

# Global Energy Management System Implementation: Case Study

India

## JK LAKSHMI CEMENT LIMITED

*Successfully achieved 14.82% reduction in the SEC, as against given target of 4.91% during “PAT”- Cycle-1 (SEC= Specific Energy Consumption)*



JK LAKSHMI CEMENT LTD – JAYKAYPURAM, SIROHI PLANT

### Business Benefits

M/s. JK Lakshmi Cement had achieved following benefits by implementing Energy Management System (EnMS), ISO 50001:-

1. Got a structured platform for energy consumption, energy conservation & energy management activities.
2. Easy approach for identification and prioritization of major energy consuming activities and equipment.
3. Close monitoring of high energy consuming processes and developed mechanism to be informed regarding any change in energy consumption pattern.

### Case Study Snapshot

Industry	INDIA
Location	IN RAJASTHAN STATE
Energy Management System	ISO 50001
Product/Service	CEMENT
Energy Performance Improvement (%)	14.82 % (for PAT cycle-1)
Annual energy cost savings	Rs 903 Millions (for PAT cycle-1)
Cost to implement	Rs 2831 Millions (for PAT cycle-1)
Payback period	38 Months

4. Improvement in operational efficiencies as well as a different approach towards maintenance and procurement procedures.
  5. Improvement in the awareness of employees as well as other associates regarding energy consumption & energy conservation.
  6. Helped to minimize wastage of energy.
- In the duration of “PAT” (Perform, Achieve & Trade) cycle-1:**
7. Overall energy performance improved from 877 kCal/Kg of major product to 747 kCal/Kg of major product for PAT cycle-1.
  8. Thermal energy intensity reduced from 759 kCal/Kg of clinker to 704 kCal/Kg of clinker.
  9. Overall electrical energy intensity reduced from 81 Units/ton of cement to 74 Units/ton of cement.

10. Up to clinkerization, electrical energy intensity reduced from 55 Units/ton of clinker to 49 Units/ton of clinker.
11. Achieved total energy cost saving of Rs 903 million, with an investment of Rs 2832 Million and an average payback period of 38 months.
12. Achieved CO<sub>2</sub> reduction, from 915 Kg CO<sub>2</sub>/ton of clinker to 891 Kg CO<sub>2</sub>/ton of clinker.
13. Increased generation of green energy, through **WHRs** (**W**aste **H**eat **R**ecovery system), from 7.56 million Units/annum to 90.62 million Units/annum.
14. **“Reduction”** in CO<sub>2</sub> increased, from 2.6 Kg CO<sub>2</sub>/ton of clinker to 24.56 CO<sub>2</sub>/ton of clinker, on account of increased generation of green energy, through **WHRs**.
15. Overall implementation of the ISO 50001, helped a lot to brand image of the company.

## Company Profile

JK Lakshmi cement Limited, established in 1982 is a member of J K Organization, which is one of the largest industrial groups in India. JK Lakshmi cement is one of the first Indian cement company that has been recommended for the prestigious certification of ISO 9000 in June, 1994 for its quality assurance system. Presently JK Lakshmi Cement is ISO 9001, ISO 14001, ISO 50001 and OHSAS 18001 certified as well as its laboratory is also accredited by NABL. JK Lakshmi Cement is one of the most modern dry process cement plant, with modern equipment. The company adheres to all applicable statutory regulations.

## Business Case for Energy Management

### “A Proactive Approach to Achieve Energy Consumption Norms notified under Energy Conservation Act-2001”

The Energy Conservation Act (EC Act)-2001, was enacted in 2001 with the goal of reducing energy intensity of Indian economy. Bureau of Energy Efficiency

(BEE) was set up as the statutory body on 1st March 2002 at the central level to facilitate the implementation of the EC Act. The Act provides regulatory mandate for: standards & labeling of equipment and appliances; energy conservation building codes for commercial buildings; and **energy consumption norms for energy intensive industries**.

There was a long deliberation between all stake holders e.g. – Bureau of Energy Efficiency (BEE), Cement Manufacturers’ Association (CMA), Senior executives as well as representatives of various cement plants and National Council for Cement & Building Materials (NCCBM) for fixation of energy consumption norms for cement manufacturing process under the EC Act-2001. Ultimately it had been come-out in the **form of “PAT” – Perform Achieve & Trade scheme of BEE**, in which participation of notified designated consumers was mandatory from 8 highly energy intensive sector. Each designated consumer from these 8 sectors was notified a unit specific energy reduction target on that 31<sup>st</sup> March, 2012. A period of 3 years was allotted to achieve the notified target from date: 01<sup>st</sup> April, 2012 to 31<sup>st</sup> March, 2015. This period of 3 years was specified as “PAT”- Cycle 1. Third year of “PAT” – Cycle 1 was considered as assessment year to achieve the target. Higher achiever shall be issued Energy Saving Certificates from the BEE, which shall be tradable in the market. Lower achiever shall be penalized with Rs 10 Lakhs and he has to comply, his notified targets, by purchasing the Energy Saving Certificates from the market.

Being a front runner in the field of energy management the JK Lakshmi Cement was aware of these activities and made self-ready proactively. So, that notified targets can be achieved.

Baseline of M/s JK Lakshmi Cement Ltd. was identified as 877 kCal/kg of major product (PPC cement) through an energy audit conducted by a third party nominated by the BEE. It had given a reduction target of 4.91%, and

had to achieve target of 834 kCal/kg of major product (PPC cement) in the assessment year of “PAT”- Cycle 1.

At the end of PAT - Cycle 1, JK Lakshmi Cement Ltd. achieved a level of 747 kCal/Kg of major product with a reduction of 14.8%, as against notified target of 4.91%. In lieu of additional savings, M/s JK Lakshmi Cement Ltd, shall be got issued 38987 Energy Saving Certificates from the BEE.

Following major energy saving projects were implemented to achieve “PAT” targets:

1. Installation of Waste Heat Recovery System
2. Installation of IKN cooler in all three kilns
3. Installation of Chinese VRM to avoid running of Ball Mill
4. Up-gradation of major process fans with high efficiency fans
5. Capacity enhancement of Kiln-1, through installation of TA duct, enlargement of cyclone inlet area & increased calciner height.
6. Installation of twin drive control system of DC drives for Kiln-1
7. Installation of one additional boiler to utilize increased volume of cooler exhaust hot gases for increasing power generation from WHRs.
8. Installation of hot air recirculation duct to increase power generation through WHRs.

#### Drivers/Business Case

Following are the driving forces/drivers to move towards energy efficiency improvement programs:

1. Reduction cost – a cut throat competition in cement market.
2. Reduce the impact of rising costs –Low operating margins because of increasing in logistic cost & input cost.
3. Survival during recession period.
4. Energy contributes approx. 55% of manufacturing cost.
5. Legal compliance under EC Act-2001

6. Reduce reliance on fossil fuels – GHG Reduction & Environmental Concern.

#### Energy Management Program

Following are the national and regional/state level government and other programs which are being organized to encourage and promote energy management activities, in which our company is participating for last so many years:

1. National Energy Conservation Award instituted by the BEE, under Ministry of Power, Govt. of India. (M/s JKLC had been Awarded one time 1<sup>st</sup> in cement sector and one time certificate of merit)
2. National Award for Excellence in Energy Management, instituted by Confederation of Indian Industry (CII). (M/s JKLC had been Awarded three times “Excellent Energy Efficient Unit” award, two times “Innovative Project” award and four times “Energy Efficient Unit” award in cement sector)
3. Rajasthan Energy Conservation Award instituted by the Rajasthan Renewable Energy Corporation Ltd (RRECL), under Ministry of Energy, Govt. of Rajasthan. (M/s JKLC had been Awarded one time 1<sup>st</sup> in cement sector and one time certificate of merit )
4. National Award for Energy Efficiency in Indian Cement Industry, instituted by National Council for Cement & Building Materials (NCCBM), under Ministry of Commerce & Industries, Govt. of India. (M/s JKLC had been Awarded three times “2<sup>nd</sup> Best Improvement in Electrical Energy Performance” award, one time “2<sup>nd</sup> Best Improvement in Thermal Energy Performance” award and one time “Best Improvement in Thermal Energy Performance” award)

#### History of Energy Reduction Approach

Energy Management System (EnMS) standard ISO 50001, was published in 2011. The Energy Conservation Act (EC Act)-2001, was enacted in 2001 by the Govt. of India. “PAT” scheme of the BEE was launched on 31<sup>st</sup> March, 2012. But the history of energy reduction

approach in Indian cement industry lasts for very long back. Being a part of Indian cement industry M/s JKLC is also having its approach towards energy reduction, since its inception. As we have been already stated that energy contributes approx. 55% of total manufacturing cost and there is always a cut throat competition in Indian cement market. So, we have to be on toes, every time to avail each and every opportunity of energy conservation, considering cost benefit analysis. By implementing various major and minor energy conservation measures, M/s JKLC was able to reduce its electrical energy intensity, from 83 Units/Ton of cement to 79 Units/ton of cement, as well as thermal energy intensity, from 768 kCal/Kg of clinker to 742 kCal/Kg of clinker, during a period of 5 years before launching of "PAT" scheme.

## **Keys to Success**

1. Commitment and support of top management towards all energy management activities.
2. Always keep eyes open to identify each and every, energy saving opportunity.
3. Minimize implementation time of all EnMP's (Energy management Programs)
4. Periodic review for the effectiveness of all implemented EnMP's (Energy management Programs)
5. Involvement of people from all levels.
6. Benchmarking with self-past performance as well as within peer groups
7. Implementation of best practices, adopted by other plants in the peer group.

## **EnMS Development and Implementation**

JKLC had established, documented, implemented and maintain an EnMS and is committed to continually improve its effectiveness in accordance with the requirement of ISO 50001:2011. It is intended to lead reduction in Green House Gases emission and other related environmental impacts and energy cost through systematic management of energy.

## **Organizational**

### **Top Management**

Sr. Vice President (Works), the Unit-Head is the Top Management in the organization. He is committed to support the EnMS and to continually improve its effectiveness. The Unit Head enunciated an Energy Policy which is required to be followed by everyone in the organization.

### **EnMS Team Leader/Management Representative**

The Unit Head had appointed a Management Representative, the EnMS team leader for the energy management systems, who irrespective of other responsibilities, has the responsibility and authority to ensure that, EnMS is established, implemented, maintained and continually improved in accordance with ISO 50001:2011.

## **Energy Review & Planning**

### **Energy Planning – General**

An energy planning consistent with the energy policy had been done and documented. The emphasis was on leading to activities that continually improve energy performance. This had involved review of organization activities that can affect energy performance.

### **Energy Review**

Organization has established, a procedure, to record and maintain an energy review. This was done through periodic audits. A procedure was established which defined the methodology & criteria to develop the energy review based on various aspects.

### **Review, Analysis and Planning – Energy Baseline**

Based on output of initial energy review, an energy baseline had been decided and recorded, considering a data period of past 2 years. Change in energy

performance was to be measured against the energy baseline established.

## Energy Performance Indicators (EnPIs)

The energy performance indicators (EnPIs) appropriate for monitoring and measuring energy performance were identified and were linked operational performance measurable such as energy used/ton of finished product. These are reviewed on an ongoing basis and compared on monthly basis to the energy baseline and updated as required.

## Energy Objectives, Energy Targets and Energy Management Action Plans

Documented energy objectives & targets had been established at relevant functions, levels, processes and facilities. While establishing and reviewing objectives and targets, due consideration was given to legal and other requirements, significant energy uses & opportunities to improve energy performance.

**Financing:** Further consideration was also given to financial, operational and business conditions, technological options and views of stake-holders. Documented Action Plans (EnMPs) were established, implemented and maintained for achieving objectives and targets. These action plans were updated at defined intervals and included designation of responsibility, the means and time frame by which individual targets are to be achieved, statement of method by which improvement in energy performance shall be verified and a statement of the method of verifying the results.

**Duration:** Approx. a time period of 18 months was estimated to establish the EnMS and it was established in a period of 17 months.

## **Development and Use of Professional Expertise, Training and Communications**

### Competence, training and Awareness

It is ensured that any person(s) working related to significant energy uses are competent on the basis of appropriate education, training, skills or experience. The organization has a system to monitor the competence of its personnel and identify training needs associated with the control of its significant energy uses and the operation of the EnMS. Training is provided or other actions are taken to meet the identified needs. Associated records, including evaluation of the effectiveness of actions are maintained.

### Communication

The Top management has established appropriate communication processes with regard to energy performance and EnMS. Internal communication within various levels and functions is done through formal meetings, internal circulars, letters, notice/display boards, internal mail system, training programs (including those for Energy Policy), internal magazine (Lakshmi Darpan), open forum meetings, daily, weekly meetings, safety committee meetings, cross functional teams, quality circles and similar means.

Any person working for, or on JKLC behalf can make comments or suggest improvements to the EnMS. Suggestions/Comments received from internal personnel are documented, reviewed & suitable actions are taken.

**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 training 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, NCCBM, CII, BEE accredited energy auditors/ BEE empaneled



energy audit firms and is engaged for various EnMS activities.

#### **Tools & Resources:**

As all the employees were well versed with the existing other management systems already in place (ISO 9001, ISO 14001 and OHSAS 18001) the implementation of ISO 50001 was smooth. But involvement and to educate bottom line workmen was challenge which was met by regular & effective training by internal & external resource persons.

#### **Steps Taken to Maintain Operational Control and Sustain Energy Performance Improved Operational Control**

It is ensured that those operations and maintenance activities which are related to significant energy uses and that consistent with energy policy, objectives, targets and action plans, are identified and it is ensured that they are carried out under specified conditions, by

- i) Establishing and setting criteria for effective operation and maintenance of significant energy uses, where their absence could lead to a significant deviation, from effective energy performance;
- ii) Operating and maintaining facilities, processes, systems and equipment, in accordance with operational criteria;
- iii) Appropriate communication of the operational controls to personnel working for, or on behalf of, the organization.
- iv) The written work-instructions are made available/displayed for a specific process or procedure. In case of any contingency, emergency situations or potential disasters, including procuring equipment, energy performance shall be included in determining how JKLC will react to these situations.

#### **Approach used to 1) determine whether Energy Performance improved and 2) to validate results Monitoring, Measurement and Analysis**

A system is established for monitoring, measuring, recording and analysis at planned intervals of key characteristics of JKLC operations that determine energy performance.

These key characteristics include:

- i) Significant energy uses and other outputs of energy review;
- ii) Relevant variables related to significant energy uses;
- iii) Energy Performance Indicators (EnPIs);
- iv) Effectiveness of the action plans in achieving objectives and targets;
- v) Evaluation of actual V/s expected energy consumption.

An energy measurement plan has been defined and implemented. This includes utility meters monitoring and measurement systems connected to a software application

#### **Internal Audit of the EnMS**

The internal audits are conducted once in six months. These audits are conducted to ensure and validate that the EnMS meets planned arrangements, ISO 50001:2011 standard requirements and EnMS it effectively implemented & maintained and improves the energy performance.

#### **Cost Benefit Analysis**

During implementation of various energy saving measures, achieved total energy cost saving of Rs 903 million, with an investment of Rs 2832 Million and an average payback period of 38 months.

*The implementation of the Energy Management System ISO 50001 at our plant, JK Lakshmi Cement Ltd. – Sirohi had helped us a lot for:*

- *Systematic approach towards energy management.*
- *Improving energy performance at various levels of production*
- *Further strengthen overall energy management system*
- *Improvement in effective measuring & monitoring system*
- *Control of wastage of energy at the point of use*

-Mr. P. L. Mehta, Sr. Vice President (Works) & Unit Head

*JK Lakshmi Cement Ltd is a front runner for continual improvement in energy efficiency, by adopting EnMS- ISO 50001, implementing best practices, involving personnel at all levels, periodic review as well as identifying opportunities and systematic implementation of the action plans.*

*We are pleased to say that this philosophy helped us a lot for achieving “PAT” targets.*

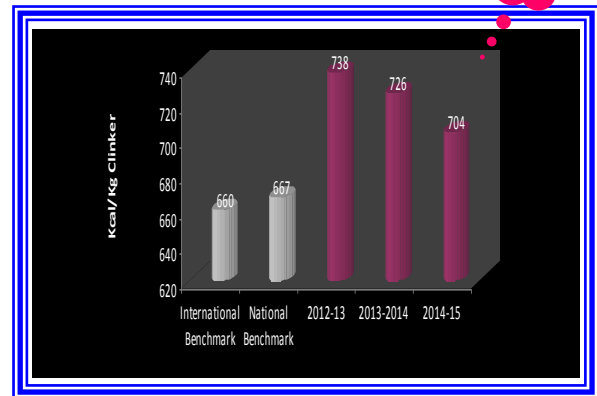
- P.L. Mehta, Sr. Vice President & Unit Head

## Lessons Learned

One should always be alert for the things going on its surrounding environment, especially when it is expected through legislation and binding for one and all. And should prepared to face, anticipated challenge, by keeping self-ready, in view of all relevant aspects.

### Thermal Energy Consumption (Kcal/KG Clk)

#### A Comparison with National & International Benchmark

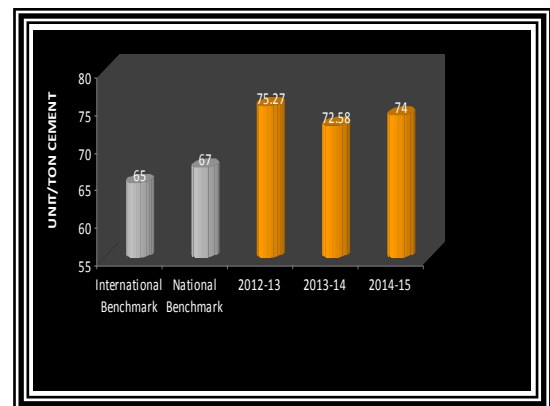


34 Kcal/

JK LAKSHMI CEMENT LTD

### Electrical Energy Consumption(Unit/ton cem )

#### A Comparison with National & International Benchmark



JK LAKSHMI CEMENT LTD

**CHINISE-VRM**



**IKN-COOLER**



**KILN-1-UPGRADATION**



**HOT-AIR RECIRCULATION DUCT**

