PERFORMANCE ENHANCEMENT THROUGH COST OPTIMISATION

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Abstract

The Indian Cement Industry is in the grip of wide-sweeping environmental change. Realizing the need for continuous improvement, most companies have initiated focused program covering various aspects of company operations. The need of the hour is to offset the continual increase in input costs and minimizing the producing cost through optimized operations. Optimization is an effective tool for improving the effectiveness of the system and hence, cost reduction in cement industries.

For obtaining real benefits there are some ground rules that need to be followed:

- Optimization of all operations and each possibility for cost reduction howsoever small.
- Effective brainstorming to generate a long list of suggestions.
- Use of new/modern processing techniques to achieve superior solutions.
- Improving capacity utilization.
- Use of by-products, wastes, alternative and materials and fuels.
- Lowering the specific energy consumption.
- Diagnostic studies to identify problems in raw materials, electrical, instrumentation, mechanical and process engineering sections and troubleshooting.
- Quality assurance with optimized utilization of resource.
- Measures for improvement in environment.
- Lowering investment cost and thereby reducing the cost of production.

This paper primarily focuses on issues related to cost optimization and suggests a possible approach and framework for an effective study for achieving significant benefits

1.0 Introduction

The Indian Industries are in the grip of wide-sweeping environmental changes. Fluctuating demand growth, industry consolidation, the spreading of areas of control of the MNC's, its all happening and at a very fast pace. Success, and even survival, depends on how nimbly organizations organize themselves to cope with various challenges.

While most manufacturers, ostensibly, have minimal individual control on variables dominated/controlled by the external environment, an enhanced focus on internally controllable variable is an absolute imperative.

Although every client feels that his business is unique and is much different from others. But a close examination reveals large number of similarities in terms of problems.

- Problems unique to their operations.
- Competitors who are giving them sleepless nights.
- Number of persons in the organization who are difficult to work with.
- Too little money to spend specifically when it comes to Consultants.
- Bottom lines to be improved.

Of course the solution for each client will vary from that of others but there are commonalities in the overall approach to the problems and methods for arriving at the solutions.

The role a Client normally desires a Consultant to play includes:

- Providing new avenues for cost saving, maximizing realization.
- Providing solutions for the problem namely cost optimization.
- Satisfying the need of the client in helping him to maintain his competitive edge by cost optimization.
- To overcome his pains and problems related to sagging bottom line/profitability.

Cost optimization is one such initiative, Holtec has taken a lead in facilitating such client-sponsored initiatives through innovative application of its multi-functional expertise.

2.0 Identification Of Focus Areas

- ➢ Raw material resources and costs

  Conserving materials costs in taking raw mix decisions, the impact of such decisions on fuel consumption (due to varying heats of formation of different mixes) or power consumption in finish grinding (due to varying clinker properties) is often not explicitly assessed.
- ➢ Bench marking of operations with other good operations and decide on the potential for further savings.
- ➢ Cost conservation in the area of maintenance.
- ➢ Freight to Market aspects.

Cost reduction alone may not be adequate. A combination of steps covering revenue increases and cost decrease are what is most important.
Thus, benefits possible from reviewing decisions related to the product mix, customer mix, etc. have also to be fully realized.

3.0 Managing The Cost

Realizing the need for continuous improvement as a means of competitive edge, most companies have initiated ongoing programs, covering various aspects of operations. This focus on continuous improvement has yielded fairy good results, with a number of key performance indicators showing improvement. However, a structured approach, that tries to address all the issues previously mentioned, can scientifically complement these continuous improvement initiatives. The key features of this approach are listed below:

- Ensuring an integrated coverage, thus eliminating the phenomenon of sub-optimization.
- Focus on both revenue enhancers as well as possible reduction in input rates.
- Exploration of non-congenital areas that are normally not addressed.
- Value addition to on-going initiatives in terms of time saving, cost saving and improved target setting.
- Usage of optimization tools to achieve superior solutions.
- Structuring the improvement initiative through a three-step approach consisting of Assessments, Action and Monitoring.

4.0 Integrated Coverage

Integration can only be ensured, if the entire supply chain is included in the scope of coverage. For those, yet unfamiliar with the term supply chain refers to the entire process by which inputs are converted into outputs and supplied to the final customer. It also includes auxiliary input flows into the system and auxiliary output flows out of the system.

The following issues are important to note:

- Firstly, the supply chain consists not only of plant operations but encompasses suppliers of input on one end and the customer to whom cement is sold at the other.

- Secondly, the supply chain consists not only of the physical process through which transformation of inputs into outputs is done, but also includes the bundles of practices that go with such a transformation, such as procurement policies, inventory policies, etc.

Supply Chain Management (SCM) refers to the efficient management and operation of the above process through well-formulated strategies for sourcing, inventory, distribution, customer service and finally, integration. Normally, the focus of most cost management programs is on manufacturing activities that form the core of the operations. The SCM route, not only widens coverage to peripheral areas but also additionally addresses the issue of inter linkages between areas, so as to optimize the entire effort.

Apart from the SCM route, improvement initiatives also need to be holistically integrated in terms of the different functional skills that are required to effect optimal improvement. For example, an intervention in the raw mixes influences:

- The cost of raw materials.
- The cost of fuel and cost of power.
- The cost of consumables such as refractories, grinding media/lining plates.
- Equipment output rates and mean time between failures.
- Ease of operations
- The respective lives of the relevant raw material deposits.

Some of these would have a positive effect on cost reduction, and some, negative. The choice would therefore be to select the most optimal from a host of options.

5.0 Focus On The Increasing Net Revenue

As has been mentioned earlier, not only it is important to improve physical parameters of performance, it is equally important to seek a reduction in input cost tariffs as well as an increase in output revenue tariffs.

Other than vendor based strategies, methods such as use of cheaper substitutes, technology interventions (e.g. power factor reduction. Material handling modes, etc.) can be appropriately investigated to influence cost performance.

Use of an optimal market access strategy as well as well-formulated product/customer mix strategy, can be extremely effective in order to realize a higher return for every unit shipped. Even in the case of the Indian Cement Industry, several firms have significantly gained from an optimized re-distribution/product mix strategy.

6.0 Structuring The System For Improvement Initiatives

In terms of setting up a system to make improvement initiatives a perpetual way of life, two issues need to be parallely addressed:

- **Organization Structure**

Persons in the organization with a flair for analytical and knowledge related work would constitute the core organization structure for effective continuous improvement.

The full time responsibility of the core team would be shortlist improvement projects in consultation with senior management, harness external expertise where required, subject each identified improvement project to rigorous analysis and finally postulate problem-solving recommendations. It would also be responsible for managing knowledge by storing information and making this available to the rest of the company on request.

Members from the operations framework of the company would jointly participate with select members of the core team on the action phase in which improvement projects are actually taken up for implementation.

- **Initiative Planning**

Structured planning is vital to preclude the possibility of errors in area choice as also in effort repetition. Experience shows that the initiatives most likely to produce expected results are those that have been meticulously and holistically planned. Companies that have a good track record of implementing improvement initiatives have been seen to follow three distinct phases:

  - **Assessment Phase**

This is the starting phase in which short listing of initiatives is first done using pre-set criteria, relevant data collected, analyses completed, improvement potential identified both in term of physical parameter/ Rupee values, implementation plan constructed and resource requirements specified. It has been seen that, the Assessment Phase extends normally over a period of 2-4 months.

- **Action Phase**

This is the phase in which, as the name itself-signifies, implementation is actually done. As has been already mentioned in the previous sub-section on Organization Structure, personnel from plant operations as well as external experts assist the core team for improvement projects in executing the implementation phase. Since the realization of benefits may require a change in operating practices, the implementation phase also includes people training, wherever required. The output of this phase is the actual improvement affected a long with the management system to measure and ensure sustenance of the improved performance.The Action Phase could extend over a period of 9-24 months.

- **Monitoring Phase**

This phase refers to the tracking of the actual improvement effected during the Action Phase through the management system mentioned. Statistical analysis as an interpretation tool is rigorously employed to preclude the possibility that the improvement occurred due to 'chance'. Modification and mid-course corrections are also effected during this phase to ensure that the improved performance stays on track. It normally runs over a period of 3-6 months for each sub-project group.

7.0 A Case Study Of Process Optimization

Holtec Consulting Private Limited (Holtec) had carried out a process optimization study in a cement plant in Pakistan. At the time of study, the plant was operating at a production level of about 1800tpd clinker. The average value of specific fuel consumption and specific power consumption at the time of study were about 977 kCal/kg clinker and about 131.55 kWh/t cement respectively. The major equipment in the plant were a two chambers central discharge ball mill for raw material grinding, a dry process kiln with twin spring preheater (PH) and a precalciner (PC) in calciner string, grate cooler and a two chamber, closed circuit all mill for cement grinding.

7.1 After preliminary study of plant operation during plant visit, Holtec suggested the following improvement measures:

- Optimization of grinding media distribution in raw mill.
- Plugging the false air infiltration in the system.
- Calibration of some instruments.
- Provision and functioning of the mechanical flaps at the bottom of dust settling chamber in the tertiary air duct (TAD)
- Adjusting the feed distribution in kiln and calciner string PH.
- Reducing the primary air quantity in PC and kiln.
- Adjusting the flame momentum of kiln firing burner.
- Optimization of grate cooler operation.
- Optimization of gas cooling in the gas-conditioning tower (GCT).

With implementation of above improvement measures and under Holtec's operational supervision, the following were achieved:

- Raw mill capacity increased from about 150tph to about 165 tph.
- Increase in kiln capacity to about 2400tpd clinker.
- Lowering of the specific fuel consumption to about 885-kCal/kg clinker.
- Reduction in specific power consumption to about 103-kWh/t cement.

7.2 After detailed study, Holtec had recommended several improvement measures for plant optimization. Recommendations were classified as 'Without investment', 'With nominal investment', and 'With major investment'. Holtec accessed the potential capacity of plant as 3000tpd clinker. For achieving this capacity, some important recommendations made are as given below:

- Removal of venturies down comer ducts of kiln and PC string PH.
- Installation of compressed air assisted water spray in PC string down comer duct.
- Installation of 3rd cyclone in parallel to the existing top stage twin cyclones in PC string for saving in pressure drop.
- Extension of PC height by 5 meters.
- Installation of grid resistance regulators for HV fans.
- Re – locating the PC string ID fan after GCT for saving in electrical energy consumption of ID fan.
- Installation of variable speed drive for cooler fans and one of the cooler exhaust fans.
- Extension of clinker cooler area by provision of 3rd grate and increasing the capacity of cooling air fans.

With Holtec's assistance, plant implemented some of the above measures. Implementation of these improvement measures was done in a planned manner in consultation and supervision of Holtec, in a planned shutdown of about 5 weeks. Plant is presently operating at an average production level of about 2,850tpd clinker. With complete implementation of the above recommendations are expected kiln production will be 3,000 – 3,100tpd clinker. At this production level, the expected specific fuel consumption and specific power consumption shall be about 750 kCal/kg clinker and 90kWh/t cement. Estimated pay back period for the capacity up gradation worked out to about 5 months. Moreover, the plant operational consistency has improved a lot as a result the annual production has increased significantly.
A comparison of the heat balance prepared for the conditions before and after implementation of the improvement measures is given below in the Table 1:

Sn	**Stream**	**Thermal energy, kCal/kg clinker**	
		Before Modification	**After Modification**
Heat Input			
1	Sensible heat of raw mill	22.78	22.78
2	Sensible heat of Raw mill moisture	0.49	0.49
3	Sensible heat of fuel	4.76	3.65
4	Sensible heat of primary air to kiln	0.60	0.4
5	Sensible heat of primary air to precalciner	2.00	-
6	Sensible heat of cooler air	23.25	20.83
7	Sensible heat of nose ring fan air and false air	15.40	9.42
8	Calorific heat from fuel	976.64	749.35
Total Heat Input		1046.22	806.92
Heat Output			
1	Sensible heat of clinker	47.50	24.70

Sn	Stream	Thermal energy, kCal/kg clinker	
		Before Modification	**After Modification**
2	Sensible heat of exhaust gas (Kiln & calciner strings)	399.49	218.59
3	Sensible heat of PH exhaust dust	24.12	19.01
4	Sensible heat of cooler exhaust air	81.17	81.17
5	Heat of formation	408.45	408.45
6	Evaporation heat for moisture in raw mill	6.49	6.49
7	Radiation and other losses	79.00	48.51
Total Heat Output		1046.22	806.92

Table 1: Saving in thermal energy

8.0 Conclusion

All forecasts seem to definitely point to the fact that the Cement Industry will become increasingly competitive; not so much in terms of the number of players but in terms of the performance levels expected of it. Consequently, to be able to sustain healthy bottom line, producers would need to re-examine the effectiveness and efficacy of the cost optimization and other revenue enhancement initiatives launched by them till now. Efforts to lower the cost of production are made on continuous basis in a cement plant.