Global Energy Management System Implementation: Case Study

India

Dalmia Cement (Bharat) Ltd

ISO: 50001 Certified in Year 2014

Dalmia Cement (B) Ltd , Ariyalur Plant is One of the Most Efficient plant and Having World Class Manufacturing Facility

Business Case for Energy Management

Company Profile

The Group was founded in 1935 by Jaidayal Dalmia, with the cement division being set up in 1939.

- Pan India presence in Cement business
- Grown to be a capacity of 25 Million Tons per annum.
- 3rd largest cement manufacturer in India
- Manufacturing of Special cements like Oil well, Air strips & Railway sleeper grade cement
- Group Turn over 7000 Crores

"The Real Profit comes when we grow with Nature"

By Mr. Mahendra Singhi Group CEO

Dalmia Cement Bharat Ltd. - Cement Plant Ariyalur Unit, is located at Thamaraikulam Village of District Ariyalur, Tamil Nadu State. The plant is having a single line, of capacity 4500 TPD, with an annual capacity of 3.0 Million tons of Cement. It manufactures OPC and PPC.

Dalmia Cement (B) Limited

Case Study Snapshot	
Industry	Dalmia Cement(B) Ltd
Product/Service	Cement
Location	Ariyalur
Energy Management System	ISO 50001
Energy Performance Improvement Period	Continuous Improvement
Energy Performance Improvement (%) over improvement Period	4.9
Total Energy Cost saving over improvement period	2060000 USD
Cost to implement EnMS	540000
Payback period On EnMS implementation (Years)	0.25 years
Total Energy saving over improvement period (GJ)	38,303 GJ
Total Co2- emission reduction over improvement period	39371 MT of Co2

Drivers/Business Case:

In cement manufacturing operations energy consumption cost accounts for 30% of total production cost

Objective to implement ISO 50001 is to achieve higher levels of energy efficiency ultimately leading to operational efficiencies

Our Vision: *"To Consistently Surpass Expectations of all Stakeholders."*

Our Mission:

"Effectively Utilize Resources and be Recognized as a Benchmark in the Cement Industry."

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Our Core Values:

- ❖ Commitment
- ❖ Humility
- ❖ Trust & Respect
- ❖ Integrity

"Values define our life direction and Journey"

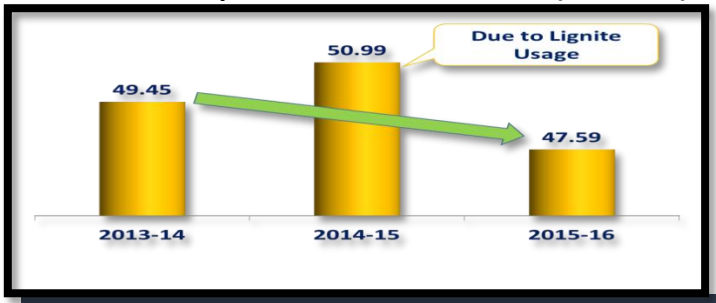
Energy Management Program:

Dalmia Cement (B) Limited, Ariyalur Plant won the "Best Energy Efficient Unit" from National Energy Conservation (BEE) consecutively two years on 2012 & 2013.

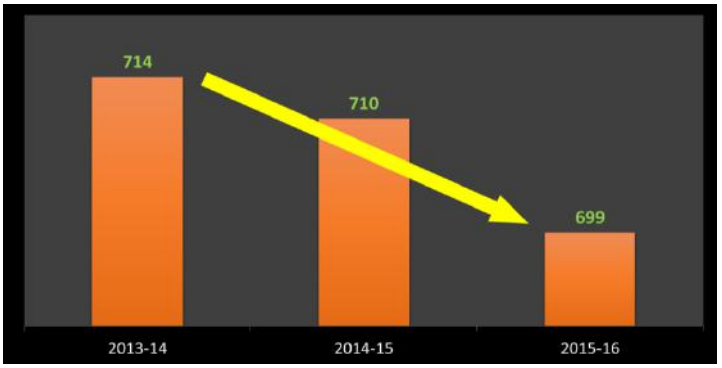
Dalmia Cement (B) Limited, Ariyalur Plant won the "Excellent Energy Efficient Unit" from CII – Hyderabad consecutively Five years from 2012 to 2016.

History of Energy Reduction Approach:

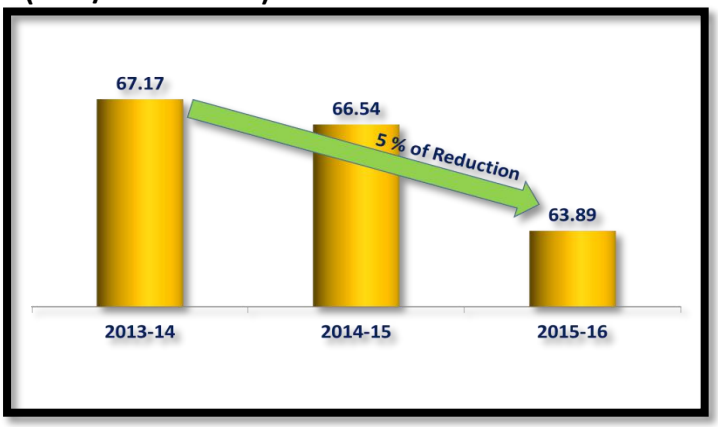
Reduction of Upto Clinkerization Power (Kwh/MT)



Reduction of Specific Heat Consumption: **(Kcal/Kg Clinker)**



Reduction of Overall Specific Power Consumption (Kwh/MT Cement)



Energy Performance improved to 5.0% from the baseline.

National & International Benchmarks with 5 Stage preheater

Description	Achieved	National Benchmark **	International Benchmark ***
Specific Energy Consumption - Thermal (kCal/kg of clinker)	699	690	681
Specific Energy Consumption - Electrical kWh/T of cement (Actual)	63.89	63	60

Business Benefits:

ISO 50001 is based on the management system model of continual improvement also used for other well-known standards such as ISO 9001 or ISO 14001. This makes it easier for organizations to integrate energy management into their overall efforts to improve quality and environmental management.

- ❖ ISO 50001:2011 provides a framework of requirements for organizations to:
- ❖ 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.

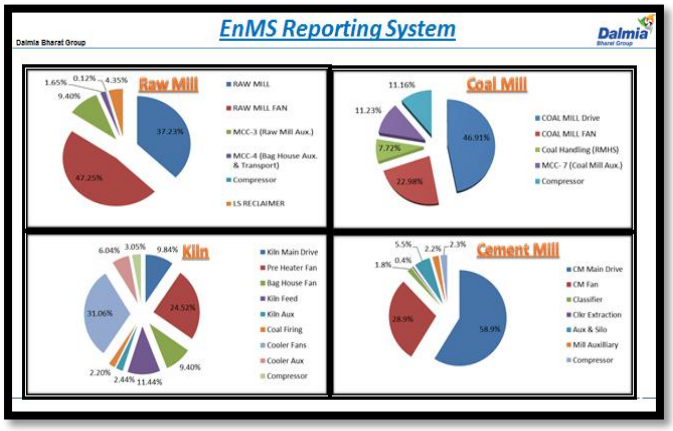
EnMS Development and Implementation

Organizational:

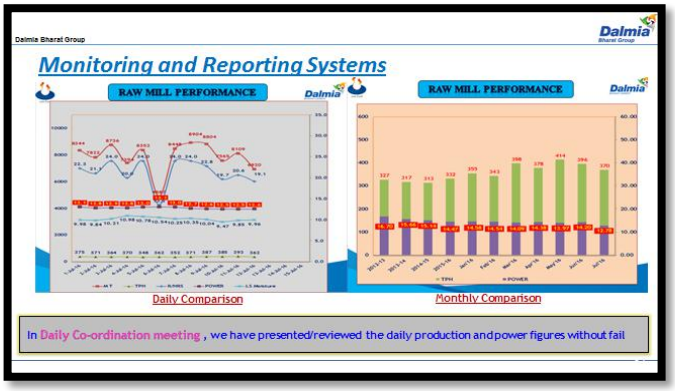
- Reduce environmental impact
- Create transparency on how energy resources are managed Be able to identify future projects that will integrate into your new structure
- Promote energy efficiency throughout your organization Establish positive external relations and public image
- Raise awareness and create greater employee stewardship
- Reduced operational and overhead costs lead to increased profitability
- Reduced air emissions, such as GHGs
- Increased assurance of legal, internal compliance
- Increased understanding of energy use and consumption via defined methods, processes of data collection

Energy Review and Planning:

- Monthly Energy meeting Co-ordinated by Energy Manager
- Energy Task Force Team formed with cross functional team members and best energy saving initiatives discussed and implemented.
- Best tracking system for speedy implementation
- Quick fund allocation by the management based on the payback period less than 2 years
- Best Energy saving initiatives are awarded every Monthly Gate meeting
- More Focus on significant drives and taking continuous efforts to reduce the significant by using this chart



- Sharing Productivity & Power Figures on every Monday meeting
- Daily Pep Talks & Awareness about Energy Conservation
- Coordination Meeting Everyday - Monitoring and reviewing of Production & Energy parameters for all the section



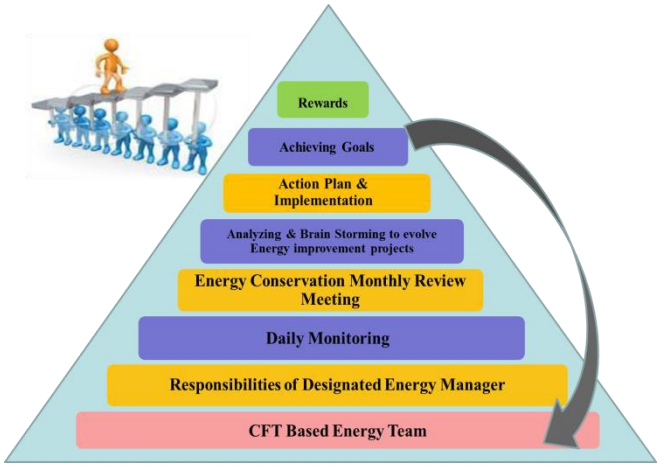
- Why- Why Analysis For the every Break Down
- Break Down Analysis Meeting on Monthly
- All the nuisance bag filters are taken into DP mode
- VFDs taken in line for energy conservation and optimization (More than 65Nos of VFDs Installed)
- All major drives like Process Bag filter Fans , PH Fans, Coolers Fans, Kiln etc. are running in VFD
- Expert Optimizer (EO) implemented for Raw Mill, Cement Mill, Coal Mill & Pyro
- Mill Fans are running maximum SPRS mode
- Continuous up gradation of Process Logic in DCS
- Auto start / stop logic developed for compressors, belt conveyors and fans to avoid the idle running hrs
- Replacing LED in place of Conventional lights

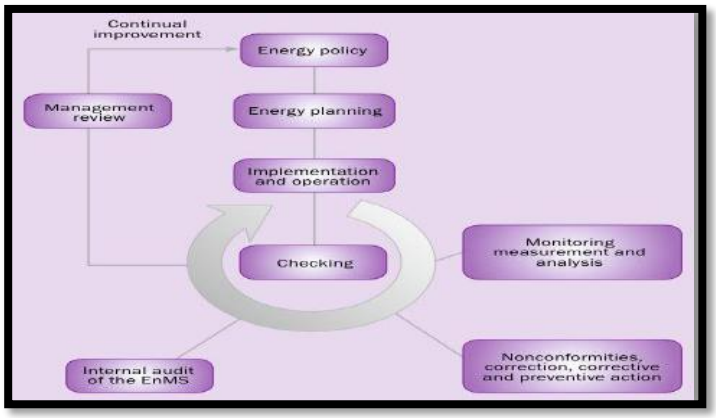
Cost Benefit Analysis:

The ISO 50001 energy management standard is a proven framework for industrial facilities to manage energy including all aspects of energy procurement and use. An energy management system establishes the structure and discipline to implement technical and management strategies that significantly cut energy costs and greenhouse gas emissions and sustain those savings over time.

S. No	Year of Implementation	Title of Energy Saving project implemented	Annual Electrical Savings achieved		Annual thermal savings		Total Annual Savings	Invest. Made	Payback
			Units Million	Rs Million	Tons of Fuel	Rs Million	Rs Million	Rs Million	Months
1	2013-14	Modifications	4	22.8	3758	56.8	79.6	28.3	4.27
2	2014-15	Modifications	2.9	14.6	1004	8.93	23.53	0.7	0.36
3	2015-16	Modifications	3.671	18	1511	8.04	26.40	5	2.27
Grand Total			10.59	55.76	6272.51	73.77	129.53	34.00	6.89

Approach For Energy Conservation Initiatives towards Excellence:





Approach Used to Validate Results:
PDCA – Continuous improvement

- P for Plan: An energy plan is the first thing to do. This is the determination of the initial energy baseline, the energy performance indicators (EnPIs), the strategic and operative energy objectives and the action plans.
- D for Do: In this phase, planning and action takes place, improvements are aimed for and implemented. Indicators and objectives for energy performance are defined on the basis of the results of the energy assessment.
- C for Check: Action only makes sense if it leads to the desired result. The plans executed in the "Do" phase must continually be checked to ensure that they are effective.
- A for Act: The constant measurements are broken down in reports. These form the basis for further studies, in order to improve the energy-related performance and the EnMS.

Development and Use of Professional Expertise, Training & Communications:

- The importance of conformity with the energy policy, procedures and requirements of EnMS
- Their roles, responsibilities and authorities in achieving the requirements of EnMS.
- Benefits of improved energy performance.

Communication:

- EnMR ensures in association with energy task force and HODs effective internal communication on the following.
- Energy Policy
- Energy objectives, targets and management action plans
- Importance of meeting energy performance improvement
- Legal and other requirements
- Significant energy use and consumption
- Roles and responsibilities to implement and maintain EnMS standard
- Concerns of interested parties (suggestion box)

Suggestion box for Encon:

Employee Engagement:

Employees from the all levels and various functions are encourage and motivated to participate in the EnMS activities through, Suggestion scheme, forum of quality circles, Cross functional teams of various sections of the plant and nominating them for internal and external programs, to depute for visit of other cement plants to see best practices implemented there.

Professional Expertise:

Energy Professionals and experts are called from external agencies like CII, BEE accredited auditors are engaged for various EnMS activities.

Tools & Resources:

All the Employees are well versed with existing ISO 9001, ISO 14001, OHSAS 18001 and ISO 50001.

Criteria for identifying the areas of significant energy use:

- ✓ Calculate the energy consumed for the past one year.
- ✓ Segregate the areas in to convenient sections (processes, areas, facilities, equipment's, systems and personnel)
- ✓ Prepare a pie diagram and indicate the percentage of energy consumption and use.
- ✓ Treat the section which consume more than 3% of total consumption, is to be treated as significant use and consumption.
- ✓ Based on the above significant area, the sectional head shall identify energy use areas within the section
- ✓ Sectional head further prepare register of Energy Management Review taking into significant energy use of the area and rate them using the following table

Significant Energy Use Calculation table

Section	Energy use	Rating	Rating factors: Energy intensity — % of total consumption of the identified functional area (A) — Description	Score	Energy consumption — % of Availability required for particular section or process (B) — Description	Score	Efficiency — Potential Saving Possibility (C) — Description	Score	Cost involvement — Cost involvement to achieve the further improvement on energy performance (D) — Description	Score	RATING	Significant /Non significant (S/NS)
Section Name	Drive Name/ sub section	5	Greater than 40% of particular section power	5	100% is required for particular process / section	5	>15% of present consumption is possible	5	Pay Back period is Less than a year	5	625	S
		4	30% to 40% of particular section power	4	75% to 100% is required for particular process / section	4	10% to 15% of present consumption is possible	4	Pay Back period is 1 to 2 Years	4	256	S
		3	20% to 30% of particular section power	3	50% to 75% is required for particular process / section	3	5% to 10% of present consumption is possible	3	Pay Back period is 2 to 3 Years	3	81	S
		2	10% to 20% of particular section power	2	25% to 50% is required for particular process / section	2	<5% of present consumption is possible	2	Pay Back period is >3 Years	2	16	NS
		1	Less than 10% of particular section power	1	<25% is required for particular process / section	1	No Possibility	1	No possibility & No cost required	1	1	NS

Note:
In case of significant and not minimizing / mitigating with existing controls of energy consumption, then there must be Management Programme (MP) or Operational Control Procedure (OCP) required.
1. Evaluation (E)= A x B x C x D
(Other criteria's can be considered for effective evaluation i.e. a) People awareness
2. Criteria for significance = E>/= 50
3. Incase of utility section, Criteria for Sifnificance = E>/=50 and/or Top 2 in the Utility section
4. Motor below 30KW are not considered for electrical energy aspect evaluation

Identifying the opportunities for improving energy performance

The following shall be considered for identifying the opportunities for improving energy performance

- ❖ Areas of significant energy use
- ❖ Best available technology
- ❖ Best practices available
- ❖ Bench marking – National and International

- Alternate sources of energy
- Awareness level

Criteria for Potential Saving & Feasibility:

Saving Potential – consideration:

- Cost saving potential
- Energy saving potential (kWh)
- Thermal Saving Potential (Kcal)
- CO2 saving potential

Investment considerations:

- Investment cost and internal rate of return
- Payback period
- Shutdown requirements
- Duration of implementation
- Resources (purchasing, manpower, storing, treatments, handling, etc.)

Steps taken to maintain Operational Control and Sustain Energy Performance Improvement Operational Controls:

- Each functional head shall maintain the operation and maintenance manuals and ensure the maintenance of equipment, facilities, processes, personnel and systems (FEPPS) in order to monitor and reduce the energy use.
- Ensures inspection and preventive maintenance of equipment, facilities, processes, systems to ensure optimum energy use and consumption.
- Ensure the regular cleaning of the equipment to ensure optimum use and consumption of energy
- Ensures operating and maintaining the facilities, processes, systems and equipment's in accordance with the manufacturer's recommendations.

Checking, Monitoring, Measurement & Analysis

The following key characteristics at specified intervals below:

- Significant energy uses and section wise and sub Section wise power consumption and fuel consumption is monitored online and reviewed on daily basis.
- Non-significant and above 30Kw motors load will be monitored online. Load will be reviewed on half yearly.
- Relevant variables related to energy use once in a quarter.
- Energy performance indicators once in a quarter.
- The effectiveness of the action plans in achieving objectives and targets once in a quarter.
- Evaluation of actual Vs expected energy consumption once in quarter.
- Over all energy performance will be reviewed against average industrial bench mark once in a year.

Competence, Training and Awareness:

The personnel at each relevant functional level are provided training in a planned manner so that they are aware of:

- The importance of conformity with the energy policy, procedures and requirements of EnMS
- Their roles, responsibilities and authorities in achieving the requirements of EnMS.
- Benefits of improved energy performance.
- The impact, actual or potential, with respect to energy use and consumption, of their activities.

Internal Audit of EnMS

- Energy Management Representative ensures conduct of Internal Audits once in 6 months to determine whether the Energy Management System conforms to planned arrangements to the requirements of ISO 50001:2011 and EnMS requirements established by M/s. Dalmia Cement (Bharat) Limited and it is effectively implemented and maintained.

- Energy Management Representative prepares an Annual Audit program taking into consideration, the status and importance of processes as well as the results of previous audits. Audit plan is prepared specifying audit objectives, audit criteria, scope and methods.
- The Internal Auditors are trained and are selected based on Education, Training, Skills, for conducting audits.
- EnMR maintain the record of audit results in the form of non-conformity and corrective and preventive action and Summary of audit results

Lessons Learned:

ISO 50001 amplified their existing commitments to environmental stewardship by committing to continuous improvement of energy performance. As part of this commitment, they are developing an energy management system to understand how and where energy is consumed and used on campus and create a process to make continuous improvement in energy performance. Their experience highlights the need for stakeholder engagement and clear goal setting when creating energy management systems for manufacturing industry.

Further, **the Dalmia Cement (B) Limited** experience underlines the effectiveness of applying the plan-do-check-act cycle to energy performance, despite the potential difficulties of adjusting to this context for evaluating energy performance.

Future Focus:

- For instance, renewable power is a major focus area for the Company with a target of reaching 20% of total energy consumption by 2019.
- Focus to achieve PPC overall specific power consumption less than 50 units.
- At Dalmia Cement, currently 7% of the power is being generated using renewable energy and this is likely to go up to 20% by 2019

Keys to Success:

- Reduction of Specific Power consumption by In-House modification of Primary Crusher tripping avoided by modifying the gear alignment and Crusher group Start & Stop sequence reduced & thereby increased the availability from 75 to 85%
- Innovative increase of Raw Mill output from 375 to 450 TPH and Reduction of Specific Power consumption from 14.3 to 13.3 Kwh/MT by following modifications
  - *Raw Mill inlet duct Modification*
  - *Nozzle Seal Gap Reduction*
  - *Nozzle Ring Blockage Pattern Modification*
  - *Centre Feed chute Modification*
  - *Grit Cone Modification*
  - *Classifier Annular Gap Reduction*
  - *False Air Reduction from 11.2 to 7%*
  - *Modification of Silo feed Elevator discharge chute & VFD Installation*
- Clinker production increased from 4500 to 6500 TPD by modifying the Kiln inlet Riser duct , Cooler vent Fan and Primary Air Fan
- Cement Mill output increased from 300 to 330 TPH and Reduction of Specific Power consumption from 26.5 to 24.8 Kwh/MT

Rewards for Employee Involvement on Encon Projects