Installation of Greenfield Vs Brownfield Cement Plant

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1.0 ABSTRACT

The setting up of greenfield cement projects means starting from scratch at a new location / site with the land and infrastructure as available. The greenfield plant can be set up as integrated plant or with split location where clinker can be manufactured at one location and cement grinding and/ or packing can be at another location.

The execution of brownfield means expansion/ modernisation projects in the existing cement plant by alterations/ modifications in the existing plant and equipment or else installing completely 'new production line' at the existing location utilising already available facilities.

This paper attempts to compare various aspects influencing the decisions to set up Greenfield Vs Brownfield projects, in the context of presently prevailing scenario through a typical case study.

2.0 CAPACITY ADDITION - HOLTEC's EXPERIENCE

Holtec has the rich experience of having engineered 60 cement projects as on date which comprises of 35 greenfield and 25 brownfield projects. Based on this experience, it is necessary to critically evaluate and carry out the 'Strength, Weakness, Opportunity and Threat (SWOT)' analysis of the situation before taking any decision about the type of the project namely greenfield or brownfield cement projects.

The decision regarding greenfield vs brownfield project heavily depends on the prevalant situation in the region/ country. A broad based SWOT analysis of the prevalent situation in Indian cement industry indicates the following:

Strengths	Weaknesses	Opportunities	Threats
• Capacity growth potential exists • Sector has raw materials and human resources for sustainable growth	• Scarce Capital Resources • Poor transport and infrastructure facilities • Economy in transition, unstable politics, frequent policy changes	• High intensity domestic demand is assured due to infrastructure related investments, untapped rural market, housing sector • Utilisation of industrial wastes for blended cements	• Entry of foreign major players into domestic market of cement • Consolidation (M & A) amongst domestic players

3.0 INFLUENCING FACTORS

Factors that influence the decisions in regard to capacity addition and the route to be adopted (greenfield vs brownfield) can be classified in two main categories namely Quantitative and Qualitative. are:

Quantitative factors

- Gestation period
- Investment cost
- Profitability and Financial Viability

Qualitative factors

- External Environment
- Technology
- Design and Engineering
- Project Management

These factors have been further described below:

3.1 Quantitative Factors

3.1.1 Gestation Period

The main activities involved in a greenfield project are as follows:

- Site identification
- Raw material studies
- EIA/EMP studies
- Plant technical concept & project report
- Financial closure
- Project implementation
- Stabilisation

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The gestation period of greenfield projects is longer than that for brownfield projects by about 6 - 12 months.

3.1.2 Investment Cost

The specific investment cost levels for the cement capacity addition at the existing cost level are as follows:

- Specific investment cost for greenfield project US$120-150 per t cement
- Specific investment cost for brownfield project (Upgradation) US$ 75 - 90 per t cement
- Specific investment cost for brownfield project (new line) US$ 100-120per t cement

3.1.3 Profitability and financially viability

For similar capacity addition the brownfield project shall generally have better financial viability due to lower gestation period and lower investment levels. The comparative merits/demerits of the brownfield project are as follows:

- Better Debt Service Coverage Ratio (DSCR), Internal Rate of Return (IRR).
- Lower Break Even Point (BEP), specific investment and unit cost of production.
- Higher freight cost depending upon market size and coverage.

3.2 Qualitative Factors

3.2.1 External Environment

The external environmental factors influencing the greenfield cement project are as follows:

- Land and Infrastructure – Fresh acquisition and development is required.
- Limestone – new mineable deposit to be identified, investigated and acquired
- Fuel linkages – to be established afresh
- Environment clearance – large lead time for data collection
- Market entry barriers
- Financing – More difficult and rigid terms & conditions.

In case of brownfield projects the above factors are under much better control and therefore pose relatively much less constraints in project execution.

3.2.2 Technology

The technological advancements provide innovative solutions for productivity enhancement as well as investment cost optimisation. The technology is used as an aid to ensure the technical feasibility of the project. The currently available technology is conducive to capacity addition both through greenfield and brownfield projects.

A few technological options now available for capacity enhancement through brownfield projects are as follows:

- Raw material availability augmentation
  - Computer Aided Deposit Evaluation (CADE)
  - Quarry Scheduling and Optimisation (QSO)
- Grinding
  - Pre grinding for raw mills
  - Separate grinding for blended cement
  - Pre-grinding, finish grinding and semi finish grinding options for cements
  - High efficiency dynamic separators
- Pyroprocessing
  - Additional streams in preheater and precalciner
  - Sizing norms for kiln
  - New generation coolers
  - High efficiency burners
  - Better refractories
- Improved equipment
  - Control and Instrumentation
  - Material handling
  - High efficiency fans
  - Improved mills internals

3.2.3 Design and Engineering

The design and engineering for brownfield projects may involve innovative layout designs and construction schemes for least downtime. Some of the important aspects to be considered during design and engineering are listed as follows:

- Layout
- Infrastructure limitations
- Safety considerations
- Environmental considerations
- Temptations to have more and more flexibility
- Energy optimisation
- Ageing of civil structures
- Ageing of old equipment proposed to be retained in the upgraded plant
- Requirements for future growth

The design and engineering in case of greenfield projects also has to keep most of the above aspects in view but it poses relatively lesser constraints.

3.2.4 Project Management

The project management is very crucial for both greenfield as well as brownfield projects. It encompasses various aspects beyond the conventional criteria of time and cost.

In case of brownfield projects the additional imposed constraints are as follows:

- Working within existing premises (care/ time)
- Hook up with parent plant (plant downtimes are very costly)
- Utilisation of available manpower (prefix mindsets)

The project implementation time has shrunk and the project overrun's are suicidal. The lenders are increasingly insisting on detailed planning, efficient monitoring and control mechanism (time/cost) to avoid/ minimise overruns.

4.0 CASE STUDY

A cement plant in Iran signed an agreement with Holtec for providing technical consultancy services for engineering services for upgradation of kiln 3 from 1,000 tpd clinker to 3,000 tpd clinker and kiln 4 unit from 2,000 tpd clinker to 4,000 tpd clinker. The details of kiln 4 upgradation is given below:

Description	Present	Proposed
Kiln capacity	2,000 tpd clinker	**4,000 tpd clinker**
Kiln size	5.0 m dia. x 80 m length	5.0 m dia. x 80 m length
Kiln slope	3.50%	3.50%
Kiln speed	2.0 rpm, maximum	4.0 rpm

Description	Present	Proposed
Preheater	Single string, 4 stage cyclone preheater	Existing string with 4 stage cyclones as kiln string and a new string with 4 stage preheater and In Line Calciner (ILC)
GCT/ ESP	One GCT and two parallel ESPs	A new GCT/ ESP is required for dedusting the new PH fan. The GCT is proposed to be before the new PH fan and it will discharge to the new ESP , where a new ESP fan will vent out the clean air to the atmosphere through an independent chimney. Its existing GCT & ESP will continue to be used.
Specific heat consumption	880 Kcal/ kg clinker	750 Kcal/kg clinker
Filling in kiln	9.64%	14.83%
Fuel firing	Kiln : 100%	Kiln : 45% Precalciner : 55%
Burner for fuel oil firing	Kiln : FLS	Kiln : FLS Duoflex burner for oil or gas. Precalciner: A new burner of FLS design
Clinker cooler	Planetary coolers	New generation, high efficiency FLS SF cooler with more than 73% heat recuperation efficiency.
Other equipments		
Crusher	600 tph	A new crusher of capacity 900 tph to meet the requirement of this kiln and for kiln 3 raw mills.
Raw mill	200 tph	360 tph For capacity upgradation of the existing raw mill, the following modifications are considered: • Replacement of the existing two nos. conventional dynamic separator by a suitably designed new generation high efficiency dynamic separator. • Installing a closed circuit roller press in front of raw mill.
Cement mill	116 tph	266 tph considering about 20% margin, it is recommended to install a new cement mill of capacity around 150 tph.
Power consumption	-	100 kWh/t cement
Manpower	-	No additional manpower is required.

The financial analysis for this **Brownfield project** with respect to the estimated investment, cost of production and profitability using discounted cash flow method is carried out by considering the following:

- Based on the estimates, the total cost for the proposed project works out to **US$ 87 million** for both kiln 3 and kiln 4 upgradation.

- A debt equity ratio of 70:30 has been considered for project financing.
- Kiln run days has been considered as 330 days per annum.
- The plant operating efficiency are considered as follows:
  - 1st year of operation 90%
  - 2nd year of operation onwards 100%

The Profitability indicators are worked out as follows:

IRR on investment 20.82%
IRR on equity 31.94%

Payback period **4 years 2 months**

5.0 CONCLUSION

- The parameters for capacity addition in cement, as discussed above have been tabulated below showing comparison between brownfield and greenfield project:

Sn	Parameter	Greenfield	Brownfield
1	External environment	-	+
2	Technology	+	+
3	Design and engineering	+	-
4	Project management	+	-
5	Gestation period	-	+
6	Investment cost	-	+
7	Financial viability	-	+

+ means favourable; - means unfavorable

- Both brownfield and greenfield projects will continue to co-exist for capacity growth.
- Each project idea has to be comprehensively evaluated through an option evaluation study encompassing:
  - Greenfield Vs Brownfield
  - Integrated Vs Split location

to arrive at the most optimum solution.

- Blended cement option provides immediate growth potential

6.0 ABOUT THE AUTHORS

The authors employed with Holtec Consulting Private Limited, have led a number of National and International Consulting Assignments in the area of Process Engineering, Plant Operation & Optimisation, Energy Conservation in cement plants and Detailed Engineering and System Designs for cement projects. Mr. V. K. Batra, Executive Director has the overall responsibility for Business Development, Project Management & co-ordination of Detailed Engineering assignments. Mr. Kamal Kumar, Sr. General Manager is heading the Process Department.