001:2011.Based on the KPIs various energy management programs are developed and been implemented one by one with monitoring and measurements. Various SOPs, OCPs are implemented to conserve energy during plant operations. Some of Energy conservation initiatives taken is attached.

Energy
Conservation Initiati

EnMS standards are followed for the implementation of all kinds of systems as mentioned below:

1. UDAAN - Manufacturing excellence drive:-It is a platform for the young engineers, Managers in the organization to suggest new ideas for various KPIs designed to achieve. Under this various ideas generation sessions are taken for energy efficiency improvement. Out of the various good ideas most feasible ideas are discussed and implemented. Good ideas are appreciated by rewards, certifications etc.

2. MASHAAL: - This is another drive for getting new ideas and encouragement for the improvement and the efficiency. In this JK cement created a separate internal portal, various idea boxes etc. for providing useful innovative work for efficiency improvement.

3. NIRMAAN: - This is also a unique mission of JK cement for the improvement in the system and the efficiency. It is another drive by JK cement to adopt new systems for monitoring of parameters. Many persons are trained for the adoption of the new system through computer and local soft network across the organization.

1.4. Energy review and planning:-

Energy
Management Team

Monitoring: - 1. Daily Production and Consumption report on daily and monthly basis.

2. Calculate Section wise Electrical Energy on daily and monthly basis.

3. Calculate the Thermal Energy on daily basis and monthly basis

4. Comparison between section-wise powers on daily basis.

Review: - 1. Daily Review meeting called PD meeting in which all KPIs and Section wise Electrical/Thermal Energy is been discussed.

2. Decision taken in PD meeting for action plan on deviations.

Planning: - 1. Action taken in daily PD meeting some actions are to be implemented are taken care of immediately and other are planned for required stoppage of plant.

"ISO 50001 makes easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management."

—S.K. Rathore, Unit Head

1.5.1 Cost Benefit Analysis: - Every EnMS program is implemented after cost benefit analysis is done. For Example:-

1. Investment required is calculated in terms of material required and services required.

2. Savings (Electrical/Thermal) is calculated for the particular EnMS program.

3. Based on saving potential calculated money saved is calculated.

4. Corresponding time period for the implementation of the energy management program is framed including the activities involved in the implementation by different departments.

5. Based on all activities involved final cost of implementation is calculated and then compared with the saving potential cost.

6. After positive cost benefit the energy management program is under implementation.

One of the calculated EnMS saving program is written below:-

EnMSP-53	Investment (USD)	Energy savings	Savings (USD)	Payback Period
Installed load tap changer at lighting transformer	2739	52600 KWH	3193	3.5 years

1.5.2 Approach used to determine performance improvement:-

1. After cost benefit analysis the specific EnMS is implemented as per the time frame.

2. Monitoring of the system after implementation is done by the team and then analysis is done.

3. Comparison with the data before implementation is done.

4. The difference of the comparison of data is the improvement observed.

5. Improvement is then compared with the expected energy savings to finalize the actual performance improvement.

6. Data are compared in terms of absolute value like Kcal/hr, Kcal/kg Material, KWH, KWH/Ts of Material etc.

7. Trends of Energy consumption before and after are compared for long time interval.

1.5.3 Approach used to validate results:-

1. EnMS results are finally validated by showing the savings achieved under 1.5.2 in review meeting.

2. It is then submitted for final compilation in the IMS department.

3. Savings are also verified under Form-3.

4. Typical Form-3 submitted is attached.

Form-3

1.6 Steps taken to maintain operational control and sustain energy performance improvement:-

1. Operational control measures are at maximum are implemented in the software of the plant engineering station itself.

2. Operation control measures are periodically reviewed for any changes required to sustain the energy performance.

3. Changes are duly informed and made through a change management system. Typical format is attached.

Change Note

4. Automatic logic controls are implemented in the system to sustain continuous energy conservation and performance improvement on day to day, hour to hour basis which is used online.

1.7 Development and use of professional expertise, training and Communications:-

1. Development of the employees is done via internal training programs, External training programs etc. List of training program is attached


Trainings

2. Experts from O&M are also called to make people understand the equipments energy potentials etc.

3. Visits of employees to other plants where good practices for energy conservation and EnMS are followed are made to make them aware.

4. Professionals from various industries are called to impart on job training to the employees for skill transfer, Employee engagement etc.

5. For the motivation and communications various rewards are given in house and internal mails are forwarded for the communication of EnMS.

1.8 Tools and resources:-

1. JK Cement Mangrol has used the ISO certifications as a resource and standards of these systems as a tool for improving its performance in environment, energy, safety and health etc.

2. Quality is monitored at every step where high technology equipments like CBA, X-Ray analyzer, HD Cameras, sophisticated tools for information transfer are used.

3. For analysis of data various statistical techniques like standard deviation, average, minimum, Maximum, graphical representation, coefficient of variation etc. are used for creating excellence product manufacturing and technology etc.

4. JK Cement is utilizing ISO as key tool for resource conservation and energy conservation to improve its overall performance year by year.

5. External audits for energy conservation are also done periodically from to further find potentials in the system. We have conducted energy audits from CII, CEMCON, and MCJ Engineers etc.

2.1 Lessons Learned/Keyes to success:-

Various challenges are faced by JK Cement for the implementation of ISO 50001 but all barriers were a learning to us. Some of the challenges are:-

1. System understanding was very less during the initial period where nobody was clear about the requirements etc.

2. Interpretation of standards written under ISO 50001 were very confusing which took a lot of time to make understanding in the organization.

3. Although energy conservation activities were going on but clear cut understanding about how the system to be followed was not there.

4. Due to non-awareness of the system it was very difficult to make people understand about the usefulness of ISO 50001.

Lessons learned were:

1. Standards given in the system are very useful for making a clear platform for energy conservation and resource conservation.

2. During the implementation competence of the employees has raised to a very good level resulting in skill development etc.

3. Various difficulties faced during the implementation of EnMS has given learning to the organization for improving vision towards various areas where small savings can lead to major success for achieving targets.

4. Ultimately system implementation has given key learning that energy is precious.

Points to Success by ISO 50001

- Thermal Energy reduced from 703 (FY 2015-16) to 682 (FY 2016-17) KCal/Kg Clinker.
- Up to Clinkerisation power reduced from 46.7 (FY 2015-16) to 45.4 (FY 2016-17) kwh/Ts of Clinker.
- Grinding Energy reduced from 30.6 (FY 2015-16) to 27.5 (FY 2016-17) kwh/Ts of Cement.
- Electrical Energy reduced from 71.7 (FY 2015-16) to 65.7 (FY 2016-17) kwh/Ts of Cement.

- CO2 reduction in FY 2016-17 as compared FY 2015-16 is 49026 Metric tons.

2.2. Quotes:-

ISO 50001:2011:-

- Develop a policy for more efficient use of energy
- Fix targets and objectives to meet the policy
- Use data to better understand and make decisions about energy use
- Measure the results
- Review how well the policy works, and
- Continually improve energy management.

2.3. Visuals:-

1. UDAAN KPIs FY 2016-17:-

UDAAN KPI : Mangrol Line - 1

KPI	UOM	Apr'16 to Dec'16 and Jan'17 to Mar'17	YTD 2015-16	Sept'16	Oct'16	Nov'16	Dec'16	Jan'17	Feb'17	Mar'17	YTD 2016-17
Sp. Thermal Energy	kcal/kg Clk	750	764	765	761	799	790	782	780	782	771
Specific Power consumption Up to Clinkerisation	kWh/T Clk	50	52.5	54.0	53.4	54.4	54.9	55.40	55.80	55.74	53.45
Specific Power consumption Cement Grinding	kWh/T Cement	33	35.9	38.4	36.3	35.8	36.1	36.4	35.44	36.34	36.51
Total plant sp.power	kWh/T Cement	85	88.7	91.7	90.1	90.6	92.1	93.38	92.36	95.09	90.78
OPC Clinker Factor	%	94	94.6	92.9	93.9	94.6	94.9	94.3	94.67	94.82	94.13
WTBF Raw Mill-1	Hr	100	39.2	31.6	231.1	78.7	560.7	154.8	-	-	43.28
WTBF Raw Mill-2	Hr	100	28.8	59.3	473	51.4	286.5	288.6	646.18	362.33	50.54
WTBF Kiln	Hr	500	257.1	132	96	65	741	237	165	91	159.84
WTBF Cement Mill	Hr	150	69.2	466	283	121	415	333	195	395	130.07
TSR (APR)	%	10	2.5	0.85	0.76	0	4.96	1.81	4.19	12.60	4.33

UDAAN Mangrol Line - 2

KPI	UOM	Apr'16 to Dec'16 and Jan'17 to Mar'17	YTD 2015-16	Sept'16	Oct'16	Nov'16	Dec'16	Jan'17	Feb'17	Mar'17	YTD 2016-17
Sp. Thermal Energy	kcal/kg clk	680	703	681	679	684	678.6	678	678	683	682
Specific Power consumption Up to Clinkerisation	kWh/T Clk	44	46.6	44.9	44.9	44.4	44.8	44.9	45.98	46.22	45.38
Specific Power consumption Cement Grinding	kWh/T Cement	27	30.5	28.3	28.6	26.9	27.0	26.9	25.4	26.83	27.52
OPC Clinker Factor	%	60	65.1	65.4	62.2	64.1	63.2	60.7	62.34	62.85	63.68
WTBF Raw Mill-1	Hr	75	29.6	83	42.6	79.5	100.2	113.0	91.7	588.67	63.16
WTBF Kiln	Hr	500	64.0	340.7	145.7	82.8	306.2	79	335	145.13	135.19
WTBF Cement Mill	Hr	150	7.9	23.8	24.5	37.3	38.4	560.2	62.2	34.07	31.69
TSR (APR)	%	10	0	0.6	9.8	7.7	10.2	12.1	13.4	15.16	8.01
Panel mix in Total Fly ash Mix	%	50	15.7	17.0	31	30.2	36.5	49.1	50.4	54.69	38.28

2. Idea generation and Brain storming session:-

3. Improving Employee skill.

4. Motivation sessions to workers.

5. Tool talk sessions to workers.