Inducting Energy Efficient Technologies in the Cement Industry

The Energy Management Cell (EMC) of the Confederation of Indian Industries (CII) in Chennai, Chandigarh and Ahmedabad act as catalysts in energy conservation related activities in the cement industry, such as conducting energy audits, developing technical industry-specific reference manuals and training programmes on energy conservation, organising buyer-seller meets, etc. The EMC have completed 270 energy audits, which have translated into annual savings of Rs 670 million. The PCRA (Petroleum Conservation Research Association), Government of India, has awarded this CII Cell the best Energy Auditors Award consecutively for the last three years.

Two energy efficiency case studies implemented by EMC are presented here

Case Study 1

Installation of high efficiency dynamic separator for Raw Mill implemented in a one-million-tonne dry process precalciner cement plant in Rajasthan in the year 1998-99.

Background: The Raw Mill is used for grinding limestone into fine raw meal powder – earlier plants used Ball Mills. Subsequently, energy efficient Vertical Roller Mills (VRMs) were incorporated. Compared to the Ball Mills, the VRMs have 30-35 per cent lower energy consumption. In the older cement plants, the VRMs had a simple static separator installed to segregate coarse from fine material. The separator was an integral part of the VRM.

In conventional separators, ground material is lifted by high velocity hot air at the louvers. The separator then segregates the coarse and fine particles. The latter are then carried away by the airflow to the dust collectors. The coarse material sinks to the bottom while the freshly ground material stays on the surface. This creates additional pressure drop in the VRM and increased circulation inside the mill. The particle size distribution is also wider owing to the presence of both very fine and coarse particles.

Recent trends have been to install cage-type high-efficiency separators, which allow the material to enter radically through them. The coarse material, after separation, is collected in a cone just below the separator and is dropped on to the grinding table through a gravity air lock. In this manner, the contact between the freshly ground material and the coarse ones is avoided. The advantages of these separators are closer particle size distribution, low-pressure drop across the VRM, and higher output at the same finesse as before or finer product at the same output rate.

Previous status: In a one-million-tonne dry process pre-calciner plant, a VRM was being used for grinding raw meal. The VRM had a conventional static separator.

Energy saving project: The existing static separator was replaced with a new cage-type dynamic high-efficiency separator.

Implementation methodology and timeframe: The new separator could not be accommodated in the mill body. Hence, the mill casings were modified. To save time, the drawings were prepared in advance and the new separator assembled outside and kept ready for installation. With all these preparations, the actual installation required stopping of only 21 days of mill operation.

Benefits of the project: The results were increased mill output, reduction in specific power consumption, and a finer product. Additionally, reduced vibration allowed trouble-free operation. A comparison of the conditions and the power consumption before and post-installation of the dynamic high efficiency separator are given in table 1 on page 21.

Power savings of 2.5 units/tonne of raw meal or 3.0 units/tonne of cement amounted to savings of 18 lakh units/year.

Cost-benefit analysis: On an investment of about Rs. 60 lakh, annual savings were Rs 54 lakh (at the rate of Rs 3/ unit). The simple payback period for the project was 13 months.

Table 1

Parameter	Pre-Implementation	Post-implementation
Feed rate	200 TPH	225 TPH
Raw Meal residue		
90 microns	18-18.5%	17-18%
212 microns	2.2-2.5%	2.0-2.2%
Mill DP	500-520 mm/Wg	480-500 mm/Wg
Mill vibration	1.6	0.75
Power consumption	24.5-units/tonne	22.0 units/tonne

Case Study 2

Blending control system for maintaining consistent kiln-feed quality implemented in one of the very modern one-million-tonne dry process precalciner cement plants in South India in 1998-99. This is one of the highly energy efficient units in India.

Background: The kiln is the heart of a cement plant, and its steady and continuous operation is essential for producing good quality clinker, higher level of output and lower energy consumption. To ensure this, consistent quality of kiln-feed is a prerequisite, which can be achieved only if the raw meal fed to the silo is consistent. The raw meal is produced by grinding various raw materials such as limestone, bauxite, iron-ore, etc. The quality of these raw materials various from time to time. Hence, the quality of the raw meal is analysed hourly and the percentage of mix varied to maintain quality.

In old plants, the mix percentage is varied manually from hour to hour. This generally leads to fluctuation in the quality of raw meal and hence the kiln-feed. In modern plants, data produced from hourly chemical analysis is fed to a computer that indicates the raw mix proportion so that the required mix quality is maintained. This has been retrofitted in many plants with substantial benefits.

Previous status: In a 3,000 TPD dry process precalciner plant operating with a VRM and a continuous blending-cum-storage silo, the raw meal was being produced by grinding limestone, bauxite and iron-ore. The raw meal was being analysed every hour through an X-ray analyser and the mix varied manually.

Energy saving project: A new software-based blending control system was introduced. The new system had a separate computer, which could be linked to the existing control system.

The X-ray analysis was fed to the blending control system, which automatically varied the raw mix proportion.

Implementation methodology and timeframe: Raw mix proportioning was earlier manually done and the blending control put into operation in a phased manner. The system was checked by both the supplier and the plant team under extreme conditions (eg. limestone of maximum and minimum LSF) so that it was consistently functional.

Benefits of the project: There was marginal increase in the output of the kiln, reduction in feed cuts on account of quality of kiln feed, better quality of clinker and steady operation of the kiln. The benefits achieved were: an increase in kiln output by 10-15 TPD, reduction in LSF variation in kiln feed from 0.4 per cent to 0.2 per cent, and reduction in thermal energy consumption.

Cost-benefit analysis: The implementation of this project resulted in an annual saving of Rs 18 lakh in terms of increased production as well as thermal energy saving, on an investment of about Rs. 15.0 lakh. The simple payback period was 10 months.

The benefits of blending control system were:

- Fine and accurate control of raw mix
- Reduced kiln-feed – LSF variation
- Lower thermal consumption

Lessons Learnt

1. The high energy component in manufacturing cost – as high as 45 percent – coupled with the need to be competitive made these units take up these energy projects.
2. By and large all the push for energy efficiency in a cement plant comes from the top management. The identification and implementation comes from the project department.
3. The two case projects mentioned here were financed by the plants' internal funds. Both projects were funded under the plants' capital expenditure budget. In both cases it took about one year for the plant to mobilise the funds and start the projects. No external funding was utilised.
4. These projects have not obtained Central or state government financial support. However, presentations and training programmes were arranged by the suppliers for giving more information about the equipment and their benefits.
5. These projects were conceptualised by the energy auditor and the plant operating team. Subsequently, the equipment suppliers were also invited to make presentations about the equipment and get further information.
6. The cement companies are implementing energy saving projects in other units owned by them. In the case of the blending control system, a new unit was being installed which incorporated the system at the design stage itself. Further the cement industry is highly open; often energy saving projects are openly shared even with competing companies.

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