

Global Energy Management System Implementation: Case Study

India

Shree Cement Limited

First company in process industries in world to implement ISO: 50001 in Year 2009



Shree Cement Limited Ras (One in World's largest Plants, 8 Kilns at single location with highest WHRB capacity in India)

Business Benefits Achieved

Shree Cement Limited is an India-based cement manufacturing company. The Company is engaged in the manufacturing of cement and also in generation of power. It has eight clinkerization units at Ras location with highest capacity of waste heat recovery boilers for electricity generation from waste hot gases of kiln.

Energy Performance improved to 4.6% from the baseline. The baseline gate to gate consumption was 747.84 in 2013-14 which is improved to 713.40 in financial year 2014-15(Apr-Mar).

- Total CO₂ reduction is 72150.8 MT/Year
- Energy saved in the year 2014-15 is 136.13 million kWh/year
- Total cost saving by implementation of EnMS is Rs 40.84 Crores

“Energy Saving: A Profitable Way To Reduce Global Warming And To Remain Sustainable.”

—Mr. H.M.Bangur, MD

Shree Cement Limited

Case Study Snapshot

Industry	Shree Cement Limited Ras
Location	Ras, Rajasthan
Energy Management System	ISO 50001
Product/Service	Cement
Energy Performance Improvement (%)	4.6
Annual energy cost savings	Rs 40.84 Cr
Cost to implement	Rs 128 Cr
Payback period	3 Years

Company Profile

SCL is one of the leading Indian cement companies and has made a remarkable presence in national cement industry. Approach for transforming risk into opportunities has bestowed it with many low hanging fruits. With a cement production capacity of 25.6 million tonnes per annum, it has become third largest cement company of India. SCL commenced up its operations in 1986 with a production capacity of just 0.6 million tonnes per annum. Later on, following the succession and adapting itself as per the market trends & consumer needs, SCL established itself as one of the premiers in cement industries.

With time and needs, SCL diversified its business portfolio and entered into power sector followed with commercial power plant i.e. Shree Mega Power with a power generation capacity of 300 MW. The total power generation capacity comes to 501 MW including 201 MW of captive power. It is further complimented with **WHR (Waste Heat Recovery)** power plants of capacity

111 MW and finally making up the total power capacity up to 612 MW. SCL is accredited with largest WHR



power plant capacity in the world, after China. It has established WHR based power plants at its Beawar, Ras & Raipur locations.

Business Case for Energy Management

Drivers/Business Case

In cement manufacturing operations energy consumption cost accounts for 20% of total production cost.

Objective to implement ISO 50001 was to achieve higher levels of energy efficiency ultimately leading to operational efficiencies. Long term scenarios including resource constraints, future government, implications for energy efficiency to align our efforts along with NAPCC under the umbrella of PAT. PAT (Perform Achieve and Trade) : The Perform Achieve Trade (PAT) is an innovative, market-based trading scheme announced by the Indian Government in 2008 under its National Mission on Enhanced Energy Efficiency (NMEEE) in National Action Plan on Climate Change (NAPCC). It aims to improve energy efficiency in industries by trading in energy efficiency certificates in energy-intensive sectors.

Shree Cement won energy efficiency and quality excellence awards instituted by National Council for Cement & Building and Materials.

Shree Cement has also been honored with First Prize in Cement Sector in "Rajasthan Energy Conservation

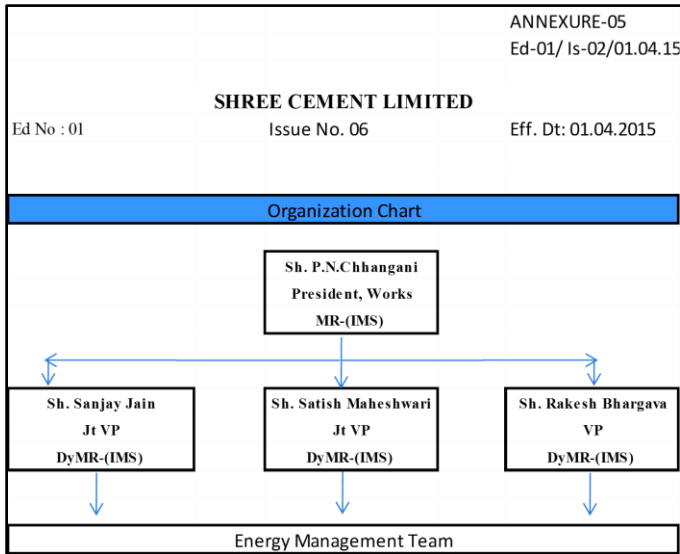
Award-2015" instituted by "Rajasthan Renewable Energy Corporation Limited

Keys to Success

- Installation of Waste Heat Recovery Boiler for generation of electricity by utilizing waste heat from kilns. Highest in India.
- Installation and commissioning of Secondary crusher to enhance Raw Mill's output
- Enlargement of Kiln inlet riser duct orifice cross section
- Removal of fan inlet dampers at Raw Mill and Coal Mill fans
- Replacement of fuel feeding double screw conveyor by direct chute with a rotary air lock in Coal Mill circuit
- Replacement of conventional fuel firing blowers by high efficiency Delta blowers
- Installation of Coal Mill rejects recirculation system
- Tipping of Raw Mill fan Impeller to increase fan flow
- Replacement of existing conventional Kiln Tire Cooling fans with high Efficiency fans
- Replacement of conventional fuel firing system by Rotor Scale
- Installation of high efficiency K-Turbo blower for jet air in kiln burner
- Installation of high efficiency IE-3 type motors.
- Replacement of Conventional lights by LED lights
- Replacement of higher rating less loaded LT Motors by low rating higher efficiency motors
- Installation of Star-Delta starter
- Installation of VFDs and MVDs for various applications
- Elevator Load Current Vs Bag Filter Fan Speed Control system at Clinker Unloading Circuit
- Louver damper removed from process fan Inlet Duct
- Plant compressor operation taken into DCS & interlocked developed in DCs with cement & packing plant operations

EnMS Development and Implementation

Organizational



There are various programs and mission to motivate to create energy consciousness in the plant for management and workers. Some of them are as follows

- Technical support from different institutions like NCBM,BEE,M/s Holtec & KHD Humboldt & FLS,FLAKT Woods India ,Reitz India.
- Workshop and seminar organized by reputed organization related to Energy efficiency ,clean development technologies
- Various journals have been provided in technical library for technology update.
- Visit of officials to other cement plants in India and abroad.
- Mission 22-28 with motto, to reduce specific energy consumption of grinding unit to 28 kWh/Tonn cement keeping 22 operating hrs
- Conducting internal energy audit and seminar inside the plant.

- “JO SOCHE WHO PAAVE” suggestion scheme.
- Celebration of energy conservation and lubrication week
- Promotion of small group activities.
- Multi skill training od personnel at various institution and on the job by the departmental head
- Various in house /external (India & Abroad) training programs were arranged from time to time in order to make aware about energy consciousness among the work force.
- Visit of various experts for demonstration of their product.
- Started Mission -11 with motto, to increase profit by 11% and reduce cost by 11 % in recession time

Energy Review & Planning

Identification of Energy Aspects & Prioritization:

All members of core team, comprising of personnel from the concerned departments like Process, Mechanical, Electrical, Power plant etc with Management Representative Conduct energy review (aspect identification and evaluation) initially. During the identification and evaluation of energy aspects, following are considered.

Analysis of energy use and consumption based on measurement and other data like identification of current energy sources. Evaluate past and present energy use and consumption.

Based on the analysis of energy use and consumption, identify the areas of significant energy use, like identify the facilities, equipment, systems, processes and personnel working for, or on behalf of, the organization

that significantly affect energy use and consumption. Identify other relevant variables affecting significant energy uses. Determine the current energy performance of facilities, equipment, systems and processes related to identify significant energy uses. Estimate future energy use and consumption;

1.4.1.1 . Identify, prioritize and record opportunities for improving energy performance.

Criteria for Potential Saving & Feasibility:

Once the energy aspects are identified, they are reviewed for their significance at the moment, the significance criteria includes “Potential Saving” and “Feasibility”.

The criteria for calculation for identification of significant energy aspects is described below

The Saving Potential and Feasibility are added to assess the significance of the energy aspect. The aspects having

The energy aspects having rating value 10 or more are considered as significant.

The significant aspects are evaluated for possible energy factors, opportunities for savings and required investment. The details are recorded in the register of opportunities (ROP). Following criteria is used for finding out the priorities of the various opportunities based on payback and use of renewable energy. The action plan to take up the significant aspect as per the priority is drawn and mentioned in the register of opportunities (ROP). The action plan may be in terms of EnMP or check sheet or work instructions or combination of all above. The responsibility of action plan is also mentioned in ROP. All members of core team, comprising of personnel from the concerned departments shall establish an energy baseline using the information in the initial energy review, considering a data period suitable to the organization's energy use and consumption. Changes in energy performance shall be measured against the energy baseline. Adjustments to the baseline shall be made in the case of one or more of the following:

- a) Energy Performance Indicator (EnPI) no longer reflect organizational energy use and consumption,
- b) There have been major changes to the process, operational patterns, or energy systems, or
- c) According to a predetermined method

Records: Monthly Progress & Monitoring Report on Objectives.

Energy aspects register

CRITERIA FOR RATING ENERGY ASPECT										
Saving Potential Rating A		Technological Feasibility Rating B		Efficiency Rating C					Possibility for Usage of Renewable Energy Rating D	Possibility for Usage of alternative / waste Energy Rating E
				Efficiency 90 % or more	Efficiency between 89.99-75 %	Efficiency between 74.99-60 %	Efficiency between 59.99-50 %	Efficiency below 50 %		
Less than Rs 10,000/annum	0	Easy to implement well established technology / method, very simple changes are required	10							
Less than Rs 1,00,000 /annum	3	Minor changes are required	7	1	2	3	4	5	2	1
Less than Rs 10,00,000 per annum	7	Major interventions / changes are required	3							
More than Rs 10,00,000 per annum	10	Technology not available or not a proven technology	0							

rating value more than 10 considered as significant.

Note

- Give 1 marks bonus if Efficiency of equipment is 90 % or more
- Give 2 marks bonus if Efficiency of equipment is between 89-75 %
- Give 3 marks bonus if Efficiency of equipment is between 74-60 %
- Give 4 marks bonus if Efficiency of equipment is between 59-50 %
- Give 5 marks bonus if Efficiency of equipment is below 50 %
- Give 2 marks bonus if Possibility for usage of Renewable Energy
- Give 1 mark bonus if the Possibility for usage of alternative / waste

Energy

SHREE CEMENT LIMITED IDENTIFICATION OF ENERGY ASPECTS AND PRIORITIZATION													
Date: XXXX			Section: YYYY			Location: ZZZZ			Page: _____ of _____ (Attachment Code (for office use only))				
Form No.: SH/XXX/YY/ZZZ		Date No.:		Effective Date:		Attachment Code (for office use only):							
S.No.	AREA	MACHINE OR ZONE	ENERGY ASPECT	POTENTIAL OF SAVING RATING A	TECHNOLOGICAL FEASIBILITY RATING B	EFFICIENCY RATING C	POSSIBILITY FOR USAGE OF RENEWABLE ENERGY RATING D	POSSIBILITY FOR USAGE OF ALTERNATIVE WASTE ENERGY RATING E	APPLICABLE LEGAL REQUIREMENT	SIGNIFICANCE NUMBER	STATUS OF SIGNIFICANCE YES NO	CURRENT CONTROLS	REMARKS
1													
2													

Register of opportunities

SHREE CEMENT LIMITED REGISTER OF OPPORTUNITIES													
Date: XXXX			Section: YYYY			Location: ZZZZ			Page: _____ of _____ (Attachment Code (for office use only))				
Form No.: SH/XXX/YY/ZZZ		Date No.:		Effective Date:		Attachment Code (for office use only):							
S.No.	AREA	MACHINE OR ZONE	KEY ENERGY ASPECTS	OPERATING EFFICIENCY OF MACHINE EQUIPMENT	POSSIBLE ACTION FOR ENERGY CONSERVATION	ESTIMATED INVESTMENT IN INR	ESTIMATED CALCULATED ANNUAL SAVING IN INR	ESTIMATED IRR (%)	PRIORITY	STATUS (including pending action, IIP and OCV)	RESPONSIBILITY FOR COMPLETION	ACTUAL ANNUAL SAVINGS INR INR INR	REMARKS

Development and use of professional expertise, training, and communications

We regularly train our people with respect to three types of training programs –organizational needs, functional needs and individual needs. In FY2014-15, 1,153 internal and external training programs were conducted across all SCL units accomplishing a total of 77,179.56 training man hours –a key highlight of our People Development Agenda. We are attempting to customize the training programs based on the individual learning style of employees in the coming year. In addition to classroom training, we also incorporate innovative and interactive modes of training such as role plays, theatre, workshops, movies and case studies to ensure the sessions have a higher recall value.

Cross-functional training is an important aspect of our training sessions where in employees are encouraged to work across department, learn new skills and aspire for an all-round development. This is aimed at building a

team of people that comprehend views of other teams and is able to address cross-sectorial challenges. Some of the training external training programs are illustrated below.

- JICA Japan (Energy Conservation techniques),JICA Kitakuso Japan : Various plant visits and understanding of different energy saving practices like VFD, Solar Energy, Vibration techniques, Energy management policies
- Green Cemenetech CII Hyderabad : Various new energy efficiency technology used in cement sector
- Energy Management Award Ceremony by CII Hyderabad : Learning of Best practices adopted by the cement and other sector
- Green Power Tech by CII Hyderabad : Various new energy efficiency technology used in Power sector
- Waste Heat Recovery System feasibility & Challenges in Indian Cement Industries by Teri New Delhi : Waste heat optimization
- PAT Scheme at Delhi, Chandigarh ,Udaipur : PAT normalization understanding

Tools & Resources

In order to allow the management team to create a structure that can help to effectively and efficiently deliver organization's objectives, SCL has adopted the following Management Systems:

- ❖ ISO-14001 – Environmental Management System
- ❖ OHSAS-18001 – Occupational Health & Safety
- ❖ SA- 8000 – Social Accountability
- ❖ ISO-9001- Quality Management

❖ ISO 50001- Energy Management Systems

We take pride for being member of a number of National & International organizations which have a continuous focus on engraining energy management into the business strategy. We actively participate in policy framing and decision making process. We are members of:

- ❖ Global Reporting Initiative
- ❖ FICCI- Climate Task Force
- ❖ The Energy & Resource Institute
- ❖ Confederation of Indian Industries
- ❖ Cement Manufacturers Association
- ❖ National Council for Cement & Building Materials
- ❖ Cement Sustainability Initiative

Steps taken to maintain operational control and sustain energy performance improvement

- IMS/04/01/OCP/01 Operational Control Procedures for General Electrical Maintenance
- IMS/04/01/OCP/02 Operational Control Procedures for Conservation of Energy by optimizing the use of office lights & Air Conditioner
- IMS/04/01/OCP/03 Operational Control Procedures for Safe Operation of Lifts
- IMS/04/01/OCP/04 Operational Control Procedures for Energy Conservation
- IMS/04/01/WIN/01 Work instruction for Shift In charge
- IMS/04/01/WIN/02 Work instruction for Section In charge

- IMS/04/01/WIN/04 Work instruction for Predictive Maintenance of Load Center
- IMS/04/01/WIN/05 Work Instruction for Preventive Maintenance work instruction of Motor, LRS ,GRR
- IMS/04/01/WIN/06 Work Instruction for safe & Efficient Operation of Lifts.
- IMS/05/01/OCP/10 Conservation of Energy Associated with Office Lighting & Air Conditioner
- IMS/05/01/OCP/11 Conservation of Energy associated with Control Panel
- IMS/06/01/WIN/01 Work Instruction for CCR operators during changeover of shift
- IMS/06/01/WIN/02 Work Instruction for CCR operators for control from CCR
- IMS/06/01/OCP/01 To control dust during operation of ESP
- IMS/06/01/OCP/02 To cont. hot mater. from kiln I/L& O/L during pressure. & normal operate.
- IMS/06/01/OCP/03 To minimize dust generation during cleaning activity in shutdown.
- IMS/06/01/OCP/04 To minimize dust generation while cleaning cyclone jam material.
- IMS/06/01/OCP/05 To control dust generation during pressurization of Raw Mill circuit
- IMS/06/01/OCP/06 To control dust generation during operation of Bag filter.
- IMS/06/01/OCP/07 To minimize Power consumption of various drives during operation.
- IMS/06/01/OCP/08 To control heat losses during kiln operation.

- IMS/03/01/OCP/02 Optimum utilization of resources during over hauling of hydraulic system.
- IMS/03/01/OCP/10 Optimum use of power & ensuring safety during operation.
- IMS/03/01/OCP/12 To Reduce Consumption of energy associated with office / site lighting & AC
- IMS/03/01/OCP/13 To Conserve Energy during operation of compressor

• *“Clean & Green is Always Profitable.”*

—Mr. Prashant Bangur, Jt.MD



Energy Management Team

Approach used to 1) determine whether energy performance improved 2) To validate results

Approach used to establish and maintain a system of internal audits to determine the effectiveness of the Shree Management System adopted by the Organization All the departments/ functions covered under Management Systems shall be audited once in a year, however Social Accountability Management Systems shall be audited twice in a year.

Audit planning Group (APG) – APG under leadership of Management Representatives are responsible for ensuring the implementation of this procedure. Also responsible for the overall coordination and administration of matters relating to internal system audits. All HOD,s will assist in implementing this procedure. Departmental Head are Responsible for providing necessary Co-operation for conduct of audits and ensuring implementation of Corrective/Preventive actions arising out of such audits

Process & Its Interface

Activity	Responsibility
PLANNING	
Prepare Annual Audit Plan covering complete Shree Management System.	System Coordinator / MR
Auditors independent of their activities shall be nominated at the time of preparing Annual Audit Plan.	System Coordinator / MR
The audit program / schedule for a specific period shall be prepared and circulated to all concerned, in advance.	System Coordinator/ MR
Unscheduled (Extra) Audits may also be planned and carried out considering following: <ul style="list-style-type: none"> • Increased Customer Complaints • A change of personnel at the level of Dept. Head and above. • Increased departmental non-conformances • No progress in Continual Improvement Projects / Objectives • Specific Report from Regulatory Bodies • Reduced Customer Satisfaction • External Audit Reports 	System Coordinator/ MR
AUDIT TEAM	

Individual auditor or a team of auditors, as found necessary and sufficient will audit each of the functional areas covered by quality/ Environment / Energy / OHS system elements. Normally the auditor will be a person from a sister department who have a general knowledge of the functions in that area. In case a team of auditors is assigned for any functional areas, one of them shall be nominated as “Team Leader” with the responsibility for overall management of the audit.	Audit Team
<u>QUALIFICATION AND TRAINING OF AUDITORS</u>	
Executives / Engineers / officers who are given auditing assignments should be Diploma Engineer Or Graduate as a minimum qualification. They should also be given requisite training which is an internal auditor course conducted In- House or Lead Assessor’s course conducted internally or externally to facilitate quick and efficient auditing.	Mgt. Rep. / System Coordinator
PERFORMING AUDITS	
The Auditors carry out audit of deptt./Activity for compliance and effectiveness of Quality system and prepare report of non-compliance, if any	Concerned Internal Auditor & Auditee
The Auditors also verify deficiency found during the previous audits and review the effectiveness of the corrective action taken.	Concerned Internal Auditor
The auditor prepares the Audit Report in 16:01:00:02 based on his finding recorded on Non-Conformance Report 16:01:00:01. This report is submitted to System Coordinator /concerned deptt and Auditee compiles the non-conformities observed during the Audit.	Concerned Internal Auditor & Auditee
Auditor shall also obtain acceptance on the observations, proposed corrective action and time required to resolve the non-conformities from the head of the auditee department on each non-conformity report.	Concerned Internal Auditor & Auditee

The auditee department shall take the necessary corrective action and inform the auditors for verification of action taken.	Concerned Auditee
The auditor shall keep System Coordinator / MR informed in respect of the audit by sending copy of the audit report at following stages : a) Immediately upon completion of audit b) After verification of corrective action taken by auditee.	Concerned Internal Auditor
Review the progress of completion of audits once in three months.	System Coordinator
Prepare audit summary report and send the same to CHAIRMAN (IMS-SMS) & MRs for review.	System Coordinator
Consolidation of NCRs is prepared and put to MRs & Chairman (IMS-SMS) for review.	System Coordinator
Prepare Consolidation of Corrective and preventive measures to avoid potential cause of Non-conformances is prepared with the consent of concerned officials and same is put up for review in MRG meeting.	System Coordinator

Cost-benefit analysis

Implementation of ISO 50001 has given Shree Cement various benefits year by year. Cost benefits for the FY 14-15 are as follows

- Annual energy cost savings Rs 40.84 Crores
- Cost to implement Rs 128 Crores
- Payback period 3 Years

Lessons Learned

We at Shree Cement have been greatly benefited by implementation of the ISO 50001 and have already been

certified for all the Cement plants, Grinding Units and the Power plants of Shree Cement.